State of Wisconsin

CORRESPONDENCE/MEMORANDUM

DATE: February 19, 1999

File Code: 4530

55 071 00025
KEY 051

PRELIMINARY* STACK TEST REVIEW

By: Jeannine Campion

Test Date: Nov 24, 1998

Name of Source: Rockwell Lime

FID #: 436-034-390

Address: 4110 Rockwood Rd

Stack #: S11

City: Manitowoc, WI

Process #: P36

Permit #: 93-RV-108

Date Issued: Feb 7, 1995

Description of Source Tested: Lime Kiln

Description of Control Equipment: Baghouse

Test Firm: Environmental Monitoring + Technologies

Crew Chief & Phone#:

Pollutant Tested: Particulates — Test Method: 5/202

Pollutant Tested: SO2 — Test Method: 19

Pollutant Tested: Opacity — Test Method: CEM

Test Production Level: 24.5 tons/hr stone feed

Rated Production Level: 25 tons/hr stone feed

Discussion of Results:

Poll. Test Ave. = 0.41 lb/ton stone — Limit = 0.30 lb/ton stone feed — In Compliance? Y (N)

Poll. Test Ave. = 1.92 lb/MMBTU — Limit = 5.5 lbs/MMBTU — In Compliance? (Y) N

Poll. Test Ave. = 1.99% — Limit = 2.1% sulfur — In Compliance? (Y) N

Poll. Test Ave. = 0 % — Limit = 10 % — In Compliance? (Y) N

JC 2/26/

Is This a Valid Test? (Y) N If answer is no, please indicate the reason.

* Test may be reviewed in depth later, if necessary.

CC Joe Perez - AM/7
US EPA Region V

GASEOUS TEST CHECKLIST

Name of Source: Rockwell Lime Gas Tested: SO_2 Test Date: Nov 24, 1998

1. A stack test shall consist of three valid runs or, at a minimum, two valid runs if one run is voided. Is this a valid test? If no, inform the District or the source that the test is unacceptable and should be redone. Your review is over. YES ✓ NO__

Eq. 1 $PPM_{DRY} = PPM_{WET}/(1-\%\ \text{Moisture as Decimal})$

Eq. 2 $PPM_{DRY}@\ 7\%\ O_2 = PPM_{DRY}*(20.9-7)/(20.9-\text{Stack } O_2)$

Eq. 3 $PPM_{DRY}@\ 12\%\ CO_2 = PPM_{DRY}*12/\text{Stack } CO_2$

---

2. If the limit is in PPM_{DRY} or in PPM_{DRY} corrected to a certain O_2 or CO_2 value, solve Eq. 1-3. Do your results match the consultant's? If no, fix the problem or call the consultant for a correction. N/A YES__ NO__

Eq. 4 $mg/DSCM = PPM_{DRY}*\text{Molecular Weight of Gas}/24.06$

Eq. 5 $Lb/DSCF = 2.595*10^{-9}*PPM_{DRY}*\text{Molecular Weight of Gas}$

Eq. 6 $Lb/DSCF = 6.243*10^{-8}*(mg/DSCM)$

Eq. 7 $Lb/Hr = 60*DSCFM*(Lb/DSCF)$ Eq. 8 $Lb/10^6\ BTU = (Lb/Hr)/(10^6\ BTU/Hr)$

Eq. 9 $Lb/10^6\ BTU = (Lb/DSCF)*F\ Factor*20.9/(20.9-\text{Stack } O_2)$

---

3. If the limit is in mg/DSCM, Lb/DSCF, Lb/Hr, or $Lb/10^6$ BTU, solve the needed Eq. Eq. 1-3 may also be needed. Do your results match the consultant's? If no, fix the problem or call the consultant for a correction. YES__ NO ✓ Fixed

---

Eq. 10 $\%\ \text{Capture Eff.} = \dfrac{(\text{Lb VOC/Hr to Control Equip.})*100}{(\text{Lb VOC/Hr Input to Process})}$

Eq. 11 $\%\ \text{Destruction Eff.} = \dfrac{(\text{Inlet Lb VOC/Hr} - \text{Outlet Lb VOC/Hr})*100}{(\text{Inlet Lb VOC/Hr})}$

Eq. 12 $\%\ \text{Overall Eff.} = (\%\ \text{Cap. Eff.}/100)*(\%\ \text{Dest. Eff.}/100)*100$

---

4. If the limit is in terms of % Capture Eff., % Dest. Eff., or % Overall Eff., solve the needed Eq. Eq. 1-9 may also be needed. Do your results match the consultant's? If no, fix the problem or call the consultant for a correction. N/A YES__ NO__

5. Is the three run(or two run) average correct? If no, write in the correct average. YES ✓ NO__

6. Is the average result in compliance? If no, the District should issue an NOV. YES ✓ NO__

7. Was the source operating at a level representative of full capacity? If no, the permit release may need to provide conditions to cap the source at the test level until a stack test at a higher production level(showing compliance) is performed. If the test was not for permit release, other actions may be warranted. YES ✓ NO__

98%

PARTICULATE CHECKLIST

Name of Source: Rockwell Line Test Date: Nov 24, 1998

1. Are the isokinetics per run between 90 and 110%? YES ✓ NO__
   If the %I for a run is outside the range, void the run. See 5.

2. Is the sample volume per run ≥ 30 DSCF? YES ✓ NO__
   If the sample volume for a run is < 30 DSCF, void the run. See 5.

3. Is the sample time per run ≥ 60 min.? YES ✓ NO__
   If the sample time for a run is < 60 min., void the run. See 5.

4. Is the sample time per sample point ≥ two min.? YES ✓ NO__
   If the sample time per point for a run is < two min., void the run. See 5.

5. A stack test shall consist of three valid runs or, at a minimum, two valid runs if one run is voided. Is this a valid test? YES__ NO__
   If no, inform the District or the source that the test is unacceptable and should be redone. Your review is over.

6. Is the total particulate per run added correctly? YES ✓ NO__
   If an incorrect total is found, correct the total and the results or call the consultant and ask for a correction.

7. Was the backhalf included in the total particulate? YES ✓ NO__
   NSPS sources are exempt from including the backhalf. All other sources must include the backhalf. If they don't, the test is invalid. See 5.

Eq. 1 Gr/DSCF = 15.43* g of part./sample volume of run in DSCF

Eq. 2 Gr/DSCF @ 12% CO_2 = (Gr/DSCF)*12/Stack CO_2

Eq. 3 Gr/DSCF @ 7% O_2 = (Gr/DSCF)*(20.9-7)/(20.9-Stack O_2)

Eq. 4 Lb/DSCF = (Gr/DSCF)/7000 Eq. 5 $Lb/MLb_{DRY} = 385.6*10^3*(Lb/DSCF)/MW_{DRY}$

Eq. 6 $Lb/MLb_{WET} = 385.6*10^3*(Lb/DSCF)*(1-(\%\ Moisture/100))/MW_{WET}$

Eq. 7 Lb/Hr = 60*DSCFM*(Lb/DSCF) Eq. 8 $Lb/10^6$ BTU = (Lb/Hr)/(10^6 BTU/Hr)

Eq. 9 $Lb/10^6$ BTU = (Lb/DSCF)*F Factor*20.9/(20.9-Stack O_2)

---

8. If the emission limit is in Gr/DSCF, Lb/DSCF, Lb/MLb, Lb/Hr or $Lb/10^6$ BTU, solve the needed Eq. Do your results match the consultant's? N/A YES__ NO__
   If no, fix the problem or call the consultant for a correction.

9. Is the three run(or two run) average correct? YES ✓ NO__
   If no, write in the correct average.

10. Is the average result in compliance? YES ✓ NO__
    If no, the District should issue an NOV.

11. Was the source operating at a level representative of full capacity? YES ✓ NO__ 98%
    If no, the permit release may need to provide conditions to cap the source at the test level until a stack test at a higher production level(showing compliance) is performed. If the test was not for permit release, other actions may be warranted.

ROCKWELL LIME COMPANY

4110 Rockwood Rd., Manitowoc, WI 54220-9619 920-682-7771 • 1-800-558-7711 • Fax: 920-682-7972

January 18, 1999

Mr. James Crawford, P.E.
State of Wisconsin \ Department of Natural Resources
Lake Michigan District Headquarters
P.O. Box 10448
1125 North Military Ave.
Green Bay, WI 54307-0448

Dear Mr. Crawford:

Enclosed are two (2) copies of Environmental Monitoring & Technologies (EMT) Report No. 98-530, detailing the procedures followed, and results obtained, from the emissions compliance test program performed on #2 kiln at Rockwell Lime Company on November 24, 1998. Attached to the back of each report is a copy of the opacity strip chart for the period during the test and a copy of the proximate and ultimate analysis report on the coal/petroleum coke blend that was used during the test.

I would like to suggest that the first particulate sample test be thrown out due to the fact that it is 208% higher than the average of the other two (2) tests and is 860% higher than the average of our last two (2) stack tests. I have contacted EMT and the only explanation that they could give me was that the sample volume for test #1 was very close to the minimum required. I have also checked our records and found that all of the filter bags for the baghouse on #2 kiln were replaced in July of 1998 which represents only four (4) months of operating time. During the previous two (2) stack tests, we had an average of 11 months operating time. Since filter bag efficiency is directly related to the amount of dust cake built up on the bags, this could explain why the 1998 stack test results were dramatically higher than the previous two (2) stack tests.

If you have any questions or require additional information regarding this report, feel free to call me at (414) 682-7771.

Sincerely,

ROCKWELL LIME COMPANY

Donald R. Brisch
V. P. of Operations

rcvd. 1/20/99

Not In compliance
JMC

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.

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

Analytical Testing
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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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- Calculation Summary Sheets
- Field Data Sheets
- Monitor Data

Appendix B
- Laboratory Results
- Chain of Custody Records

Appendix C
- Calibration Data
- Gas Certification Sheets

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.

INTRODUCTION

Overview of Project

Rockwell Lime Company is located at 4110 Rockwood Road, in Manitowoc, Wisconsin.

Three (3) one-hour runs were performed on November 24, 1998, at the Lime Kiln Baghouse Exhaust, for particulate emissions, condensible particulate, and sulfur dioxide.

Sampling Location

The sampling location complied with the requirements in 40 CFR, Part 60, Appendix A, Method 1, with the following exception:

> "B" dimension of approximately 6.5 ft. = approx. 1.08 dia.

This deviation was previously deemed acceptable by Mr. Jim Crawford, of the Wisconsin DNR for the 1996 compliance test program, and was addressed in EMT Protocol 98-530.

The test ports were located beyond all existing pollution control devices.

The sampling location at the Lime Kiln Exhaust has a stack area of 27.494 ft.

SUMMARY OF SAMPLING

EMT performed the following USEPA procedures to meet the requirements of their specified work. These methods may be referenced in Title 40, Code of Federal Regulations, Part 60, Appendix A, Part 51, Appendix M, and the applicable ASTM documents.

The methods are titled as follows:

EPA Method 1	Sample and Velocity Traverses for Stationary Sources
EPA Method 2	Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
EPA Method 3	Gas Analysis for the Determination of Dry Molecular Weight
EPA Method 4	Determination of Moisture Content in Stack Gas
EPA Method 5	Determination of Particulate Emissions from Stationary Sources (WI modified method)
EPA Method 6C	Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrument Analyzer Procedure)
EPA Method 19	Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides Emission Rates
EPA Method 202	Determination of Condensible Particulate Emissions

EMT also adhered to the following EPA and ASTM procedures:

EPA 600/9-76-005	Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. 1, Principles, 1976
EPA 600/4-77-027b	Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. III, 1979
ASTM E 300-92	Standard Practice for Sampling Industrial Chemicals, 1992

Determination of Volumetric Flow Rate

At the Lime Kiln Baghouse Exhaust, EMT sampled in accordance with EPA Methods 1-4

1. Teflon Tape was used on all joints to seal sample train.
   As part of each test run, the following was acquired:
   a. a multi-point integrated gas sample was collected in order to determine the carbon dioxide content using Orsat gas analysis.
   b. the gas flow was determined.
   c. a point-by-point temperature grid was established.
   d. the stack gas moisture was determined.
   e. the static pressure was determined.

Determination of Particulate Matter (including Condensible Particulate Matter)

Each test run for Particulate Matter was performed in accordance with EPA Method 5, as well as adhering to WDNR requirements:

1. Teflon Tape was used on all joints to seal the sampling train.
2. Sampling was performed isokinetically.
3. Glass microfibre filters were used to collect particulate matter.
4. Particulate grain loading was determined.
5. "Back-half" condensible particulate matter was determined in accordance with EPA Method 202.
6. Each test run was a minimum of 60 minutes in duration, with a minimum sample volume of 31.8 dscf. Three test runs were performed.
7. Results are reported in gr/dscf, lb/hr and lb/ton stone feed.

Determination of Sulfur Dioxide

Each test run for Sulfur Dioxide was per formed in accordance with EPA Method 6C, as well as adhering to WDNR requirements:

1. An integrated gas sample was extracted and drawn through a Bovar/Western Research 721 SO_2 monitor.
2. The sample gas was drawn through a heated sample line to prevent condensation prior to the gas conditioner.
3. Protocol calibration gases were used to calibrate this instrument Before and after every run.
4. A datalogger was used to collect data.
5. Results are expressed as ppmv db, and lb/hr.
6. Heat input is determined from the hourly average recorded during testing. Natural gas consumption and coal consumption was continuously monitored during testing.
7. F-factor for the above fuels is determined from Title 40, Code of Federal Regulations, Appendix A. Park 60, Method 19, Table 19-1.

Visual Determination of the Opacity of Emissions from Stationary Sources

As per conversations with Mr. James Crawford, of the Wisconsin Department of Natural Resources, Green Bay Office, and as addressed in EMT Protocol 98-530, Opacity CEM data will be acceptable for the determination of visible emissions.

Strip chart to be submitted directly to the Wisconsin DNR, by Rockwell Lime Company, along with this report.

QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

Quality Control Procedures

Quality Control Procedures for all aspects of field sampling; sample preservation, holding time, reagent quality, analytical method, analyst training and safety, instrument cleaning, calibration and safety are followed. These procedures are consistent with EPA Guidelines documented in "Quality Assurance Handbook for Air Pollution Measurement Systems;" Volume III, "Stationary Source Specific Methods:" (EPA-600/4-77-027b).

All appropriate equipment is calibrated at EMT's laboratory prior to delivery to the job site.

Chain of Custody

Documentation of the chain of custody of samples and data obtained during the test program is essential for insuring the validity of the test program results. These procedures are followed during sampling, sample and data transport, sample preparation and analysis, storage of data, as well as archived samples and reported results.

EMT follows the protocol listed in SW 846, Section 1.3 during field sampling and in-house laboratory analysis.

EMT Calibration Procedures and Frequency Chart

Dry gas meter:	Acceptable if Yi=Y± 2% Calibrated vs. Standard meter.
Thermometers:	Impinger thermometer accurate within ± 1°C, dry gas meter thermometer within ± 3°C over range, stack temperature sensor ±1.5% of absolute temperature.
Probe Heating System:	Capable of maintaining 248°F±25° at a flow of 0.71 ft./min.
Barometer:	Accurate within ± 2.5 mm(0.1in) Hg of Hg in glass barometer. Calibrated vs. Hg in glass barometer.
Type S Pitot tube:	Calibrated initially in the lab. Before and after each test run visual inspection.
Stack gas temperature measurement system:	Acceptable if capable of measuring within ± 1.5% of minimum stack temperature. Calibrated initially and after each field testing program.

SUMMARY OF RESULTS

Summaries of test results from the emissions compliance test program conducted at Rockwell Lime Company, on November 24,1998, as well as process data furnished by Rockwell Lime Company, is presented in the tables on the following pages.

Appendix A contains all Calculations Summary Pages, Field Data Sheets, and Monitor Data.

Appendix B contains Laboratory Results and Chain of Custody Forms.

Appendix C contains Calibration Data and Cylinder Gas Certification Sheets.

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
847-967-6666
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Groundwater Monitoring
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Waste Characterization (RCRA)
Wastewater Compliance Monitoring
• Pretreatment
• User Charge

FAX TRANSMISSION NOTICE

Date: 2-19-99

Time: 4:30pm

To: JIM CRAWFORD

Company: WDNR/ GREEN BAY

Fax Number: 920-492-5913

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: REVISED PAGES 8 + 9 (ALSO AFFECTED) + CALC. SUMMARY 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~~ 1.92
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

1.77 OK F-factor not require JC 4/21

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.

use F factor

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**

02/19/99 FRI 16:46 FAX 8479675006 ENVIRO MONITORNGNITORING 003

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

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 AND TECHNOLOGIES, INC. FIELD DATA SHEET

CLIENT: Rockwell Lne AMBIENT TEMPERATURE: 45 BAROMETRIC PRESSURE: 29.80 FILTER NUMBER 6686

LOCATION: MANITOWAC ASSUMED MOISTURE, %: 8.8% Y FACTOR: .9969 PRE-LEAK RATE: .001 CFM@ 12 in.Hg

SOURCE: PROBE HEATER SETTING: 260 METER ΔH@: 1.960 POST-LEAK RATE: .00 CFM@ 11 in.Hg

DATE: 11/24/96 HEATER BOX SETTING: 260 PROBE NUMBER: Pr 96 PITOT LEAK CHECK PRE: ✓ POST: ✓

OPERATOR: JM + MB PROJECT MANAGER: JW NOZZLE #,DIAM.,In.: .28 % OXYGEN: 15 % CO_2: 13.5

RUN #: 1 METERBOX #: 2 STACK DIAMETER Inches: 71 LIQUID GAINED: 30 + GEL 11 =Vlc:

START: 1009 STOP: 11:09 K FACTOR: 4.34 / 3.89 PORT LENGTH,Inches: 7.5 C_p: .84 STATIC PRESSURE + ⊙ .21

CLOCK TIME	TRAVERSE POINT NUMBER	MIN/PT 2.5 SAMPLING	INITIAL VOLUME 720.12 SAMPLE VOLUME	VELOCITY HEAD Δ P	ORIFICE SETTING ΔH	PUMP VACUUM	STACK TEMPERATURE Ts	GAS METER TEMPERATURE Tin	GAS METER TEMPERATURE Tout	IMPINGER OUTLET TEMPERATURE	FILTER BOX TEMPERATURE	PROBE TEMPERATURE
	1-1	2.5	721.2	.30	1.30	2	268	76	74	60	250	250
	2	5.0	722.7	.30	1.30	2	270	77	74	53		
	3	7.5	723.6	.31	1.35	3	277	78	75	53		
	4	10.0	724.15	.28	1.22	2	275	79	76	54		
	5	12.5	~~726.0~~	.24	1.00	2	278	81	77	54		
	6	15.0	727.84	.26	1.30	3	281	82	77	55		
	7	17.5	729.23	.36	1.56	4	280	83	78	56		
	8	20.0	729.61	.36	1.56	4	280	84	79	56		
	9	22.5	731.52	.40	1.736	4	280	84	80	56		
	10	25.0	733.80	.35	1.52	4	280	85	81	57		
	11	27.5	735.49	.23	.998	3	279	89	82	58		
	12	30.0	736.92	.27	1.17	3	280	89	82	58		
	2-1	32.5	738.29	.25	1.09	2	360	81	83	58		
	2	35.0	739.74	.32	1.40	2	365	85	84	53		
	3	37.5	741.38	.38	1.67	2	368	85	84	54		
	4	40.0	742.84	.30	1.17	2	369	88	86	53		
	5	42.5	744.31	.39	1.52	2	371	88	86	55		
	6	45.0	745.90	.39	1.52	2	372	89	87	56		
	7	47.5	747.45	.30	1.16	2	372	90	87	56		
		50.0					376					
	9	52.5	750.18	.29	1.13	2	370	89	86	57		
	10	55.0	751.59	.30	1.16	2	372	91	86	58		
	11	57.5	753.01	.27	1.05	2	372	91	86	58		
	12	60.0	753.85	.27	1.05	2	355	90	87	58		

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 # 2
Date 11-24-98

Barometric (Pbar)	29.80	in.Hg	Static Pressure (Pg)	-0.22	in.H2O
Meter Y Factor (Y)	0.9969		Volume Measured (Vm)	48.890	cubic ft.
Stack Area (As)	27.494	sq. ft.	Square Root delta P	0.5551	in.H2O
Oxygen	13.8	%	Δ H	2.38	in.H2O
Carbon Dioxide	13.0	%	Gas Temperature (Ts)	374.4	°F
Impinger Condensate (Wi)	42	mL	Meter Temp. (Tm)	83.4	°F
Silica Gel Gain (Ws)	13	g	CPM Inorganic Mass (Mi)	22.9	mg
Front ½ Particulate (Mf)	32.0	mg	CPM Organic Mass (Mo)	3.6	mg
Run Time	60	minutes	Nozzle Diameter (Dn)	0.325	inches

GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)

17.64 x Vm x Y x (Pbar + ^H/13.6) x 1/Tm°R = 47.430 dscf

VOLUME OF WATER IN GAS SAMPLE, STANDARD CONDITIONS (Vwstd)

(Wi x 0.04707) + (Ws x 0.04715) = 2.590 scf

PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)

Vwstd / (Vmstd + Vwstd) = 0.052

= 5.2 % by volume

GAS MOLECULAR WEIGHT, DRY BASIS (Md)

(0.44 x CO2%)+(0.32 x O2%)+(0.28 x (100 - O2% - CO2%)) = 30.63 lb/lb-mole

GAS MOLECULAR WEIGHT, WET BASIS (Ms)

(Md x (1-Bws))+ (18 x Bws) = 29.98 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) = 38.5 ft/sec.

GAS VOLUME FLOW RATE, (acfm) Stack Area x Vs x 60 = 63570.6 acfm

GAS VOLUME FLOW RATE, (scfm)

acfm x Tstd x Ps / (Ts°R x Pstd) = 40042.8 scfm

GAS VOLUME FLOW RATE, (scfh) scfm x 60 = 2402567.1 scfh

GAS VOLUME FLOW RATE, (dscfm)

(1-Bws) x acfm x Tstd x Ps / (Ts°R x Pstd) = 37969.5 dscfm

GAS VOLUME FLOW RATE, (dscfh) dscfm x 60 = 2278168.0 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 # 2
Date 11-24-98

GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)	=	47.430	dscf
PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)	=	0.052	
GAS VOLUME FLOW RATE, (dscfh)	=	2278168.0	dscfh
FRONT ½ PARTICULATE MASS, FILTER AND PROBE WASH (Mf)	=	32.0	mg
CONDENSIBLE PARTICULATE MATTER (CPM), INORGANIC MASS (Mi)	=	22.9	mg
CONDENSIBLE PARTICULATE MATTER (CPM), ORGANIC MASS (Mo)	=	3.6	mg
FRONT ½ PARTICULATE CONCENTRATION, (gr/dscf) Mf x 0.001g/mg x 1/Vmstd x 15.43 gr/g	=	0.0104	gr/dscf
INORGANIC CPM CONCENTRATION, (gr/dscf) Mi x 0.001g/mg x 1/Vmstd x 15.43 gr/g	=	0.0074	gr/dscf
ORGANIC CPM CONCENTRATION, (gr/dscf) Mo x 0.001g/mg x 1/Vmstd x 15.43 gr/g	=	0.0012	gr/dscf
TOTAL MEASURED PARTICULATE MATTER CONCENTRATION, (gr/dscf)	=	0.0190	gr/dscf
FRONT ½ PARTICULATE EMISSION RATE, (lb/hr) 2.205E-06 lb/mg x Mf x dscfh x 1/Vmstd	=	3.3892	lb/hr
INORGANIC CPM EMISSION RATE, (lb/hr) .205E-06 lb/mg x Mi x dscfh x 1/Vmstd	=	2.4254	lb/hr
ORGANIC CPM EMISSION RATE, (lb/hr) 2.205E-06 lb/mg x Mo x dscfh x 1/Vmstd	=	0.3813	lb/hr
TOTAL MEASURED PARTICULATE EMISSION RATE, (lb/hr)	=	**6.1958**	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))	=	99.4	%

Gas Temperature, Ts°R =	834.4	Gas Velocity, Vs =	38.5
Absolute Gas Pressure, Ps =	29.78	1 - Bws =	0.948
Area of Nozzle (sq.ft.), An =	0.0005761	minutes =	60

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC. FIELD DATA SHEET

CLIENT: Rockwell Line
LOCATION: MANITOWAC
SOURCE:
DATE: 11/24/98
OPERATOR: JM & MB
RUN #: 2
START: 12:00 STOP:

AMBIENT TEMPERATURE:
ASSUMED MOISTURE, %:
PROBE HEATER SETTING:
HEATER BOX SETTING:
PROJECT MANAGER:
METERBOX #: 2
K FACTOR: 7.79 7.51

BAROMETRIC PRESSURE:
Y FACTOR: .9969
METER ΔH@: 1.960
PROBE NUMBER:
NOZZLE #,DIAM.,in.: .325
STACK DIAMETER inches:
PORT LENGTH,inches:

FILTER NUMBER 6685
PRE-LEAK RATE: .001 CFM@ 15 in.Hg
POST-LEAK RATE: .001 CFM@ 12 in.Hg
PITOT LEAK CHECK: PRE: POST:
% OXYGEN: 13.8 % CO_2: 13.0
LIQUID GAINED: 42 + GEL 13 = Vlc:
C_p: STATIC PRESSURE + (-) .22

CLOCK TIME	TRAVERSE POINT NUMBER	MIN/PT 2.5 SAMPLING	INITIAL VOLUME 754.15 SAMPLE VOLUME	VELOCITY HEAD Δ P	ORIFICE SETTING ΔH	PUMP VACUUM	STACK TEMPERATURE Ts	GAS METER TEMPERATURE Tin	GAS METER TEMPERATURE Tout	IMPINGER OUTLET TEMPERATURE	FILTER BOX TEMPERATURE	PROBE TEMPERATURE
	1-1	2.5	756.38	.35	2.72	4	380	85	90	56	250	
	2	5.0	758.47	.35	2.72	4	378	85	90	56		
	3	7.5	760.56	.31	2.41	4	382	86	91	56		
	4	10.0	762.66	.31	2.41	4	381	86	91	56		
	5	12.5	764.86	.40	3.11	5	382	87	89	56		
	6	15.0	767.11	.32	2.49	4	376	89	88	57		
	7	17.5	769.13	.32	2.49	4	375	88	88	57		
	8	20.0	771.01	.32	2.49	4	375	89	87	57		
	9	22.5	773.34	.31	2.41	4	374	91	87	58		
	10	25.0	775.40	.30	2.34	4	373	90	88	58		
	11	27.5	777.35	.28	2.18	3	373	91	87	61		
	12	30.0	779.07	.17	1.32	2	370	91	86	60		
	2-1	32.5	780.91	.26	1.95	3	373	82	84	58		
	2-2	35.0	782.82	.32	2.4	3	372	83	83	54		
	3	37.5	784.83	.28	2.1	3	372	84	83	54		
	4	40.0	786.83	.34	2.55	4	373	85	81	53		
	5	42.5	788.93	.34	2.55	4	373	84	80	53		
	6	45.0	791.16	.40	3.00	5	373	84	79	52		
	7	47.5	792.91	.35	2.63	4	372	83	77	52		
	8	50.0	795.50	.35	2.63	4	372	82	76	53		
	9	52.5	797.67	.37	2.78	4	373	77	71	51		
	10	55.0	799.64	.29	2.18	3	373	72	69	50		
	11	57.5	801.40	.20	1.50	2	371	72	69	50		
	12	60.0	803.04	.22	1.65	2	370	72	69	49		

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 # 3
Date 11-24-98

Barometric (Pbar)	29.80	in.Hg	Static Pressure (Pg)	-0.22	in.H2O
Meter Y Factor (Y)	0.9969		Volume Measured (Vm)	46.970	cubic ft.
Stack Area (As)	27.494	sq. ft.	Square Root delta P	0.5690	in.H2O
Oxygen	14.0	%	Δ H	2.47	in.H2O
Carbon Dioxide	13.0	%	Gas Temperature (Ts)	371.4	°F
Impinger Condensate (Wi)	46	mL	Meter Temp. (Tm)	53.8	°F
Silica Gel Gain (Ws)	14	g	CPM Inorganic Mass (Mi)	30.1	mg
Front ½ Particulate (Mf)	11.2	mg	CPM Organic Mass (Mo)	10.7	mg
Run Time	60	minutes	Nozzle Diameter (Dn)	0.325	inches

GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)

17.64 x Vm x Y x (Pbar + ^H/13.6) x 1/Tm°R = 48.203 dscf

VOLUME OF WATER IN GAS SAMPLE, STANDARD CONDITIONS (Vwstd)

(Wi x 0.04707) + (Ws x 0.04715) = 2.825 scf

PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)

Vwstd / (Vmstd + Vwstd) = 0.055

= 5.5 % by volume

GAS MOLECULAR WEIGHT, DRY BASIS (Md)

(0.44 x CO2%)+(0.32 x O2%)+(0.28 x (100 - O2% - CO2%)) = 30.64 lb/lb-mole

GAS MOLECULAR WEIGHT, WET BASIS (Ms)

(Md x (1-Bws))+ (18 x Bws) = 29.94 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) = 39.5 ft/sec.

GAS VOLUME FLOW RATE, (acfm) Stack Area x Vs x 60 = 65084.7 acfm

GAS VOLUME FLOW RATE, (scfm)

acfm x Tstd x Ps / (Ts°R x Pstd) = 41146.4 scfm

GAS VOLUME FLOW RATE, (scfh) scfm x 60 = 2468783.9 scfh

GAS VOLUME FLOW RATE, (dscfm)

(1-Bws) x acfm x Tstd x Ps / (Ts°R x Pstd) = 38868.2 dscfm

GAS VOLUME FLOW RATE, (dscfh) dscfm x 60 = 2332093.0 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 # 3
Date 11-24-98

GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)	=	48.203	dscf
PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)	=	0.055	
GAS VOLUME FLOW RATE, (dscfh)	=	2332093.0	dscfh
FRONT ½ PARTICULATE MASS, FILTER AND PROBE WASH (Mf)	=	11.2	mg
CONDENSIBLE PARTICULATE MATTER (CPM), INORGANIC MASS (Mi)	=	30.1	mg
CONDENSIBLE PARTICULATE MATTER (CPM), ORGANIC MASS (Mo)	=	10.7	mg
FRONT ½ PARTICULATE CONCENTRATION, (gr/dscf) Mf x 0.001g/mg x 1/Vmstd x 15.43 gr/g	=	0.0036	gr/dscf
INORGANIC CPM CONCENTRATION, (gr/dscf) Mi x 0.001g/mg x 1/Vmstd x 15.43 gr/g	=	0.0096	gr/dscf
ORGANIC CPM CONCENTRATION, (gr/dscf) Mo x 0.001g/mg x 1/Vmstd x 15.43 gr/g	=	0.0034	gr/dscf
TOTAL MEASURED PARTICULATE MATTER CONCENTRATION, (gr/dscf)	=	0.0166	gr/dscf
FRONT ½ PARTICULATE EMISSION RATE, (lb/hr) 2.205E-06 lb/mg x Mf x dscfh x 1/Vmstd	=	1.1948	lb/hr
INORGANIC CPM EMISSION RATE, (lb/hr) .205E-06 lb/mg x Mi x dscfh x 1/Vmstd	=	3.2110	lb/hr
ORGANIC CPM EMISSION RATE, (lb/hr) 2.205E-06 lb/mg x Mo x dscfh x 1/Vmstd	=	1.1415	lb/hr
TOTAL MEASURED PARTICULATE EMISSION RATE, (lb/hr)	=	**5.5473**	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))	=	98.7	%

Gas Temperature, Ts°R =	831.4	Gas Velocity, Vs =	39.5
Absolute Gas Pressure, Ps =	29.78	1 - Bws =	0.945
Area of Nozzle (sq.ft.), An =	0.0005761	minutes =	60

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC. FIELD DATA SHEET

CLIENT: Rockwall Lime
LOCATION: Magnitowick
SOURCE: BAGHOUSE OUTLET
DATE: 11/24/98
OPERATOR: MB/JM
RUN #: 3
START: 13:47 STOP:

AMBIENT TEMPERATURE:
ASSUMED MOISTURE, %:
PROBE HEATER SETTING:
HEATER BOX SETTING:
PROJECT MANAGER:
METERBOX #: 2
K FACTOR: 7.50

BAROMETRIC PRESSURE:
Y FACTOR: .9969
METER ΔH@: 1.960
PROBE NUMBER: PT
NOZZLE #,DIAM.,in.:
STACK DIAMETER Inches:
PORT LENGTH,Inches:

FILTER NUMBER 6688
PRE-LEAK RATE: .001 CFM@ 14 in.Hg
POST-LEAK RATE: .001 CFM@ 13 in.Hg
PITOT LEAK CHECK: PRE: POST:
% OXYGEN: 14.0 % CO_2: 13.8
LIQUID GAINED: 46 + GEL 14 =Vlc:
C_p: .22 STATIC PRESSURE + ⊙ .22

CLOCK TIME	TRAVERSE POINT NUMBER	MIN PT SAMPLING 2.5	INITIAL VOLUME 803.90 SAMPLE VOLUME	VELOCITY HEAD Δ P	ORIFICE SETTING ΔH	PUMP VACUUM	STACK TEMPERATURE Ts	GAS METER TEMPERATURE Tin	GAS METER TEMPERATURE Tout	IMPINGER OUTLET TEMPERATURE	FILTER BOX TEMPERATURE	PROBE TEMPERATURE
	1-1	2.5	805.72	.32	2.40	6	365	50	51	42		
	2	5.0	807.75	.31	2.32	6	368	50	51	42		
	3	7.5	809.81	.35	2.63	6	366	51	51	44		
	4	10.0	811.75	.35	2.63	6	366	51	51	45		
	5	12.5	813.75	.35	2.63	6	366	53	50	46		
	6	15.0	815.80	.40	3.0	6	367	53	50	46		
	7	17.5	818.03	.42	3.15	8	368	54	50	46		
	8	20.0	820.03	.32	2.40	6	366	54	50	46		
	9	22.5	821.91	.30	2.25	5	368	55	50	47		
	10	25.0	823.97	.40	3.0	7	367	56	50	47		
	11	27.5	826.06	.35	2.63	7	367	57	50	47		
	12	30.0	827.51	.16	1.20	3	367	57	50	47		
	2-1	32.5	829.01	.16	1.20	3	368	57	50	47		
	2	35.0	830.68	.30	2.25	5	360	57	51	45		
	3	37.5	832.63	.34	2.55	6	366	56	51	46		
	4	40.0	834.66	.36	2.7	6	367	59	51	46		
	5	42.5	836.80	.30	2.25	6	368	59	52	46		
	6	45.0	838.94	.45	3.38	11	368	61	52	47		
	7	47.5	840.00	.30	2.25	6	367	61	52	47		
	8	50.0	842.88	.28	2.10	5	360	59	52	47		
	9	52.5	844.81	.29	2.18	5	375	60	52	47		
	10	55.0	846.61	.35	2.63	6	372	61	52	46		
	11	57.5	848.78	.34	2.55	7	381	61	53	47		
	12	60.0	850.87	.36	2.70	7	380	61	53	47		
			(1.0 ft)	(Total 47)			(371.38)	(57.75)				

Environmental Monitoring & Technologies, Inc.

Method 202 Inorganic CPM Calculations

Company Rockwell Lime
Location Manitowoc, WI
Source Lime Kiln Exhaust
Date 11-24-98

INPUT DATA:

	RUN 1	RUN 2	RUN 3
Inorg CPM, mg	51.2	22.1	27.8
impinger vol., mL	240	255	245
IC aliquot, mL	5	5	5
SO4 conc, mg/mL	0.0900	0.0749	0.3420

Mc = K x (SO4 conc.) x (impinger vol)

Mi = (Inorg CPM) x (impinger vol/(impinger vol - IC aliquot)) - Mc

Mc = mass of the NH4+ added to sample to form ammonium sulfate
K = -0.0208 (constant)
Mi = (Corrected) Mass of Inorganic CPM, mg

CALCULATIONS:

	RUN 1	RUN 2	RUN 3
Mc (mg)	-0.4	-0.4	-1.7
Mi (mg)	**52.7**	**22.9**	**30.1**

Environmental Monitoring & Technologies, Inc.

Continuous Emission Monitor Field Data Sheet

Company Rockwell Lime
Location Rockwood/WI
Source Lime Kiln Exhaust
Run #
Date 11-24-98

Cylinder #	Cert. Conc.	PSI	Type	Cylinder #	Cert. Conc.	PSI	Type
CC10433	90.89	1100	SO2				
CC65878	45.4	1900	SO2				
CC84918	450	1200					
CC38489	246	900					

	CEM I.D.	CEM I.D.
	SPAN VALUE	
VOC		
NOx		
CO		
SO2	500	
O2		
CO2		

CEM I.D. SO2 Parameter SO2			CEM I.D. Parameter			CEM I.D. Parameter			CEM I.D. Parameter		
Time	Conc.	Comments	Time	Conc.	Comments	Time	Conc.	Comments	Time	Conc.	Comments
0841	Ø	Direct									
0846	450	"									
0851	246	"									
0857	Ø	Bias									
0859	450	RT									
0904	450	Bias									
0907	246	Bias									
0947	Ø	Zero/Pre									
0951	450	Cal/Pre									
1009	Run1	O2 15.0 CO2 13.5									
1116	Ø	pre/post									
1120	450	pre/post									
1200	Run2	O2 13.8 CO2 13.0									
1312	Ø	pre/post									
1334	450	pre/post									
1342	Run3	O2 14.0 CO2 13.8									
1415	Coal shute plugged										
1448	Ø	Zero									
1453	450	Cal									

Rockwell Lime, Lime Kiln Exhaust, Manitowoc, WI

Calibration Data in BOLD
Test Data UNDERLINED

MMDDYY	TIME	SO2 ppm
112498	8:25	0.1
112498	8:26	0.1
112498	8:27	-0.1
112498	8:28	-0.1
112498	8:29	-0.0
112498	8:30	-0.0
112498	8:31	-0.0
112498	8:32	4.9
112498	8:33	294.4
112498	8:34	347.9
112498	8:35	335.9
112498	8:36	322.9
112498	8:37	189.0
112498	8:38	5.3
112498	8:39	0.8
112498	8:40	**0.4**
112498	8:41	**0.2**
112498	8:42	0.1
112498	8:43	135.4
112498	8:44	285.1
112498	8:45	**450.3**
112498	8:46	**452.0**
112498	8:47	354.9
112498	8:48	46.9
112498	8:49	232.8
112498	8:50	**245.7**
112498	8:51	**245.8**
112498	8:52	225.3
112498	8:53	19.9
112498	8:54	**4.0**
112498	8:55	**2.5**
112498	8:56	5.9
112498	8:57	361.3
112498	8:58	209.0
112498	8:59	249.7
112498	9:00	155.1
112498	9:01	141.5
112498	9:02	383.8
112498	9:03	**450.5**
112498	9:04	**450.6**
112498	9:05	320.5
112498	9:06	238.3
112498	9:07	**242.7**
112498	9:08	**239.7**
112498	9:09	43.6
112498	9:10	5.7
112498	9:11	3.1
112498	9:12	2.2
112498	9:13	6.0
112498	9:14	261.1
112498	9:15	360.5
112498	9:16	366.1
112498	9:17	365.8
112498	9:18	392.3
112498	9:19	350.9
112498	9:20	333.9
112498	9:21	330.9
112498	9:22	345.0

Rockwell Lime, Lime Kiln Exhaust, Manitowoc, WI

MMDDYY	TIME	SO2 ppm
112498	9:23	347.6
112498	9:24	380.1
112498	9:25	400.2
112498	9:26	397.6
112498	9:27	375.3
112498	9:28	312.9
112498	9:29	283.1
112498	9:30	242.1
112498	9:31	250.8
112498	9:32	251.9
112498	9:33	304.8
112498	9:34	312.9
112498	9:35	325.4
112498	9:36	339.4
112498	9:37	290.4
112498	9:38	277.3
112498	9:39	269.8
112498	9:40	265.0
112498	9:41	305.3
112498	9:42	322.9
112498	9:43	330.4
112498	9:44	42.7
112498	9:45	6.4
112498	9:46	**3.5**
112498	9:47	**2.4**
112498	9:48	40.4
112498	9:49	403.6
112498	9:50	**450.7**
112498	9:51	**451.3**
112498	9:52	294.9
112498	9:53	21.6
112498	9:54	7.0
112498	9:55	4.0
112498	9:56	116.9
112498	9:57	288.9
112498	9:58	367.5
112498	9:59	400.0
112498	10:00	468.1
112498	10:01	471.4
112498	10:02	441.2
112498	10:03	457.4
112498	10:04	390.7
112498	10:05	378.1
112498	10:06	362.4
112498	10:07	342.0
112498	10:08	321.2

Rockwell Lime, Lime Kiln Exhaust, Manitowoc, WI

MMDDYY	TIME	SO2 ppm
112498	10:09	355.0
112498	10:10	371.9
112498	10:11	314.2
112498	10:12	337.5
112498	10:13	303.8
112498	10:14	307.6
112498	10:15	297.3
112498	10:16	328.9
112498	10:17	354.2
112498	10:18	414.7
112498	10:19	441.9
112498	10:20	461.5
112498	10:21	477.3
112498	10:22	438.1
112498	10:23	422.3
112498	10:24	363.6
112498	10:25	370.3
112498	10:26	387.2
112498	10:27	430.5
112498	10:28	428.7
112498	10:29	398.7
112498	10:30	434.8
112498	10:31	406.9
112498	10:32	383.1
112498	10:33	374.5
112498	10:34	387.9
112498	10:35	434.0
112498	10:36	481.1
112498	10:37	479.6
112498	10:38	492.5
112498	10:39	467.9
112498	10:40	446.5
112498	10:41	389.2
112498	10:42	347.7
112498	10:43	345.1
112498	10:44	349.8
112498	10:45	405.6
112498	10:46	438.1
112498	10:47	455.0
112498	10:48	451.5
112498	10:49	413.7
112498	10:50	382.6
112498	10:51	353.7
112498	10:52	347.6
112498	10:53	371.0
112498	10:54	384.5
112498	10:55	405.4
112498	10:56	384.5
112498	10:57	383.0
112498	10:58	378.6
112498	10:59	350.7
112498	11:00	326.1
112498	11:01	327.6
112498	11:02	335.8
112498	11:03	342.2
112498	11:04	323.4
112498	11:05	296.9
112498	11:06	293.9

START RUN 1

AVERAGE CONCENTRATION

SO2	380.6	ppm
		%

AVERAGE CALIBRATION

	ZERO	CAL.	
SO2	1.7	450.8	ppm

FINAL CALIBRATION CORRECTED TEST RESULTS

SO2	**379.7**	**ppm ***
SO2	**145.06**	**lb/hr ****
FLOW	**2297551.5**	**dscfh**

Rockwell Lime, Lime Kiln Exhaust, Manitowoc, WI

MMDDYY	TIME	SO2 ppm
112498	11:07	256.1
112498	11:08	275.5
112498	11:09	283.1
112498	11:10	298.5
112498	11:11	300.4
112498	11:12	122.3
112498	11:13	6.6
112498	11:14	2.3
112498	11:15	1.1
112498	11:16	0.5
112498	11:17	**0.2**
112498	11:18	-0.0
112498	11:19	-0.1
112498	11:20	18.3
112498	11:21	383.8
112498	11:22	445.2
112498	11:23	449.0
112498	11:24	**450.2**
112498	11:25	**451.0**
112498	11:26	401.8
112498	11:27	45.0
112498	11:28	8.4
112498	11:29	3.5
112498	11:30	1.7
112498	11:31	0.8
112498	11:32	0.2
112498	11:33	-0.1
112498	11:34	-0.3
112498	11:35	-0.4
112498	11:36	-0.6
112498	11:37	-0.8
112498	11:38	-0.8
112498	11:39	-0.9
112498	11:40	-0.9
112498	11:41	-0.5
112498	11:42	-0.6
112498	11:43	-0.7
112498	11:44	-0.5
112498	11:45	-0.6
112498	11:46	-0.8
112498	11:47	-0.6
112498	11:48	91.4
112498	11:49	360.9
112498	11:50	382.2
112498	11:51	399.6
112498	11:52	336.3
112498	11:53	297.5
112498	11:54	279.1
112498	11:55	291.9
112498	11:56	289.2
112498	11:57	320.8
112498	11:58	315.1
112498	11:59	312.8

END RUN 1

* Corrected SO2 calculated as follows :
2 conc.-Avg. zero)x(Cal. gas conc.)/(Avg. cal.-Avg. zero)
SO2 cal gas = 450 ppm

** SO2 lb/hr calculated as follows :
(Flow,dscfh) x (Corrected SO2 ppm x 64.06) / (385.26E06)

Rockwell Lime, Lime Kiln Exhaust, Manitowoc, WI

MMDDYY	TIME	SO2 ppm
112498	12:00	338.5
112498	12:01	311.7
112498	12:02	312.9
112498	12:03	307.2
112498	12:04	293.8
112498	12:05	307.0
112498	12:06	304.0
112498	12:07	346.6
112498	12:08	335.1
112498	12:09	353.3
112498	12:10	357.9
112498	12:11	333.6
112498	12:12	306.9
112498	12:13	293.1
112498	12:14	307.9
112498	12:15	346.4
112498	12:16	360.1
112498	12:17	356.2
112498	12:18	371.2
112498	12:19	331.7
112498	12:20	316.4
112498	12:21	303.2
112498	12:22	292.5
112498	12:23	318.1
112498	12:24	353.0
112498	12:25	356.9
112498	12:26	365.2
112498	12:27	369.1
112498	12:28	346.8
112498	12:29	332.2
112498	12:30	309.5
112498	12:31	332.4
112498	12:32	331.8
112498	12:33	374.8
112498	12:34	400.6
112498	12:35	383.4
112498	12:36	416.8
112498	12:37	385.2
112498	12:38	388.8
112498	12:39	358.6
112498	12:40	367.7
112498	12:41	373.2
112498	12:42	440.2
112498	12:43	473.9
112498	12:44	466.5
112498	12:45	451.2
112498	12:46	431.6
112498	12:47	408.7
112498	12:48	390.2
112498	12:49	397.7
112498	12:50	391.0
112498	12:51	462.7
112498	12:52	466.1
112498	12:53	474.1
112498	12:54	486.7
112498	12:55	433.3
112498	12:56	426.3
112498	12:57	383.1

START RUN 2

AVERAGE CONCENTRATION

SO2	369.7	ppm
		%

AVERAGE CALIBRATION

	ZERO	CAL.	
SO2	0.8	449.8	ppm

FINAL CALIBRATION CORRECTED TEST RESULTS

SO2	369.7	ppm *
SO2	140.04	lb/hr **
FLOW	2278168.0	dscfh

Rockwell Lime, Lime Kiln Exhaust, Manitowoc, WI

MMDDYY	TIME	SO2 ppm
112498	12:58	380.9
112498	12:59	371.6
112498	13:00	431.2
112498	13:01	449.7
112498	13:02	441.0
112498	13:03	457.2
112498	13:04	395.2
112498	13:05	363.3
112498	13:06	329.9
112498	13:07	329.5
112498	13:08	343.9
112498	13:09	254.8
112498	13:10	11.8
112498	13:11	**2.0**
112498	13:12	**0.4**
112498	13:13	18.7
112498	13:14	122.3
112498	13:15	132.5
112498	13:16	139.5
112498	13:17	126.6
112498	13:18	128.5
112498	13:19	119.5
112498	13:20	117.5
112498	13:21	6.6
112498	13:22	6.5
112498	13:23	-0.3
112498	13:24	-1.1
112498	13:25	-1.3
112498	13:26	-0.7
112498	13:27	-0.7
112498	13:28	-0.9
112498	13:29	1.6
112498	13:30	26.9
112498	13:31	304.0
112498	13:32	**447.0**
112498	13:33	**451.1**
112498	13:34	446.3
112498	13:35	109.2
112498	13:36	11.8
112498	13:37	5.1
112498	13:38	2.9
112498	13:39	1.7
112498	13:40	136.9
112498	13:41	368.8

END RUN 2

* Corrected SO2 calculated as follows :
2 conc.-Avg. zero)x(Cal. gas conc.)/(Avg. cal.-Avg. zero)
SO2 cal gas = 450 ppm

** SO2 lb/hr calculated as follows :
(Flow,dscfh) x (Corrected SO2 ppm x 64.06) / (385.26E06)

Rockwell Lime, Lime Kiln Exhaust, Manitowoc, WI

MMDDYY	TIME	SO2 ppm
112498	13:42	386.1
112498	13:43	385.5
112498	13:44	401.5
112498	13:45	464.1
112498	13:46	474.3
112498	13:47	464.1
112498	13:48	476.2
112498	13:49	433.3
112498	13:50	442.3
112498	13:51	422.6
112498	13:52	422.1
112498	13:53	410.1
112498	13:54	492.1
112498	13:55	476.4
112498	13:56	481.3
112498	13:57	482.2
112498	13:58	440.1
112498	13:59	423.1
112498	14:00	380.4
112498	14:01	376.3
112498	14:02	393.0
112498	14:03	433.9
112498	14:04	483.8
112498	14:05	471.8
112498	14:06	469.2
112498	14:07	457.6
112498	14:08	436.0
112498	14:09	378.8
112498	14:10	382.3
112498	14:11	412.3
112498	14:12	479.9
112498	14:13	250.3
112498	14:14	41.7
112498	14:15	17.7
112498	14:16	140.8
112498	14:17	212.4
112498	14:18	238.2
112498	14:19	261.0
112498	14:20	278.8
112498	14:21	361.8
112498	14:22	388.5
112498	14:23	366.7
112498	14:24	448.5
112498	14:25	427.2
112498	14:26	392.0
112498	14:27	365.7
112498	14:28	374.3
112498	14:29	406.2
112498	14:30	403.5
112498	14:31	434.1
112498	14:32	438.2
112498	14:33	461.8
112498	14:34	467.3
112498	14:35	431.5
112498	14:36	416.6
112498	14:37	430.4
112498	14:38	443.2
112498	14:39	416.0

START RUN 3

AVERAGE CONCENTRATION

SO2	395.0	ppm
		%

AVERAGE CALIBRATION

	ZERO	CAL.	
SO2	2.6	450.2	ppm

FINAL CALIBRATION CORRECTED TEST RESULTS

SO2	394.5	ppm *
SO2	152.98	lb/hr **
FLOW	2332093.0	dscfh

Rockwell Lime, Lime Kiln Exhaust, Manitowoc, WI

MMDDYY	TIME	SO2 ppm
112498	14:40	420.5
112498	14:41	414.9
112498	14:42	404.3
112498	14:43	446.6
112498	14:44	443.4
112498	14:45	242.1
112498	14:46	9.8
112498	14:47	**4.6**
112498	14:48	**3.5**
112498	14:49	3.1
112498	14:50	2.8
112498	14:51	**452.9**
112498	14:52	**449.9**
112498	14:53	220.0
112498	14:54	74.5
112498	14:55	-999.0
112498	14:56	-999.0
112498	14:57	-999.0
112498	14:58	-999.0
112498	14:59	-999.0

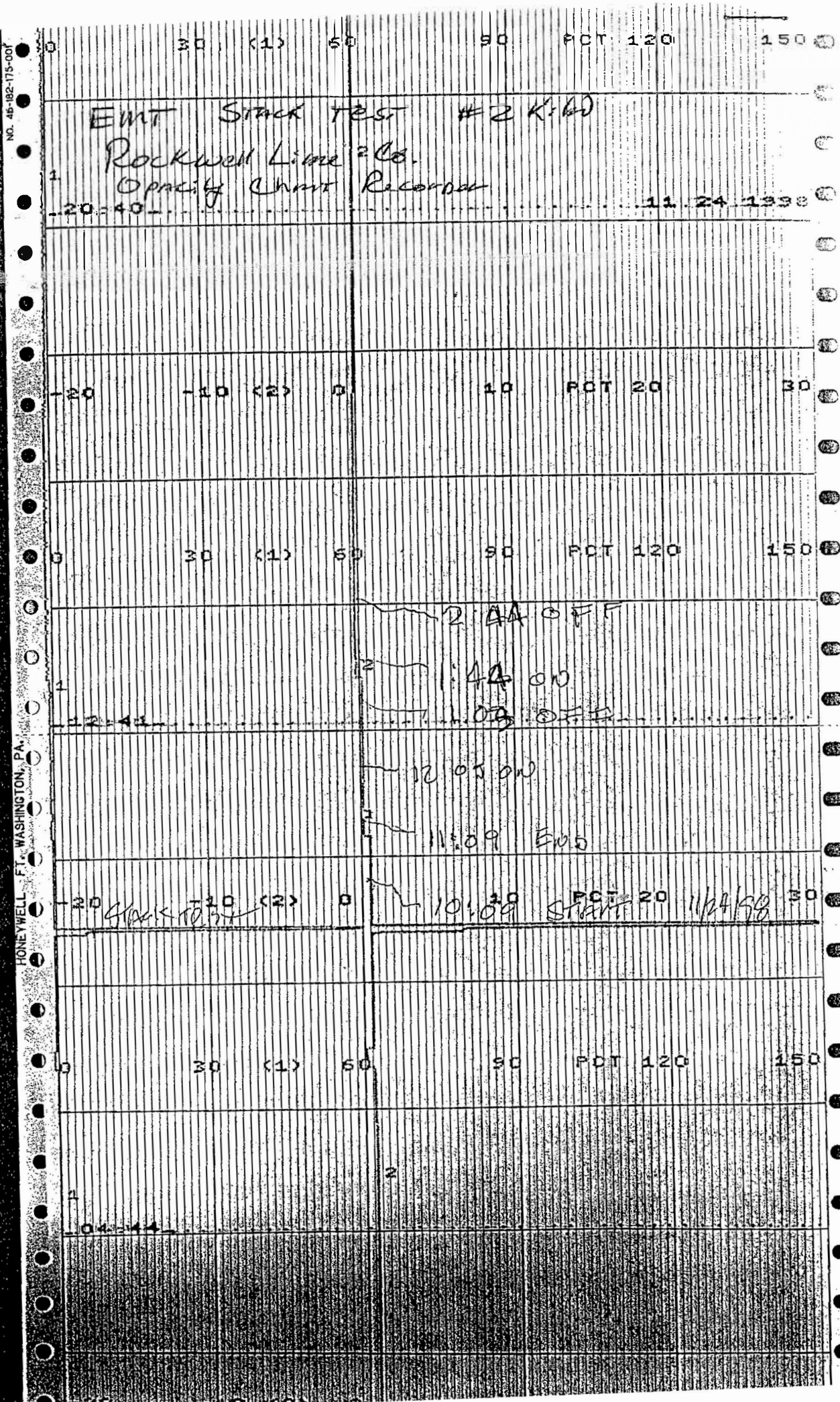
END RUN 3

* Corrected SO2 calculated as follows :
2 conc.-Avg. zero)x(Cal. gas conc.)/(Avg. cal.-Avg. zero)
SO2 cal gas = 450 ppm

** SO2 lb/hr calculated as follows :
(Flow,dscfh) x (Corrected SO2 ppm x 64.06) / (385.26E06)

Appendix B

Laboratory Results
Chain of Custody Records



EMT Stack Test #2 Kiln
Rockwell Lime Co.
Opacity Chart Recorder
11.24.1998
2:44 OFF
1:44 ON
1:03 OFF
12:05 ON
11:09 END
10:09 START 11/24/98
Stack Test
HONEYWELL FT. WASHINGTON, PA.
NO. 46-182-175-001