AP-42 Section Number: 11.6

Reference Number: 25

Title: Source Emissions Survey of Lone Star Industries, Inc.

Mullins Environmental Testing Co.

November 1981

Source category: Portland Cement
Plant name : Lone Star Industries, Inc.
Test date : 11/9 - 11/13/81
Process : wet

Date: 01/28/93
Location: New Orleans, LA
Ref. No.: 18
Basis for process rate : feed

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor		Volumetric flow rate, DSCFM	Concen %
						kg/Mg	lb/ton		
rotary kiln No. 1 (coal-fired)	ESP	filt. PM	1	19.8	83	0.119	0.239		
		filt. PM	2	18.7	83	0.113	0.225		
		filt. PM	3	16.5	83	0.0994	0.199		
					average	0.110	0.221	Rating :	B
		SO_2	1	174.1	83	1.05	2.10		
		SO_2	2	309.4	83	1.86	3.73		
		SO_2	3	280	83	1.69	3.37		
					average	1.53	3.07	Rating :	C
		CO_2	1	103,388	83	623	1,246	121,897	12.4
		CO_2	2	107,930	83	650	1,300	128,287	12.3
		CO_2	3	107,919	83	650	1,300	126,221	12.5
					average	641	1,282	Rating :	B
		SO_3	1	8.42	83	0.0507	0.101		
		SO_3	2	7.6	83	0.0458	0.0916		
		SO_3	3	2.59	83	0.0156	0.0312		
					average	0.0374	0.0747	Rating :	C
		NH_4	1	1.24	83	0.00747	0.0149		
		NH_4	2	0.99	83	0.00596	0.0119		
		NH_4	3	2.31	83	0.0139	0.0278		
					average	0.00912	0.0182	Rating :	C
		Cl	1	15.17	83	0.0914	0.183		
		Cl	2	28.51	83	0.172	0.343		
		Cl	3	28.05	83	0.169	0.338		
					average	0.144	0.288	Rating :	C
		K	1	2.41	83	0.0145	0.0290		
		K	2	1.60	83	0.00964	0.0193		
		K	3	2.05	83	0.0123	0.0247		
					average	0.0122	0.0243	Rating :	B
		Na	1	2.13	83	0.0128	0.0257		
		Na	2	2.35	83	0.0142	0.0283		
		Na	3	2.32	83	0.0140	0.0280		
					average	0.0137	0.0273	Rating :	B
		SO_4	1	21.82	83	0.131	0.263		
		SO_4	2	17.42	83	0.105	0.210		
		SO_4	3	9.75	83	0.0587	0.117		
					average	0.0984	0.197	Rating :	B

rotary kiln No. 2 (coal-fired)	ESP	filt. PM	1	25.1	83	0.151	0.302		
		filt. PM	2	14.3	83	0.0861	0.172		
		filt. PM	3	12.8	83	0.0771	0.154		
					average	0.105	0.210	Rating :	B
		SO2	1	175.3	83	1.06	2.11		
		SO2	2	85	83	0.512	1.024		
		SO2	3	25.8	83	0.155	0.311		
					average	0.574	1.15	Rating :	C
		CO2	1	98,175	83	591	1,183	115,751	12.4
		CO2	2	90,090	83	543	1,085	107,082	12.3
		CO2	3	97,431	83	587	1,174	113,954	12.5
					average	574	1,147	Rating :	B
		SO3	1	1.58	83	0.00952	0.0190		
		SO3	2	1.61	83	0.00970	0.0194		
		SO3	3	2.78	83	0.0167	0.0335		
					average	0.0120	0.0240	Rating :	C
		NH4	1	0.93	83	0.00560	0.0112		
		NH4	2	0.73	83	0.00440	0.00880		
		NH4	3	0.64	83	0.00386	0.00771		
					average	0.00462	0.00924	Rating :	C
		Cl	1	22.06	83	0.133	0.266		
		Cl	2	15.85	83	0.0955	0.191		
		Cl	3	11.43	83	0.0689	0.138		
					average	0.0991	0.198	Rating :	C
		K	1	2.60	83	0.0157	0.0313		
		K	2	2.16	83	0.0130	0.0260		
		K	3	1.26	83	0.00759	0.0152		
					average	0.0121	0.0242	Rating :	B
		Na	1	2.03	83	0.0122	0.0245		
		Na	2	2.62	83	0.0158	0.0316		
		Na	3	1.53	83	0.00922	0.0184		
					average	0.0124	0.0248	Rating :	B
		SO4	1	7.94	83	0.0478	0.0957		
		SO4	2	7.12	83	0.0429	0.0858		
		SO4	3	6.97	83	0.0420	0.0840		
					average	0.0442	0.0885	Rating :	B

SUMMARY

PLANT: LONE STAR - NEW ORLEANS

LOCATION: NEW ORLEANS - LOUISIANA

TEST/IDENTIFICATION 81-107 DATE: NOV. 1981

TESTING BY: MULLINS ENVIRONMENTAL TESTING CO.

KILN/COOLER NO. 1 & 2 AVG.

PERFORMANCE

Kiln Production	Ton/Hr.	44.6	@ 1.984	K.F. Factor
Kiln Feed Rate	Ton/Hr.	88.5		
Fuel Rate (Coal)	Ton/Hr.	11.0	@ 11,500	BTU/lb.
" " (Oil)	Gal/Hr.	—		
Fuel Ash	%			
Fuel Sulphur	%			iln Feed S.
KILN (Stack)				LE
Exhaust Gas Flow	DSCFM			
Part. Concen.	lb/SCF			
Emission Rate	lb/Ton			
SOX (Kiln) (Concentration)	PPM			
Emission Rate	lb/Ton			
Emission Rate	lb/MMBTU			
NOX (Kiln) (Concentration)	PPM			
Emission Rate	lb/Ton			
COOLER (Stack)				
Exhaust Gas Flow	DSCFM	N.D.		
Part. Concen.	lb/SCF			
Emission Rate	lb/Ton			

Reference 39:

(2) Coal-fired, wet process kilns w/ ESPs; Minimal process data!

No documentation on clinker production or conversion factor!

Data Rating: C

REMARKS:

MULLINS ENVIRONMENTAL TESTING CO., INC.
P.O. Box 598
Addison, Tx 75001
(214) 931-7127

WLG your files

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WLG

SOURCE EMISSIONS SURVEY
OF
LONE STAR INDUSTRIES, INC.
NEW ORLEANS, LOUISIANA

NOVEMBER 1981

FILE NUMBER 81-107

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TABLE OF CONTENTS

SOURCE EMISSIONS SURVEY
LONE STAR INDUSTRIES, INC.
NEW ORLEANS, LOUISIANA
FILE NUMBER 81-107

INTRODUCTION

Mullins Environmental Testing Co., Inc., Dallas, Texas, conducted a source emissions survey at the Lone Star Industries, Inc. plant located in New Orleans, Louisiana, on November 10, 11, 12 and 13, 1981. The purpose of the survey was to determine the concentrations of particulate matter, sulfur dioxide, chloride, sodium, potassium, and ammonium being emitted to the atmosphere via the precipitator exhaust stacks of Kiln Number 1 and Kiln Number 2.

The sampling followed the procedures set forth in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60.

The tests were observed by Mr. Bob Wasconick of the Louisiana Air Control Commission and Mr. Roy Click of Lone Star Industries, Inc.

SUMMARY OF RESULTS

The principal conclusions are as follows:

Kiln Number 1 Stack

dry to feed kiln!

1. The emissions of particulate matter from the stack were equal to 0.197 pounds per ton of kiln feed (18.3 pounds per hour), based on averaging the three tests using only the "front-half" collection from the EPA-type sampling train. The allowable emission rate as calculated from the Regulations of the Louisiana Air Control Commission, Table 3 is equal to 50.66 pounds per hour. The actual emissions were 36.2 percent of the permitted emission rate.

2. The emissions of sulfur dioxide from the stack were equal to 203 parts per million (254.5 pounds per hour), based on averaging the three tests.

3. The emissions of ammonium from the stack were equal to 1.5 pounds per hour, based on averaging the three tests.

4. The emissions of chloride from the stack were equal to 23.9 pounds per hour, based on averaging the three tests.

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Kiln Number 2 Stack

1. The emissions of particulate matter from the stack were equal to 0.209 pounds per ton of kiln feed (17.4 pounds per hour), based on averaging the three tests using only the "front-half" collection from the EPA-type sampling train. The allowable emission rate as stated in the Code of Federal Regulations, Title 40, Chapter I, Part 60, Subpart F is equal to 0.30 pounds per ton of kiln feed. The actual emissions were 69.8 percent of the permitted emission rate.

2. The emissions of sulfur dioxide from the stack were equal to 84.8 parts per million (95.4 pounds per hour), based on averaging the three tests.

3. The emissions of ammonium from the stack were equal to 0.77 pounds per hour, based on averaging the three tests.

4. The emissions of chloride from the stack were equal to 16.4 pounds per hour, based on averaging the three tests.

SUMMARY OF RESULTS

Kiln Number 1 Stack

Run Number	1	2	3
Stack Flow Rate - ACFM	246,766	255,832	253,631
Stack Flow Rate - DSCFM* 125,468	121,897	128,287	126,221
% Water Vapor - % Vol.	23.5	22.4	23.8
% CO_2 - % Vol. CO_2 12.4	12.4	12.3	12.5
% O_2 - % Vol. O_2 11.7 N_2 75.9	11.6	12.0	11.6
% Excess Air @ Sampling Point [illegible]	136	149	136
Particulates Probe, Cyclone & Filter Catch grains/dscf*	0.0190	0.0170	0.0153
grains/cf @ Stack Conditions	0.0093	0.0085	0.0076
lbs/hr	19.8	18.7	16.5
Total Catch grains/dscf*	------	------	------
grains/cf @ Stack Conditions	------	------	------
lbs/hr	------	------	------
Kiln Feed Rate as Provided by Lone Star Industries, Inc. - tons/hr	94.0	94.0	94.0
Emission Rate - lbs/ton of kiln feed	0.21	0.20	0.18
Allowable Emission Rate LACC Reg. Table 3 - lbs/hr	50.66	50.66	50.66
Sulfur Dioxide Emissions - lbs/hr	174.1	309.4	280.0

*29.92 "Hg, 68°F

81-107

SUMMARY OF EMISSION TESTS
New Orleans
November 9th - 13, 1981

	Kiln No. 1		Kiln No. 2	
Stack Flow ACFM	252076		229817	
Stack Flow DSCFM	125468		112262	
% Water Vapor %Vol	23.2		22.8	
Particulates Front Half				
Grains/Cf @Stack Conditions	0.0085		0.0088	
Emissions lbs/hr.	18.33		17.4	
Kiln Feed Rate	94.0 (La.)		83.0 (EPA)	
Allowable Emission Rate lbs/hr.	50.7 (La.)			
Allowable Emission Rate lbs/hr			24.9 (EPA	
Sulfur Dioxide Emissions lbs/hr.				
Allowed by Louisiana State	325 - 340		325 - 340	
Sulfur Dioxide Emissions by Test lbs/hr.	254.5		95.4	
	lbs/hr	ppm	lbs/hr	ppm
Ammonium lbs/hr - ppm	1.51(4.78)*	2.67(7.7)*	0.77(3.94)*	1.3(7.3)*
Chlorides lbs/hr - ppm	23.9	33.7	16.5	25.0
Potassium lbs/hr - ppm	2.02	2.67	2.01	2.3
Sodium lbs/hr - ppm	2.27	5.0	2.06	5.0
Sulfate lbs/hr - ppm	16.3	11.3	7.3	5.3

Pounds of NH_3 picked up in the first impinger had already began to form compounds with SO_2 and Cl.

Charlie your file after you review.

LONE STAR INDUSTRIES, INC.

Interoffice Memo

Mail: P. O. Box 12449, Dallas, Texas 75225

January 11, 1982

RECEIVED
JAN 14 1981

TO: Mike Reid

FROM: Roy Click

SUBJECT: New Orleans Emission Testing

Attached are reports on the New Orleans Emission Tests for your review.

The test reports from Mullins Environmental are in my office and will not be forwarded to Louisiana Air Control until I receive your directions.

At present, I plan to send a short letter to Louisiana Air Control stating that particulate and SO_2 emissions are within regulations. The other components analyzed are in low concentrations, and no harmful effects should occur.

Also, if agreeable with you, I plan to send the two reports attached "Sulfur Dioxide Oxidation and Plume Formation at Cement Kilns" and "Reactive Plumes - Sampling and Opacity - Concerns for Cement Kilns". These reports will give them some background.

Awaiting your comments.

Roy

RC:ss

Attachments

cc: Pratt Lathem
Bob Searles

LONE STAR INDUSTRIES, INC.

Interoffice Memo

Mail: P. O. Box 12449, Dallas, Texas 75225

January 11, 1982

TO: Mike Reid

FROM: Roy Click

SUBJECT: Emission Testing of New Orleans Stacks in Accordance with a Direction from Louisiana Air Control.

During the past several months, Lone Star has had several discussions with Louisiana Air Control, regarding the detached plume at the New Orleans Plant. In these discussions, attempts were made to describe the phenomena, as well as, emphasizing that there are no harmful effects associated with the plume. Since Louisiana Air was not satisfied with these discussions, and there were associated emission problems, they requested that we conduct emission tests on kilns No. 1 and No. 2 to determine constituents of the exit gases. In the meeting of October 2, an agreement was reached that the exit gases would be analyzed for particulates, ammonia, chlorides, sulfates, sulfur dioxide, sodium, and potassium. These tests were conducted during the period of November 9, through November 13. Attached is a summary of these results for your review. Also, enclosed is a complete report on these tests prepared by Mullins Environmental Testing Company, Inc.

Results of these tests indicate that the New Orleans Plant is in compliance with regulation on particulates and SO_2 emissions.

Discussion of Results

These results show that the particulate emissions were 17 and 18 lbs/hr., which is below the maximum allowed by Louisiana State Regulations and EPA. Also, SO_2 emissions were on an average between 95 to 255 lbs/hr., which again is below the maximum allowables of 325 to 340 lbs/hr. permitted by Louisiana Air Control. During this testing period, a 0.66% Sulfur Coal was used, which without any absorbtion would have allowed SO_2 emissions to be approximately 463 lbs/hr. Therefore, based on the numbers available, the absorbtion rate is between 45% and 80%.

In regards to the other components, ammonia, chlorides, potassium, sodium, and sulfates are in such low concentrations, that no harmful effects could occur. In addition, these components combine to form complex compounds of ammonium, potassium, sodium and calcium sulfites and sulfates, as well as, complex chloride compounds. The data obtained during these tests are similiar to previous studies on reactive or detached plumes. A comparsion of this test with previous studies shows that our emission concentrations of SO_2 and NH_3 are lower and could be partly responsible for a less noticeable plume. The chlorides are higher, but again the chlorides are combined as sodium, potassium, ammonium, and calcium chlorides.

During the testing period, the detached plume was not as evident as I have seen in the past, which can be attributed to a lower ambient humidity, smaller temperature differential, and a lower SO_2 concentration.

Therefore, based on these tests, as well as previous tests, observations and discussions, I am in agreement with the attached publications that the detached plume is formed by a combination of water droplets, complex compounds of ammonium sulfates, and chlorides of sodium, potassium, and calcium.

RC:ss

Attachments

cc: Pratt Lathem
Bob Searles

LONE STAR INDUSTRIES, INC.

One Greenwich Plaza, Greenwich, Connecticut 06830

send WCG your files

Interoffice Memo

January 20, 1982

TO: R. Click

FROM: M. M. Reid

SUBJECT: New Orleans Emission Testing

I have quickly reviewed the test results of the New Orleans kilns. Basically, I have no problems with submitting the results to the Louisiana Air Control Board. I would like for Charlie Fehnel to review the results before our final submission. He will contact you and release the information or suggest any corrections.

I do not necessarily see any advantage to Lone Star in submitting the two reports to the Board, but I have no large objections. I would only submit the paper titled "Sulfur Dioxide Oxidation and Plume Formation at Cement Kilns". I would not submit the Chadbourne article.

The only other comment I have is why are the emissions so low when previous tests indicated excessive emissions of particulates.

Mike

M. M. Reid

MMR/jag

cc: C. D. Fehnel
S. P. Lathem
R. A.Searles

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SUMMARY OF RESULTS

Kiln Number 1 Stack

(All results expressed as pounds per hour)

	Ammonium	Chloride	Potassium	Sodium	Sulfate	Sulfur Dioxide
Run Number 1						
Front Wash	0.00	0.58	0.50	0.15	0.73	-----
Filter	0.01	3.69	1.89	1.98	3.23	-----
Back Half	1.23 (6.11)*	10.9	0.02	0.00	17.86	174.1
Total Run Number 1	1.24	15.17	2.41	2.13	21.82	174.1
Run Number 2						
Front Wash	0.00	0.58	0.54	0.22	1.02	-----
Filter	0.03	5.23	0.96	2.12	1.85	-----
Back Half	0.96 (4.30)*	22.7	0.10	0.01	14.55	309.4
Total Run Number 2	0.99	28.51	1.60	2.35	17.42	309.4
Run Number 3						
Front Wash	0.01	0.49	1.15	0.33	0.59	-----
Filter	0.01	4.86	0.88	1.98	1.44	-----
Back Half	2.29 (3.94)*	22.7	0.02	0.01	7.72	280.0
Total Run Number 3	2.31	28.05	2.05	2.32	9.75	280.0

* These results were obtained by analyzing the first impinger of the particulate tests for ammonia.

SUMMARY OF RESULTS

Kiln Number 1 Stack
(All results expressed as parts per million)

	Ammonium	Chloride	Potassium	Sodium	Sulfate	Sulfur Dioxide
Run Number 1						
Front Wash	<1	1	1	<1	<1	---
Filter	<1	5	3	5	2	---
Back Half	2 (10)*	16	<1	<1	13	143
Total Run Number 1	2	22	4	5	15	143
Run Number 2						
Front Wash	0	1	1	<1	1	---
Filter	<1	7	1	5	1	---
Back Half	2 (7)*	31	<1	<1	10	242
Total Run Number 2	2	39	2	5	12	242
Run Number 3						
Front Wash	<1	1	1	1	<1	---
Filter	<1	7	1	4	1	---
Back Half	4 (6)*	32	<1	<1	6	223
Total Run Number 3	4	40	2	5	7	223

* These results were obtained by analyzing the first impinger of the particulate tests for ammonia.

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SUMMARY OF RESULTS

Kiln Number 2 Stack

Run Number	1	2	3
Stack Flow Rate - ACFM	237,341	218,290	233,821
Stack Flow Rate - DSCFM* 112,262	115,751	107,082	113,954
% Water Vapor - % Vol.	22.6	22.3	23.4
% CO_2 - % Vol.	13.2	12.4	12.6
% O_2 - % Vol.	10.9	11.6	11.7
% Excess Air @ Sampling Point	118	136	140
Particulates Probe, Cyclone & Filter Catch grains/dscf*	0.0253	0.0156	0.0131
grains/cf @ Stack Conditions	0.0123	0.0076	0.0064
lbs/hr	25.1	14.3	12.8
Total Catch grains/dscf*	------	------	------
grains/cf @ Stack Conditions	------	------	------
lbs/hr	------	------	------
Kiln Feed Rate as Provided by Lone Star Industries, Inc. - tons/hr	83.0	83.0	83.0
Emission Rate - lbs/ton of kiln feed	0.302	0.172	0.154
Allowable Emission Rate 40 CFR 60 - lbs/ton of kiln feed	0.30	0.30	0.30
Sulfur Dioxide Emissions - lbs/hr	175.3	85.0	25.8

*29.92 "Hg, 68°F

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SUMMARY OF RESULTS

Kiln Number 2 Stack

(All results expressed as pounds per hour)

	Ammonium		Chloride	Potassium	Sodium	Sulfate	Sulfur Dioxide
Run Number 1							
Front Wash	0.03		0.14	0.29	0.08	0.25	-----
Filter	0.02		4.62	2.30	1.95	3.72	-----
Back Half	0.88	(4.09)*	17.3	0.01	0.00	3.97	175.3
Total Run Number 1	0.93		22.06	2.60	2.03	7.94	175.3
Run Number 2							
Front Wash	0.01		0.14	0.28	0.09	0.45	-----
Filter	0.02		4.41	1.85	2.39	2.81	-----
Back Half	0.70	(4.56)*	11.3	0.03	0.14	3.86	85.0
Total Run Number 2	0.73		15.85	2.16	2.62	7.12	85.0
Run Number 3							
Front Wash	0.00		0.37	0.26	0.08	0.45	-----
Filter	0.01		3.16	1.00	1.45	1.56	-----
Back Half	0.63	(3.18)*	7.0	0.00	0.00	4.96	25.8
Total Run Number 3	0.64		11.43	1.26	1.53	6.97	25.8

* These results were obtained by analyzing the first impinger of the particulate tests for ammonia.

METCO

SUMMARY OF RESULTS

Kiln Number 2 Stack

(All results expressed as parts per million)

	Ammonium	Chloride	Potassium	Sodium	Sulfate	Sulfur Dioxide
Run Number 1						
Front Wash	<1	<1	<1	<1	1	---
Filter	<1	7	3	5	2	---
Back Half	2 (7)*	26	<1	<1	3	152
Total Run Number 1	2	33	3	5	6	152
Run Number 2						
Front Wash	<1	<1	<1	<1	<1	---
Filter	<1	7	3	6	2	---
Back Half	1 (9)*	18	<1	<1	3	80
Total Run Number 2	1	25	3	6	5	80
Run Number 3						
Front Wash	0	<1	<1	<1	<1	---
Filter	<1	5	1	4	1	---
Back Half	1 (6)*	12	<1	<1	4	23
Total Run Number 3	1	17	1	4	5	23

* These results were obtained by analyzing the first impinger of the particulate tests for ammonia.

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SUMMARY OF RESULTS

Total Milliequivalents of Cations and Anions

	Cations	Anions
Front Washes		
Kiln Number 1		
Run Number 1	0.0856	0.1299
Run Number 2	0.0644	0.0963
Run Number 3	0.1902	0.0668
Kiln Number 2		
Run Number 1	0.0510	0.1416
Run Number 2	0.0475	0.0471
Run Number 3	0.0439	0.0775
Filters		
Kiln Number 1		
Run Number 1	0.5911	0.7402
Run Number 2	0.3269	0.5081
Run Number 3	0.3101	0.4669
Kiln Number 2		
Run Number 1	0.5754	0.8195
Run Number 2	0.6279	0.7473
Run Number 3	0.3835	0.5158

Notes: In all cases, except Kiln Number 1, Run Number 3 wash, the milliequivalents of anions exceed the cations, indicating presence of another cation not analyzed for. Sample Kiln Number 2, Run Number 2 wash has equal amounts which indicates that probably all of the cations and anions are accounted for.

DISCUSSION OF RESULTS

Kiln Number 1 Stack

The three tests for particulates and sulfur dioxide taken on the Kiln Number 1 Stack appeared to be valid representations of the actual emissions during the tests. The indicative parameters calculated from the field tests were in close agreement. The moisture percentages for the three tests were within 3.6 percent of the mean value. The measured flow rates (Q_s) for the tests were within 2.8 percent of the mean value. The rates of sampling for the three tests were well within the specified limits, the greatest deviation being 2.7 percent.

The calculated emissions (pounds per hour) of particulate for the three tests showed a range of -10.0 percent to +8.0 percent variation from the mean value.

Sulfur dioxide was determined simultaneously with the particulate run. The indicative parameters all indicate that the results were valid. The collection efficiencies between the two sulfur dioxide impingers in these tests were very good, indicating that little, if any, sulfur dioxide was bypassed.

The efficiencies were as follows:

	Run #1	Run #2	Run #3
Impinger #2	98.5	98.7	98.5
Impinger #3	1.5	1.3	1.5

Collection of 90 percent or more of the sampled sulfur dioxide in the first sulfur dioxide impingers is a verification of a representative sample.

The calculated emissions (parts per million) of sulfur dioxide for the three tests showed a range of -29.3 percent to +19.4 percent variation from the mean value.

Kiln Number 2 Stack

The three tests for particulates and sulfur dioxide taken on the Kiln Number 2 Stack appeared to be valid representations of the actual emissions during the tests. The indicative parameters calculated from the field data were in close agreement. The moisture percentages for the three tests were within 2.9 percent of the mean value. The measured flow rates (Q_s) for the tests were within 4.6 percent of the mean value. The rates of sampling for the three tests were well within the specified limits, the greatest deviation being 9.5 percent.

The calculated emissions (pounds per hour) of particulate for the three tests showed a range of -26.4 percent to +44.3 percent variation from the mean value.

Sulfur dioxide was determined simultaneously with the particulate run. The indicative parameters all indicate that the results were valid. The collection efficiencies between the two sulfur dioxide impingers in these tests were very good, indicating that little, if any, sulfur dioxide was bypassed.

The efficiencies were as follows:

	Run #1	Run #2	Run #3
Impinger #2	98.8	98.4	97.9
Impinger #3	1.2	1.6	2.1

Collection of 90 percent or more of the sampled sulfur dioxide in the first sulfur dioxide impingers is a verification of a representative sample.

The calculated emissions (parts per million) of sulfur dioxide for the three tests showed a large variation from the mean value.

DESCRIPTION OF PROCESS OPERATION

The process used in manufacturing Portland Cement at New Orleans is the wet process system.

The basic raw materials used at the New Orleans plant are aragonite and clay. These materials are fed to a ball mill in proportions of 80 percent aragonite, 18 percent clay and 2 percent iron ore, and are ground so that 80 percent passes 200 mesh screen. Water is added to this mixture in the ball mill forming a slurry containing 36 percent to 40 percent water.

The slurry, when properly blended, and when it conforms to the desired chemical composition, is fed or pumped to the rotary kiln. At New Orleans, the Number One and Two Rotary Kilns are 12.5 feet by 14.5 feet in diameter and 460 feet long. The Kilns are coal fired with temperatures ranging from 600°F at the feed end to 2800°F in the clinkering zone. Four main processes take place within the Kilns and are as follows:

1. Drying.
2. Calcination or decarbonation of aragonite or limestone.
3. Clinkering - liquid formation to form cement compounds.
4. The cooling of clinker.

The liquid, upon cooling, forms hard masses 1/8 inch to 1-1/2 inches in diameter in size. These masses are called clinkers. Clinkers, when cooled, are conveyed to a storage area and are eventually transferred to a ball mill where they are ground to a fine powder. This is the final product.

Flow Diagram

Exhibit "A" presents a general material flow diagram.

Process Weight

During the past several years, considerable production and process data has been compiled and summarized which enables a prediction and verification of production capacities of the various process units.

Presently, kiln production is obtained by weighing clinker as it departs the clinker cooler area to storage. Daily clinker production may be further substantiated by flow meter rate, slurry tank measurements or an inventory of raw mix slurries.

During the emission sampling of Kiln Number 1, the production process weight was 83.0 tons per hour. Coal was being fed to the kiln at an average rate of 11.0 tons per hour, which brings the total feed to Kiln Number 1 to 94.0 tons per hour. Production process weight for

Kiln Number 2 during emission testing was 83.0 tons per hour. Coal is not considered part of the process weight under EPA Regulations.

Identity of Emissions

Emissions from the process are fine particulates and combustion gases. Coal is used as a source of fuel which contains some sulfur; consequently, the combustion gases are a mixture of water vapor, oxygen, carbon dioxide, and sulfur dioxide. The particulates are composed of calcined or semi-calcined aragonite and clay.

Plant Operation

Plant operations were normal except for a time when the induced draft fan cut out on Kiln Number 1. Emission testing was discontinued until the Kiln was back to normal operations.

PRODUCTION DATA DURING TESTING

	Raw Feed (tons/hr)	Coal Feed (tons/hr)	Total Feed (tons/hr)	Allowable Emissions (lbs/hr)
Kiln Number 1	83.0	11.0	94.0	Louisiana Regulation 50.66
Kiln Number 2	83.0	11.0	83.0	EPA Regulation 24.9

Kiln Number 1 Under State Regulations

Kiln Number 2 Installed after 1971, therefore, must abide by EPA Regulations.

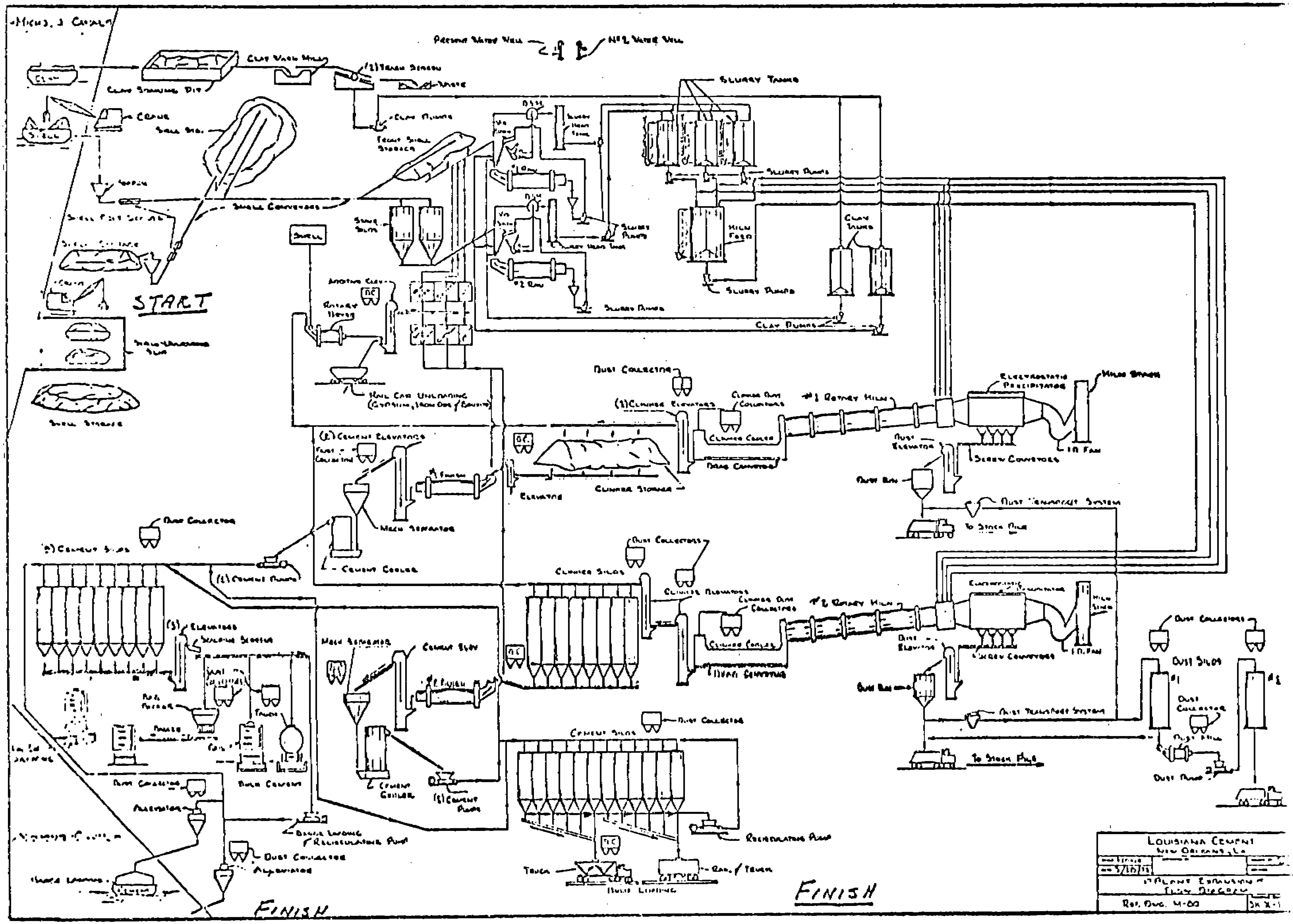

EXHIBIT "A" PROPOSED FLOW DIAGRAM

SK-PEP-1

DESCRIPTION OF SAMPLING LOCATIONS

The sampling location on the exhaust stack of the precipitator of Kiln Number 1 is approximately 64 feet above the ground. The inlet to the stack is approximately 47 feet above ground level. The sampling ports are located approximately 16 feet 7 inches (1.65 stack diameters) downstream from the inlet to the stack and 11 feet 9 inches (1.17 stack diameters) upstream from the outlet of the stack.

The sampling location on the exhaust stack of the precipitator of Kiln Number 2 is approximately 69 feet above the ground. The inlet to the stack is approximately 51 feet above ground level. The sampling ports are located approximately 18 feet 6 inches (1.85 stack diameters) downstream from the inlet to the stack and 5 feet 8 inches (0.57 stack diameters) upstream from the outlet of the stack.

SAMPLING AND ANALYTICAL PROCEDURES

The sampling followed the procedures outlined in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60.

A preliminary velocity traverse was made at each of the two ports on the exhaust stacks of the precipitator of Kiln Number 1 and of Kiln Number 2 in order to determine the uniformity and magnitude of the flow prior to testing. Twenty-four traverse points were sampled from each of the two ports on each stack for a total of forty-eight traverse points on each stack. Samples of two-minute duration were taken isokinetically at each of the twenty-four points on the traverse from each port using an EPA-type, heated, glass-lined probe.

On all the tests the sampling train was leak-checked at the nozzle at 15 inches of mercury vacuum before each test, and leak-checked at the nozzle after each test at the highest vacuum reading recorded during the test. This was performed to predetermine the possibility of a diluted sample.

Also before and after each test, the pitot tube lines were checked for leaks under both a vacuum and pressure. The lines were also checked for clearance and the manometer zeroed before each test.

Particulate emissions were calculated from gravimetric analysis using only the "front-half" collections from the EPA-type sampling train. The "back-half" of the sampling train contained a deionized water impinger to absorb hydrogen chloride, an 80 percent isopropyl alcohol solution to absorb sulfur trioxide, a six percent hydrogen peroxide solution to absorb sulfur dioxide, and silica gel to absorb moisture.

The ammonium samples were taken using two impingers containing 0.1 N sulfuric acid.

The particulate samples were also analyzed for ammonium, chloride, potassium, sulfate, and sodium.

DESCRIPTION OF TESTS

Personnel from Mullins Environmental Testing Co., Inc. arrived at the plant at 8:00 a.m. on Tuesday, November 10, 1981. After meeting with plant personnel, the equipment was moved onto the exhaust stack of Kiln Number 2. The preliminary data were collected, but further testing was delayed while adjustments were made to the precipitator. It was decided by plant personnel to delay testing until later that day. Testing personnel left the plant at 4:30 p.m. and returned to the plant at 6:30 p.m. Plant personnel decided to delay testing until the next day. The equipment was secured for the night at 7:00 p.m.

On Wednesday, November 11, work began at 8:00 a.m. Plant personnel decided to test Kiln Number 1 Stack while the Number 2 Precipitator was being repaired. The equipment was moved over to Kiln Number 1 Stack and the preliminary data were collected. The first test for particulate, chloride, and sulfur dioxide began at 10:50 a.m. Testing continued until 11:55 a.m. when testing was stopped while repairs were made to the induced draft fan. Testing resumed at 3:07 p.m. and continued until completion of the test at 3:50 p.m. Operational problems associated with a grate in the cooler prevented further testing that day. The equipment was secured for the night at 5:00 p.m.

On Thursday, November 12, work began at 8:00 a.m. Personnel stood by while the kiln achieved the desired operating level. The first test for ammonia was taken from 11:34 a.m. until 12:04 p.m. The second test for particulate, chloride, and sulfur dioxide began at 1:08 p.m. and continued until its completion at 2:56 p.m. The second ammonia test was taken from 3:32 p.m. until 4:02 p.m. The third test for particulate, chloride, and sulfur dioxide began at 4:39 p.m. and continued until completion of the test at 6:34 p.m. The third ammonia test was taken from 7:23 p.m. until 7:53 p.m. The equipment was moved off of Kiln Number 1 Stack and moved onto Kiln Number 2 Stack. The equipment was set up and secured for the night at 9:30 p.m.

On Friday, November 13, work began at 8:00 a.m. The equipment was prepared for testing and the first test for particulate, chloride, and sulfur dioxide began at 8:48 a.m. and continued until completion of the test at 10:35 a.m. The first ammonia test began at 11:06 a.m. and was completed at 11:36 a.m. The second test for particulate, chloride, and sulfur dioxide began at 12:07 p.m. and continued until 12:37 p.m. when a malfunction of the clinker elevator delayed testing. Testing was resumed at 1:21 p.m. and continued without difficulty until completion of the test at 2:40 p.m. The second test for ammonia was taken from 3:10 p.m. to 3:40 p.m. The third test for particulate, chloride, and sulfur dioxide was taken from 4:09 p.m. until 5:56 p.m. The third ammonia test began at 6:32 p.m. and ended at 7:02 p.m.

The equipment was moved off the stack and loaded into the sampling van. The samples were recovered and transported to Mullins Environmental Testing Co.'s laboratory in Dallas, Texas for analysis and evaluation.

Operations at the Lone Star Industries, Inc. Cement Plant in New Orleans, Louisiana were completed at 8:30 p.m. on Friday, November 13, 1981.

Billy J. Mullins, Jr.

Billy J. Mullins, Jr., P.E.
President

APPENDICES

A. Location of Sampling Points

B. Source Emissions Calculations

C. Calibration of Equipment

D. Field Testing Data

E. Analytical Data

F. Chain of Custody

G. Resumes of Test Personnel

APPENDIX A

Location of Sampling Points
Kiln Number 1 Stack

The sampling ports located on the Kiln Number 1 Stack are approximately 16 feet 7 inches (1.65 stack diameters) downstream from the inlet to the stack and 11 feet 9 inches (1.17 stack diameters) upstream from the outlet of the stack. The locations of the sampling points were calculated as follows:

Port and Wall Thickness = 6 inches
Inside Stack Diameter = 120 1/4 inches

Point No.	Percent of Diameter From Wall	Distance From Wall
1	1.1	1 5/16"
2	3.2	3 7/8 "
3	5.5	6 5/8 "
4	7.9	9 1/2 "
5	10.5	12 5/8 "
6	13.2	15 7/8 "
7	16.1	19 3/8 "
8	19.4	23 5/16"
9	23.0	27 11/16"
10	27.2	32 11/16"
11	32.3	38 13/16"
12	39.8	47 7/8 "
13	60.2	72 3/8 "
14	67.7	81 7/16"
15	72.8	87 9/16"
16	77.0	92 9/16"
17	80.6	96 15/16"
18	83.9	100 7/8 "
19	86.8	104 3/8 "
20	89.5	107 5/8 "
21	92.1	110 3/4 "
22	94.5	113 5/8 "
23	96.8	116 3/8 "
24	98.9	118 15/16"

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APPENDIX A

Location of Sampling Points
Kiln Number 2 Stack

The sampling ports located on the Kiln Number 2 Stack are approximately 18 feet 6 inches (1.85 stack diameters) downstream from the inlet to the stack and 5 feet 8 inches (0.57 stack diameters) upstream from the outlet of the stack. The locations of the sampling points were calculated as follows:

Port and Wall Thickness = 5 1/4 inches
Inside Stack Diameter = 120 3/16 inches

Point No.	Percent of Diameter From Wall	Distance From Wall
1	1.1	1 5/16"
2	3.2	3 7/8 "
3	5.5	6 5/8 "
4	7.9	9 1/2 "
5	10.5	12 5/8 "
6	13.2	15 7/8 "
7	16.1	19 3/8 "
8	19.4	23 5/16"
9	23.0	27 5/8 "
10	27.2	32 11/16"
11	32.3	38 13/16"
12	39.8	47 13/16"
13	60.2	72 3/8 "
14	67.7	81 3/8 "
15	72.8	87 1/2 "
16	77.0	92 9/16"
17	80.6	96 7/8 "
18	83.9	100 13/16"
19	86.8	104 5/16"
20	89.5	107 9/16"
21	92.1	110 11/16"
22	94.5	113 9/16"
23	96.8	116 5/16"
24	98.9	118 7/8 "

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APPENDIX B

Nomenclature and Equations
for
Calculation of Source Emissions

Nomenclature for Particulate Calculations

Symbol	English Units	Metric Units	Description
A_s	$in.^2$	m^2	Stack Area
C_{an}	gr/dscf	g/dscm	Particulate - probe, cyclone and filter
C_{ao}	gr/dscf	g/dscm	Particulate - total
C_{at}	gr/CF @ stack conditions	g/m^3	Particulate - probe, cyclone and filter
C_{au}	gr/CF @ stack conditions	g/m^3	Particulate - total
C_{aw}	lbs/hr	kg/hr	Particulate - probe, cyclone and filter
C_{ax}	lbs/hr	kg/hr	Particulate - total
C_p			Pitot Tube Calibration Factor
D_n	in.	m	Sampling Nozzle Diameter
%EA			Percent Excess Air at sampling point
g	32.2 ft/sec^2		Acceleration of gravity
%I			Percent isokinetic
%M			Percent moisture in the stack gas by volume
M_d			Mole fraction of dry gas
m_f	mg	mg	Particulate - probe, cyclone and filter
M_{H_2O}	18 lb/lb-mole		Molecular Weight of Water

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

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Symbol	English Units	Metric Units	Description
m_t	mg	mg	Particulate - total
MW	lb/lb-mole	g/g-mole	Molecular Weight of stack gas
MW_{air}	28.95 lb/ lb-mole		Molecular Weight of air
MW_d	lb/lb-mole	g/g-mole	Molecular Weight of dry stack gas
P_b	"Hg Absolute	mm Hg	Barometric Pressure
P_m	"H_2O	mm H_2O	Orifice Pressure drop
P_s	"Hg Absolute	mm Hg	Stack Pressure
ΔP_s	"H_2O	mm H_2O	Velocity Head of stack gas
P_{std}	29.92 "Hg	760 mm Hg	Standard Barometric Pressure
Q_a	ACFM	m^3/hr	Stack Gas Volume at Actual Stack Conditions
Q_s	DSCFM	dscm/hr	Stack Gas Volume at 29.92 "Hg, 528°R, dry
R	21.83 "Hg-ft^3/lb-mole-°R		Universal Gas Constant
T_m	°F	°C	Average Gas Meter Temperature
T_t	min	min	Net time of test
T_s	°F	°C	Stack Temperature
T_{std}	528°R	293°K	Standard Temperature
V_m	ft^3	m^3	Volume of dry gas sampled @ meter conditions
$V_{m_{std}}$	dscf	dscm	Volume of dry gas sampled @ standard conditions
V_s	fpm	m/sec	Stack velocity @ stack conditions

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

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Symbol	English Units	Metric Units	Description
V_w	ml	ml	Total Water Collected in Impingers and Silica Gel
$V_{w_{gas}}$	scf	scm	Volume of Water Vapor Collected @ standard conditions
ρ_{air}	0.0748 lbs/ft^3		Density of Air
ρ_{H_2O}	1 g/ml		Density of Water
ρ_{man}	51.63 lbs/ft^3		Density of Manometer Oil

Standard Conditions: 68°F, 29.92 "Hg (20°C, 760 mm Hg)

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

Example Particulate Calculations

1. Volume of dry gas sampled at standard conditions.*

$$V_{m_{std}} = V_m \left(\frac{T_{std}}{T_m + 460}\right) \left[\frac{P_b + \frac{P_m}{13.6}}{P_{std}}\right]$$

$$V_{m_{std}} = 17.65\ V_m \left[\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right] = \text{dscf}$$

$$V_{m_{std}} = \text{dscf} \times 0.028317 = \text{dscm}$$

2. Volume of water vapor collected at standard conditions.*

$$V_{w_{gas}} = \frac{(V_w - \text{gms } SO_2 - \text{gms } H_2S)\ \rho_{H_2O}\ R\ T_{std}}{P_{std}\ M_{H_2O}\ 453.6}$$

$$V_{w_{gas}} = 0.0472\ (V_w - \text{gms } SO_2 - \text{gms } H_2S) = \text{scf}$$

$$V_{w_{gas}} = \text{scf} \times 0.028317 = \text{scm}$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

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3. Percent moisture in stack gas.

$$\%M = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \%$$

4. Mole fraction of dry gas.

$$M_d = \frac{100 - \%M}{100}$$

5. Average molecular weight of dry stack gas.

$$MW_d = \left[\%CO_2 \times \frac{44}{100}\right] + \left[\%O_2 \times \frac{32}{100}\right] + \left[\%N_2 \times \frac{28}{100}\right] + \left[\%CO \times \frac{28}{100}\right] = \text{lb/lb-mole}$$

$$= \text{g/g-mole}$$

6. Molecular weight of stack gas.

$$MW = MW_d \times M_d + 18\ (1-M_d) = \frac{\text{lb}}{\text{lb-mole}} = \text{g/g-mole}$$

7. Percent excess air at sampling point.

$$\%EA = \frac{100\ (\%O_2 - 0.5\%\ CO)}{0.265\ (\%N_2) - (\%O_2) + 0.5\ (\%CO)}$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

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8. Stack Pressure.

$$P_s = P_b + \frac{\text{stack pressure ''}H_2O}{13.6} = \text{''Hg Absolute}$$

$$P_s = \text{''Hg Abs.} \times 25.4 = \text{mm Hg}$$

9. Stack velocity at stack conditions.

$$V_s = C_p\ 60 \left[\frac{2g \times \rho_{man} \times P_{std} \times MW_{air} \times (T_s + 460) \times \Delta P_s}{12 \times \rho_{air} \times P_s \times MW \times T_{std}}\right]^{\frac{1}{2}}$$

$$V_s = 5123.8\ C_p \left[\frac{(T_s + 460) \times \Delta P_s}{P_s \times MW}\right]^{\frac{1}{2}} = \text{fpm}$$

$$V_s = \text{fpm} \times 0.00508 = \text{m/sec}$$

10. Dry stack gas volume at standard conditions.

$$Q_s = \frac{1}{144} V_s \times A_s \times M_d \times \frac{T_{std}}{T_s + 460} \times \frac{P_s}{P_{std}}$$

$$Q_s = \frac{0.123\ V_s \times A_s \times M_d \times P_s}{T_s + 460} = \text{DSCFM}$$

$$Q_s = \text{DSCFM} \times 1.6990 = \text{dscm/hr}$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

ΔP_s	velocity head of stack gas	"H_2O (mm H_2O)	0.592 (15.0)	0.638 (16.2)	0.629 (16.0)
T_s	stack temperature	°F (°C)	371 (188)	367 (186)	359 (182)
P_s	stack pressure	"Hg Abs. (mm Hg)	30.31 (770)	30.17 (766)	30.19 (767)
V_s	stack velocity @ stack conditions	fpm (m/sec)	3,129 (15.90)	3,244 (16.48)	3,216 (16.34)
A_s	stack area	in.^{2} (m^2)	11,357 (7.33)	11,357 (7.33)	11,357 (7.33)
Q_s	dry stack gas volume @ standard conditions*	DSCFM (dscm/hr)	121,897 (207,103)	128,287 (217,960)	126,221 (214,449)
Q_a	actual stack gas volume @ stack conditions	ACFM (m^3/hr)	246,766 (419,255)	255,832 (434,659)	253,631 (430,919)

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

METCO

Source Emissions Calculations

Lone Star Industries, Inc.
Kiln Number 1 Stack
File Number 81-107

Symbol	Description	Units			
T_t	net time of test	min.	96	96	96
D_n	sampling nozzle diam.	in. (m)	0.296 (0.008)	0.235 (0.006)	0.235 (0.006)
%I	percent isokinetic	%	99.4	100.1	102.7
m_f	particulate - probe, cyclone and filter	mg	86.6	51.8	47.0
m_t	particulate - total	mg	------	------	------
C_{an}	particulate - probe, cyclone and filter	gr/dscf* (g/dscm)	0.0190 (0.0435)	0.0170 (0.0389)	0.0153 (0.0350)
C_{ao}	particulate - total	gr/dscf* (g/dscm)	------ (------)	------ (------)	------ (------)
C_{at}	particulate - probe, cyclone and filter @ stack conditions	gr/cf (g/m^3)	0.0093 (0.0214)	0.0085 (0.0195)	0.0076 (0.0174)
C_{au}	particulate total @ stack conditions	gr/cf (g/m^3)	------ (------)	------ (------)	------ (------)
C_{aw}	particulate - probe, cyclone and filter	lbs/hr (kg/hr)	19.8 (9.0)	18.7 (8.5)	16.5 (7.5)
C_{ax}	particulate - total	lbs/hr (kg/hr)	------ (------)	------ (------)	------ (------)

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

SO_2 EMISSION DATA

Client Lone Star Industries, Inc. Job Number 81-107

Unit Tested Kiln Number 1 Stack

Run Number	1	2	3			
Date	11/11/81	11/12/81	11/12/81			
Time	1050-1550	1308-1456	1639-1834			
N - normality of $BaCl_2$	0.0100	0.0100	0.0100			
ML_I - ml in impinger #1	------	------	------			
ML_I - ml in impinger #3	283	302	308			
ML_I - ml in impinger #4	262	294	325			
ML_A - ml in aliquot #1	------	------	------			
ML_A - ml in aliquot #3	2	2	2			
ML_A - ml in aliquot #4	10	10	10			
ML_B - ml of $BaCl_2$ to titrate #1	------	------	------			
ML_B - ml of $BaCl_2$ to titrate #3	16.50	17.50	15.90			
ML_B - ml of $BaCl_2$ to titrate #4	1.40	1.25	1.20			
ML_{BB} - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05			
T_m - average gas meter temp., °F	77	75	73			
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$	70.214	46.993	47.244			
P_b - barometric pressure, "Hg Abs.	30.32	30.20	30.20			
Q_s - Stack gas volume dry @ standard conditions, *SCFM	121,897	128,287	126,221			
C_I - SO_2 in impinger #1, mgs	------	------	-------			
C_I - SO_2 in impinger #3, mgs	744.9	843.2	781.1			
C_I - SO_2 in impinger #4, mgs	11.3	11.3	12.0			
C_T - total SO_2 in impingers, mgs	756.2	854.5	793.1			
ppm SO_2	143.3	242.0	222.6			
C_{SO_2} - emission rate of SO_2, lbs/day	4,178.4	7,426.2	6,720.2			
C_S - emission rate of S, lbs/day	2,089.2	3,713.1	3,360.1			

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 32}{ML_A}$$

$$C_T = C_I\ \#1 + C_I\ \#2 + C_I\ \#3$$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m\ P_b}$$

$$C_{SO_2} = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-6}$$

$$C_s = \frac{C_{SO_2}}{2}$$

MULLINS ENVIRONMENTAL TESTING CO., INC.

		(m^3)	15.213 (0.431)	14.797 (0.419)	14.937 (0.423)
T_m	avg. gas meter temp.	°F (°C)	70 (21)	77 (25)	70 (21)
$V_{m_{std}}$	volume dry gas sampled @ standard conditions*	dscf (dscm)	15.355 (0.435)	14.715 (0.417)	15.046 (0.426)
V_w	total H_2O collected, impingers & silica gel	ml	99.4	97.8	100.9
$V_{w_{gas}}$	volume water vapor collected @ standard conditions*	scf (scm)	4.692 (0.133)	4.616 (0.131)	4.762 (0.135)
%M	moisture in stack gas by volume	%	23.40	23.88	24.04

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

METCO

Source Emissions Calculations

Lone Star Industries, Inc.
Kiln Number 1 Stack
File Number 81-107

Symbol	Description	Units			
M_d	mol fraction of dry gas	----	0.7646	0.7760	0.7622
CO_2		%	12.4	12.3	12.5
O_2		%	11.6	12.0	11.6
N_2		%	76.0	75.7	75.9
%EA	excess air @ sampling point	%	135.8	148.9	136.3
MW_d	molecular weight of dry stack gas	lb/lb-mole (g/g-mole)	30.45 (30.45)	30.45 (30.45)	30.46 (30.46)
MW	molecular weight of stack gas	lb/lb-mole (g/g-mole)	27.52 (27.52)	27.66 (27.66)	27.50 (27.50)
ΔPs	velocity head of stack gas	"H_2O (mm H_2O)	0.592 (15.0)	0.638 (16.2)	0.629 (16.0)
T_s	stack temperature	°F (°C)	371 (188)	367 (186)	359 (182)
P_s	stack pressure	"Hg Abs. (mm Hg)	30.31 (770)	30.17 (766)	30.19 (767)
V_s	stack velocity @ stack conditions	fpm (m/sec)	3,129 (15.90)	3,244 (16.48)	3,216 (16.34)
A_s	stack area	in.^{2} (m^2)	11,357 (7.33)	11,357 (7.33)	11,357 (7.33)
Q_s	dry stack gas volume @ standard conditions*	DSCFM (dscm/hr)	121,897 (207,103)	128,287 (217,960)	126,221 (214,449)
Q_a	actual stack gas volume @ stack conditions	ACFM (m^3/hr)	246,766 (419,255)	255,832 (434,659)	253,631 (430,919)

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METCO

Source Emissions Calculations

Lone Star Industries, Inc.
Kiln Number 1 Stack
File Number 81-107

Symbol	Description	Units			
T_t	net time of test	min.	96	96	96
D_n	sampling nozzle diam.	in. (m)	0.296 (0.008)	0.235 (0.006)	0.235 (0.006)
%I	percent isokinetic	%	99.4	100.1	102.7
m_f	particulate - probe, cyclone and filter	mg	86.6	51.8	47.0
m_t	particulate - total	mg	------	------	------
C_{an}	particulate - probe, cyclone and filter	gr/dscf* (g/dscm)	0.0190 (0.0435)	0.0170 (0.0389)	0.0153 (0.0350)
C_{ao}	particulate - total	gr/dscf* (g/dscm)	------ (------)	------ (------)	------ (------)
C_{at}	particulate - probe, cyclone and filter @ stack conditions	gr/cf (g/m^3)	0.0093 (0.0214)	0.0085 (0.0195)	0.0076 (0.0174)
C_{au}	particulate total @ stack conditions	gr/cf (g/m^3)	------ (------)	------ (------)	------ (------)
C_{aw}	particulate - probe, cyclone and filter	lbs/hr (kg/hr)	19.8 (9.0)	18.7 (8.5)	16.5 (7.5)
C_{ax}	particulate - total	lbs/hr (kg/hr)	------ (------)	------ (------)	------ (------)

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

SO_2 EMISSION DATA

Client Lone Star Industries, Inc. Job Number 81-107

Unit Tested Kiln Number 1 Stack

Run Number	1	2	3			
Date	11/11/81	11/12/81	11/12/81			
Time	1050-1550	1308-1456	1639-1834			
N - normality of $BaCl_2$	0.0100	0.0100	0.0100			
ML_I - ml in impinger #1	------	------	------			
ML_I - ml in impinger #3	283	302	308			
ML_I - ml in impinger #4	262	294	325			
ML_A - ml in aliquot #1	------	------	------			
ML_A - ml in aliquot #3	2	2	2			
ML_A - ml in aliquot #4	10	10	10			
ML_B - ml of $BaCl_2$ to titrate #1	------	------	------			
ML_B - ml of $BaCl_2$ to titrate #3	16.50	17.50	15.90			
ML_B - ml of $BaCl_2$ to titrate #4	1.40	1.25	1.20			
ML_{BB} - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05			
T_m - average gas meter temp., °F	77	75	73			
V_m - volume of dry gas sampled @ meter conditions, ft.^{3}	70.214	46.993	47.244			
P_b - barometric pressure, "Hg Abs.	30.32	30.20	30.20			
Q_s - Stack gas volume dry @ standard conditions, *SCFM	121,897	128,287	126,221			
C_I - SO_2 in impinger #1, mgs	------	------	-------			
C_I - SO_2 in impinger #3, mgs	744.9	843.2	781.1			
C_I - SO_2 in impinger #4, mgs	11.3	11.3	12.0			
C_T - total SO_2 in impingers, mgs	756.2	854.5	793.1			
ppm SO_2	143.3	242.0	222.6			
C_{SO_2} - emission rate of SO_2, lbs/day	4,178.4	7,426.2	6,720.2			
C_S - emission rate of S, lbs/day	2,089.2	3,713.1	3,360.1			

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 32}{ML_A}$$

$$C_T = C_I \#1 + C_I \#2 + C_I \#3$$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m P_b}$$

$$C_{SO_2} = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-6}$$

$$C_s = \frac{C_{SO_2}}{2}$$

METCO

SULFUR TRIOXIDE EMISSION DATA

Job Number 81-107

Job Name Lone Star Industries, Inc.

Location New Orleans, Louisiana

Unit Tested Kiln Number 1 Stack

Run Number	1	2	3	
Date	11/11/81	11/12/81	11/12/81	
Time	1050-1550	1308-1456	1639-1834	
$\underline{N}$ - normality of $BaCl_2$	0.0100	0.0100	0.0100	
ML_I - ml in impinger	380	238	305	
ML_A - ml in aliquot	10	10	10	
ML_B - ml of $BaCl_2$ to titrate	2.45	2.25	0.65	
ML_{BB} - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05	
T_m - average gas meter temp., °F	77	75	73	
V_m - volume of dry gas sampled @ meter conditions, ft.^{3}	70.214	46.993	47.244	
P_b - barometric pressure, "Hg Abs.	30.32	30.20	30.20	
Q_s - stack gas volume dry @ standard conditions, *SCFM	121,897	128,287	126,221	
C_I - SO_3 in impinger, mgs	36.5	20.9	7.3	
ppm SO_3	5.5	4.8	1.6	
C_{SO_3} - emission rate of SO_3, lbs/day	202.0	182.4	62.2	
C_S - emission rate of S, lbs/day	80.8	73.0	24.9	

*68°F, 29.92 "Hg (20°C, 760 mm Hg)

$$\text{ppm } SO_3 = \frac{0.6021 \times C_I \times (T_m + 460)}{V_m P_b}$$

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 40}{ML_A}$$

$$C_{SO_3} = \text{ppm } SO_3 \times Q_s \times 299.1 \times 10^{-6}$$

$$C_S = \frac{C_{SO_3}}{2.5}$$

METCO

SOURCE EMISSIONS SURVEY
LONE STAR INDUSTRIES, INC.
NEW ORLEANS, LOUISIANA
FILE NUMBER 81-107

SOURCE EMISSIONS CALCULATIONS

Kiln Number 1 Stack
Ammonium Tests

Symbol	Description	Units			
Run No.			1A	2A	3A
Date			11/12/81	11/12/81	11/12/81
Begin			1134	1532	1923
End			1204	1602	1953
P_b	barometric pressure	"Hg Abs. (mm Hg)	30.25 (768)	30.20 (767)	30.19 (767)
P_m	orifice pressure drop	"H_2O (mm H_2O)	0.795 (20.2)	0.758 (19.3)	0.780 (19.8)
V_m	volume dry gas sampled @ meter conditions	$ft.^3$ (m^3)	15.213 (0.431)	14.797 (0.419)	14.937 (0.423)
T_m	avg. gas meter temp.	°F (°C)	70 (21)	77 (25)	70 (21)
$V_{m_{std}}$	volume dry gas sampled @ standard conditions*	dscf (dscm)	15.355 (0.435)	14.715 (0.417)	15.046 (0.426)
V_w	total H_2O collected, impingers & silica gel	ml	99.4	97.8	100.9
$V_{w_{gas}}$	volume water vapor collected @ standard conditions*	scf (scm)	4.692 (0.133)	4.616 (0.131)	4.762 (0.135)
%M	moisture in stack gas by volume	%	23.40	23.88	24.04

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

METCO

Source Emissions Calculations

Lone Star Industries, Inc.
Kiln Number 1 Stack - Ammonium Tests
File Number 81-107

Symbol	Description	Units			
M_d	mol fraction of dry gas	----	0.7660	0.7612	0.7596
CO_2		%	11.0	12.4	12.6
O_2		%	12.2	12.0	11.8
N_2		%	76.8	75.6	75.6
%EA	excess air @ sampling point	%	149.7	149.4	143.3
MW_d	molecular weight of dry stack gas	lb/lb-mole (g/g-mole)	30.25 (30.25)	30.46 (30.46)	30.49 (30.49)
MW	molecular weight of stack gas	lb/lb-mole (g/g-mole)	27.38 (27.38)	27.49 (27.49)	27.49 (27.49)
ΔPs	velocity head of stack gas	"H_2O (mm H_2O)	------ (------)	------ (------)	------ (------)
T_s	stack temperature	°F (°C)	392 (200)	367 (186)	362 (183)
P_s	stack pressure	"Hg Abs. (mm Hg)	------ (------)	------ (------)	------ (------)
V_s	stack velocity @ stack conditions	fpm (m/sec)	------ (------)	------ (------)	------ (------)
A_s	stack area	in.^{2} (m^2)	------ (------)	------ (------)	------ (------)
Q_s	dry stack gas volume @ standard conditions*	DSCFM (dscm/hr)	------ (------)	------ (------)	------ (------)
Q_a	actual stack gas volume @ stack conditions	ACFM (m^3/hr)	------ (------)	------ (------)	------ (------)

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

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APPENDIX C

Calibration of Equipment

Equipment	Calibration Factor	Calibration Date
Pitot Tube #7	0.805	10/15/81
Probe Tip #III-3	0.235	9/23/81
Probe Tip #III-4	0.296	9/23/81
Dry Gas Meter #1	1.027	9/22/81
Stack Unit Orifice #1		10/16/81
Digital Temperature Indicator #1		10/16/81
Barometer #6		9/ 2/81

PITOT TUBE CALIBRATION

Date: 10/15/81

Pitot No. 7 (5')

Time: 1315

P_b: 29.51 "Hg P_s: — "H_2O

T_s: 78 °F C_{pstd}: 0.99

Motor Setting	fps mark	CALIBRATOR STANDARD START	CALIBRATOR STANDARD END	$\sqrt{\text{STANDARD AVERAGE}}$	HIGH	$\sqrt{\text{HIGH}}$	CAL. FACTOR	LOW	$\sqrt{\text{LOW}}$	CAL. FACTOR
39	20	0.100	0.100	0.316	0.160	0.400	0.782	0.160	0.400	0.782
48	30	0.210	0.215	0.461	0.320	0.566	0.806	0.320	0.566	0.806
55	40	0.350	0.350	0.592	0.540	0.735	0.797	0.530	0.728	0.805
63	50	0.570	0.570	0.755	0.865	0.930	0.804	0.865	0.930	0.804
70	60	0.795	0.805	0.894	1.20	1.095	0.808	1.20	1.095	0.808
76	70	1.05	1.05	1.025	1.55	1.245	0.815	1.55	1.245	0.815
84	80	1.40	1.40	1.183	2.10	1.449	0.808	2.10	1.449	0.808
100	90	1.70	1.70	1.304	2.50	1.581	0.817	2.55	1.597	0.808
Average							0.805			0.805

Summary of Results:

Normal high side calibration factor 0.805
variation -1.5, +2.9

Normal low side calibration factor 0.805
variation -1.2, +2.9

Stephen Christian

Signature of Calibrator

METCO

NOZZLE CALIBRATION

Nozzle Set No. III

Date: 9/23/81 Calibrator: R. Ripka

	1	2	3	4	5
Reading 1	0.112	0.175	0.234	0.295	0.375
Reading 2	0.112	0.175	0.235	0.295	0.375
Reading 3	0.112	0.175	0.233	0.296	0.375
Reading 4	0.112	0.175	0.236	0.296	0.375
Reading 5	0.113	0.175	0.236	0.297	0.375
Reading 6	0.112	0.177	0.235	0.295	0.375
Reading 7	0.111	0.175	0.234	0.295	0.375
Reading 8	0.112	0.175	0.235	0.296	0.375
Reading 9	0.111	0.175	0.235	0.295	0.375
Reading 10	0.112	0.175	0.236	0.296	0.375
Average	0.112	0.175	0.235	0.296	0.375

	6	7	8	9	10
Reading 1	0.430	0.485	0.605	0.725	0.975
Reading 2	0.429	0.485	0.605	0.725	0.975
Reading 3	0.429	0.485	0.609	0.725	0.975
Reading 4	0.429	0.485	0.607	0.725	0.975
Reading 5	0.429	0.485	0.605	0.725	0.975
Reading 6	0.429	0.485	0.608	0.725	0.975
Reading 7	0.430	0.485	0.610	0.725	0.975
Reading 8	0.429	0.485	0.609	0.725	0.975
Reading 9	0.429	0.485	0.609	0.725	0.975
Reading 10	0.430	0.485	0.608	0.725	0.975
Average	0.429	0.485	0.608	0.725	0.975

METCO

DRY GAS METER CALIBRATION

Meter Number: 1

Calibrator: [illegible signature]

Date: 9/22/81

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No: 1 5

P_b: 29.42 "Hg

Control Module Vacuum 14.8 "Hg

	Wet Test Meter				Dry Gas Meter			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	0917	10.008 cf	75 °F	-5.80 "H_2O	961.826 cf	57 °F	81 °F	3.00 "H_2O
Start	0906	0.000 cf	75 °F	-5.50 "H_2O	951.726	84	80	3.00 "H_2O
		10.008 cf	°F	"H_2O	10.100 cf	°F	°F	"H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.008 \left(\frac{29.42 + \frac{-5.50}{13.6}}{75 + 460}\right) \times 1.033\ (C_f) = 9.589 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 10.100 \left(\frac{29.42 + \frac{3.00}{13.6}}{83 + 460}\right) = 9.731 \text{ dscf}$$

C_{DG} Avg = 1.027

$$C_{DG} = \frac{9.589}{9.731} = \boxed{1.016}$$

MULLINS ENVIRONMENTAL TESTING CO., INC.

METCO

SOURCE EMISSIONS SURVEY
LONE STAR INDUSTRIES, INC.
NEW ORLEANS, LOUISIANA
FILE NUMBER 81-107

SOURCE EMISSIONS CALCULATIONS

Kiln Number 2 Stack

Symbol	Description	Units			
Run No.			1	2	3
Date			11/13/81	11/13/81	11/13/81
Begin			0848	1207	1609
End			1035	1440	1756
P_b	barometric pressure	"Hg Abs. (mm Hg)	30.27 (769)	30.20 (767)	30.20 (767)
P_m	orifice pressure drop	"H_2O (mm H_2O)	1.247 (31.7)	1.164 (29.6)	1.400 (35.6)
V_m	volume dry gas sampled @ meter conditions	ft.^{3} (m^3)	60.136 (1.703)	58.089 (1.645)	64.497 (1.826)
T_m	avg. gas meter temp.	°F (°C)	70 (21)	73 (23)	73 (23)
$V_{m_{std}}$	volume dry gas sampled @ standard conditions*	dscf (dscm)	60.804 (1.722)	58.257 (1.650)	64.720 (1.833)
V_w	total H_2O collected, impingers & silica gel	ml	375.1	353.8	419.4
$V_{w_{gas}}$	volume water vapor collected @ standard conditions*	scf (scm)	17.705 (0.501)	16.699 (0.473)	19.796 (0.561)
%M	moisture in stack gas by volume	%	22.55	22.28	23.42

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

METCO

Source Emissions Calculations

Lone Star Industries, Inc.
Kiln Number 2 Stack
File Number 81-107

Symbol	Description	Units			
M_d	mol fraction of dry gas	----	0.7745	0.7772	0.7658
CO_2		%	13.2	12.4	12.6
O_2		%	10.9	11.6	11.7
N_2		%	75.9	76.0	75.7
%EA	excess air @ sampling point	%	118.3	135.8	139.9
MW_d	molecular weight of dry stack gas	lb/lb-mole (g/g-mole)	30.55 (30.55)	30.45 (30.45)	30.48 (30.48)
MW	molecular weight of stack gas	lb/lb-mole (g/g-mole)	27.72 (27.72)	27.67 (27.67)	27.56 (27.56)
ΔPs	velocity head of stack gas	"H_2O (mm H_2O)	0.537 (13.6)	0.459 (11.7)	0.521 (13.2)
T_s	stack temperature	°F (°C)	391 (199)	387 (197)	380 (193)
P_s	stack pressure	"Hg Abs. (mm Hg)	30.25 (768)	30.18 (767)	30.18 (767)
V_s	stack velocity @ stack conditions	fpm (m/sec)	3,013 (15.31)	2,771 (14.08)	2,968 (15.08)
A_s	stack area	in.^{2} (m^2)	11,345 (7.32)	11,345 (7.32)	11,345 (7.32)
Q_s	dry stack gas volume @ standard conditions*	DSCFM (dscm/hr)	115,751 (196,661)	107,082 (181,932)	113,954 (193,608)
Q_a	actual stack gas volume @ stack conditions	ACFM (m^3/hr)	237,341 (403,242)	218,290 (370,875)	233,821 (397,262)

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

METCO

Source Emissions Calculations

Lone Star Industries, Inc.
Kiln Number 2 Stack
File Number 81-107

Symbol	Description	Units			
T_t	net time of test	min.	96	96	96
D_n	sampling nozzle diam.	in. (m)	0.296 (0.008)	0.296 (0.008)	0.296 (0.008)
%I	percent isokinetic	%	90.5	93.8	97.9
m_f	particulate - probe, cyclone and filter	mg	99.9	59.1	55.0
m_t	particulate - total	mg	------	------	------
C_{an}	particulate - probe, cyclone and filter	gr/dscf* (g/dscm)	0.0253 (0.0579)	0.0156 (0.0358)	0.0131 (0.0300)
C_{ao}	particulate - total	gr/dscf* (g/dscm)	------ (------)	------ (------)	------ (------)
C_{at}	particulate - probe, cyclone and filter @ stack conditions	gr/cf (g/m^3)	0.0123 (0.0282)	0.0076 (0.0175)	0.0064 (0.0146)
C_{au}	particulate total @ stack conditions	gr/cf (g/m^3)	------ (------)	------ (------)	------ (------)
C_{aw}	particulate - probe, cyclone and filter	lbs/hr (kg/hr)	25.1 (11.4)	14.3 (6.5)	12.8 (5.8)
C_{ax}	particulate - total	lbs/hr (kg/hr)	------ (------)	------ (------)	------ (------)

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

SO_2 EMISSION DATA

Client Lone Star Industries, Inc.

Job Number 81-107

Unit Tested Kiln Number 2 Stack

Run Number	1	2	3			
Date	11/13/81	11/13/81	11/13/81			
Time	0848-1035	1207-1440	1609-1756			
$\underline{N}$ - normality of $BaCl_2$	0.0100	0.0100	0.0100			
ML_I - ml in impinger #1	------	------	------			
ML_I - ml in impinger #3	287	325	365			
ML_I - ml in impinger #4	255	355	365			
ML_A - ml in aliquot #1	------	------	------			
ML_A - ml in aliquot #3	2	2	2			
ML_A - ml in aliquot #4	10	10	10			
ML_B - ml of $BaCl_2$ to titrate #1	------	------	------			
ML_B - ml of $BaCl_2$ to titrate #3	15.00	6.65	1.90			
ML_B - ml of $BaCl_2$ to titrate #4	1.05	0.55	0.25			
ML_{BB} - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05			
T_m - average gas meter temp., °F	70	73	73			
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$	60.136	58.089	64.497			
P_b - barometric pressure, "Hg Abs.	30.27	30.20	30.20			
Q_s - Stack gas volume dry @ standard conditions, *SCFM	115,751	107,082	113,954			
C_I - SO_2 in impinger #1, mgs	------	------	------			
C_I - SO_2 in impinger #3, mgs	686.5	343.2	108.0			
C_I - SO_2 in impinger #4, mgs	8.2	5.7	2.3			
C_T - total SO_2 in impingers, mgs	694.7	348.9	110.3			
ppm SO_2	152.0	79.6	22.7			
C_{SO_2} - emission rate of SO_2, lbs/day	4,207.3	2,039.8	618.2			
C_s - emission rate of S, lbs/day	2,103.6	1,019.9	309.1			

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 32}{ML_A}$$

$$C_T = C_I \#1 + C_I \#2 + C_I \#3$$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m \; P_b}$$

$$C_{SO_2} = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-6}$$

$$C_s = \frac{C_{SO_2}}{2}$$

METCO

SULFUR TRIOXIDE EMISSION DATA

Job Number 81-107

Job Name Lone Star Industries, Inc.

Location New Orleans, Louisiana

Unit Tested Kiln Number 2 Stack

Run Number	1	2	3	
Date	11/13/81	11/13/81	11/13/81	
Time	0848-1035	1207-1440	1609-1756	
$\underline{N}$ - normality of $BaCl_2$	0.0100	0.0100	0.0100	
ML_I - ml in impinger	313	367	398	
ML_A - ml in aliquot	10	10	10	
ML_B - ml of $BaCl_2$ to titrate	0.55	0.50	0.85	
ML_{BB} - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05	
T_m - average gas meter temp., °F	70	73	73	
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$	60.136	58.089	64.497	
P_b - barometric pressure, "Hg Abs.	30.27	30.20	30.20	
Q_s - stack gas volume dry @ standard conditions, *SCFM	115,751	107,082	113,954	
C_I - SO_3 in impinger, mgs	6.3	6.6	12.7	
ppm SO_3	1.1	1.2	2.1	
C_{SO_3} - emission rate of SO_3, lbs/day	38.0	38.7	71.5	
C_S - emission rate of S, lbs/day	15.2	15.5	28.6	

*68°F, 29.92 "Hg (20°C, 760 mm Hg)

$$\text{ppm } SO_3 = \frac{0.6021 \times C_I \times (T_m + 460)}{V_m P_b}$$

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 40}{ML_A}$$

$$C_{SO_3} = \text{ppm } SO_3 \times Q_s \times 299.1 \times 10^{-6}$$

$$C_S = \frac{C_{SO_3}}{2.5}$$

METCO

SOURCE EMISSIONS SURVEY
LONE STAR INDUSTRIES, INC.
NEW ORLEANS, LOUISIANA
FILE NUMBER 81-107

SOURCE EMISSIONS CALCULATIONS

Kiln Number 2 Stack
Ammonium Tests

Symbol	Description	Units			
Run No.			1A	2A	3A
Date			11/13/81	11/13/81	11/13/81
Begin			1106	1510	1832
End			1135	1540	1902
P_b	barometric pressure	"Hg Abs. (mm Hg)	30.27 (769)	30.20 (767)	30.20 (767)
P_m	orifice pressure drop	"H_2O (mm H_2O)	0.780 (19.8)	0.770 (19.6)	0.770 (19.6)
V_m	volume dry gas sampled @ meter conditions	$ft.^3$ (m^3)	15.080 (0.427)	14.975 (0.424)	14.990 (0.424)
T_m	avg. gas meter temp.	°F (°C)	73 (23)	71 (22)	70 (21)
$V_{m_{std}}$	volume dry gas sampled @ standard conditions*	dscf (dscm)	15.144 (0.429)	15.060 (0.426)	15.104 (0.428)
V_w	total H_2O collected, impingers & silica gel	ml	98.7	95.5	101.4
$V_{w_{gas}}$	volume water vapor collected @ standard conditions*	scf (scm)	4.659 (0.132)	4.508 (0.128)	4.786 (0.136)
%M	moisture in stack gas by volume	%	23.52	23.04	24.06

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

METCO

Source Emissions Calculations

Lone Star Industries, Inc.
Kiln Number 2 Stack - Ammonium Tests
File Number 81-107

Symbol	Description	Units			
M_d	mol fraction of dry gas	----	0.7648	0.7696	0.7594
CO_2		%	12.0	13.2	13.4
O_2		%	12.0	11.4	11.4
N_2		%	76.0	75.4	75.2
%EA	excess air @ sampling point	%	147.4	132.9	133.7
MW_d	molecular weight of dry stack gas	lb/lb-mole (g/g-mole)	30.40 (30.40)	30.57 (30.57)	30.60 (30.60)
MW	molecular weight of stack gas	lb/lb-mole (g/g-mole)	27.48 (27.48)	27.67 (27.67)	27.57 (27.57)
ΔPs	velocity head of stack gas	"H_2O (mm H_2O)	------ (------)	------ (------)	------ (------)
T_s	stack temperature	°F (°C)	400 (204)	384 (196)	380 (193)
P_s	stack pressure	"Hg Abs. (mm Hg)	------ (------)	------ (------)	------ (------)
V_s	stack velocity @ stack conditions	fpm (m/sec)	------ (------)	------ (------)	------ (------)
A_s	stack area	in.^{2} (m^2)	------ (------)	------ (------)	------ (------)
Q_s	dry stack gas volume @ standard conditions*	DSCFM (dscm/hr)	------ (------)	------ (------)	------ (------)
Q_a	actual stack gas volume @ stack conditions	ACFM (m^3/hr)	------ (------)	------ (------)	------ (------)

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

METCO

DRY GAS METER CALIBRATION

Meter Number: 1

Calibrator: Don C. Alexander

Date: 9/22/81

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No: 28

P_b: 29.42 "Hg

Control Module Vacuum 10.2 "Hg

	Wet Test Meter				Dry Gas Meter			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	0935	13.006 cf	75 °F	-7.20 "H_2O	976.195 cf	90 °F	83 °F	4.00 "H_2O
Start	0925	0.000 cf	75 °F	-7.20 "H_2O	963.004	84	81	4.00 "H_2O
		cf	°F	"H_2O	13.191 cf	°F	°F	"H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 13.006 \left(\frac{29.42 + \frac{-7.20}{13.6}}{+ 460} \right) \times 1.033 \, (C_f) = 12.805 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 13.191 \left(\frac{29.42 + \frac{4.00}{13.6}}{84 + 460} \right) = 12.717 \text{ dscf}$$

$$C_{DG} = \frac{12.805}{12.717} = \boxed{1.007}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 1 Calibrator: Don C Oldland

Date: 9/22/81

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No: 3 P_b: 29.43 "Hg

Control Module Vacuum 15.2 "Hg

	Wet Test Meter			Dry Gas Meter			
Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End 0956	10.000 cf	75 °F	-4.30 "H_2O	987.002 cf	90 °F	84 °F	2.00 "H_2O
Start 0945	0.000 cf	75 °F	-4.20 "H_2O	~~977~~ 976.902	86	83	2.00 "H_2O
	10.011 cf	75 °F	-4.25 "H_2O	10.100 cf	86 °F	°F	2.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.011 \left(\frac{29.43 + \frac{-4.25}{13.6}}{75 + 460} \right) \times \underset{(C_f)}{1.033} = 9.934 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 10.100 \left(\frac{29.43 + \frac{2.00}{13.6}}{86 + 460} \right) = 9.657 \text{ dscf}$$

$$C_{DG} = \frac{9.934}{9.657} = \boxed{1.029}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 1

Calibrator: [signature]

Date: 9/22/81

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No: 4

P_b: 29.44 "Hg

Control Module Vacuum 8.0 "Hg

	Wet Test Meter				Dry Gas Meter			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1028	10.003 cf	75 °F	-3.50 "H_2O	997.573 cf	85 °F	83 °F	1.50 "H_2O
Start	1017	0.000 cf	75 °F	-3.50 "H_2O	987.500	83	83	1.50 "H_2O
		cf	°F	"H_2O	10.073 cf	°F	°F	"H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.003 \left(\frac{29.44 + \frac{-3.50}{13.6}}{75 + 460} \right) \times \underset{(C_f)}{1.033} = 9.948 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 10.073 \left(\frac{29.44 + \frac{1.50}{13.6}}{84 + 460} \right) = 9.658 \text{ dscf}$$

$$C_{DG} = \frac{9.948}{9.658} = \boxed{1.030}$$

MULLINS ENVIRONMENTAL TESTING CO., INC.

METCO

DRY GAS METER CALIBRATION

Meter Number: 1 Calibrator: Don C. Alexander

Date: 9/22/81

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No: 5 P_b: 29.44 "Hg

Control Module Vacuum 10.2 "Hg

	Wet Test Meter				Dry Gas Meter			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1037	~~8.002~~ 8.252 cf	75 °F	-2.70 "H_2O	1006.777 cf	85 °F	83 °F	1.00 "H_2O
Start	1048	0.000 cf	75 °F	-2.70 "H_2O	998.501	54	53	1.00 "H_2O
		cf	°F	"H_2O	cf	°F	°F	"H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 8.252 \left(\frac{29.44 + \frac{-2.70}{13.6}}{75 + 460}\right) \times \underset{(C_f)}{1.033} = 8.223 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 8.276 \left(\frac{29.44 + \frac{1.00}{13.6}}{84 + 460}\right) = 7.925 \text{ dscf}$$

$$C_{DG} = \frac{8.223}{7.925} = \boxed{1.038}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 1

Calibrator: Dan C. Alexander

Date: 9/22/81

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No: 6

P_b: 29.43 "Hg

Control Module Vacuum 10.0 "Hg

	Wet Test Meter				Dry Gas Meter			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1217	5.750 cf	76 °F	-2.20 "H_2O	35.225 cf	85 °F	84 °F	0.50 "H_2O
Start	1205	0.000 cf	76 °F	~~-1.90~~ -2.20 "H_2O	29.500	84	83	0.50 "H_2O
		5.750 cf	°F	"H_2O	5.725 cf	°F	°F	"H_2O

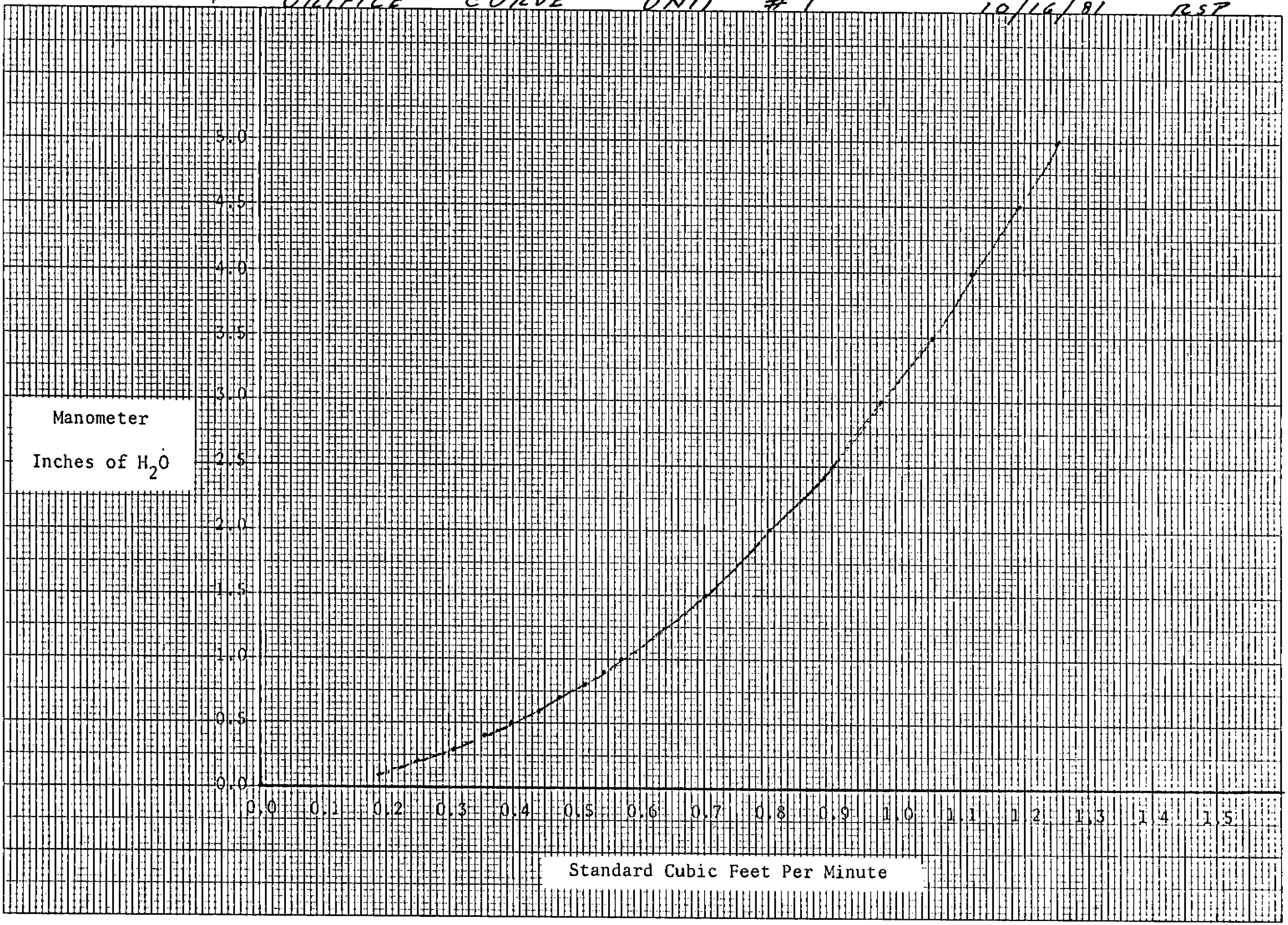
$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 5.750 \left(\frac{29.43 + \frac{-2.20}{13.6}}{876 + 460}\right) \times 1.033\ (C_f) = 5.718 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times \cancel{5.730}\ 5.725 \left(\frac{29.43 + \frac{0.50}{13.6}}{84 + 460}\right) = 5.473 \text{ dscf}$$

C_{DG} Average = 1.027

$$C_{DG} = \frac{5.718}{5.473} = \boxed{1.045}$$

ORIFICE CURVE UNIT #1 10/16/81 RST



METCO

DIGITAL TEMPERATURE INDICATOR NO. 1

CALIBRATION DATA

Date: 10/16/81

Media	Time	Mercury Thermometer (°F)	DTI (°F)
Ice Bath	1300	35	35
Ambient Air	1310	75	75
Boiling Water	1315	210	213
Oven	1330	452	444
Oven	1345	380	374
Oven	1400	336	330
Oven	1415	280	278

Meter Adjusted? Yes ____ No ✓

Randy [illegible]

Signature of Calibrator

METCO

BAROMETER CALIBRATION

Barometer No. 6

Date: 9-2-81

Time: 1610

Barometric Pressure @ Addison Field @ 719 ft.	=	29.85
	-	0.719
Absolute Pressure at Addison Field	=	29.131
	+	0.076
Absolute Pressure @ METCO @ 643 ft.	=	$\boxed{29.207}$
Barometer Reading	=	29.21
Variation	=	0.003

Barometer Adjusted? Yes_____ No ✓

Stephen Christian
Signature of Calibrator

METCO

APPENDIX D

Field Testing Data

MULLINS ENVIRONMENTAL [illegible] CO.

Job [redacted]). [redacted] 81-[redacted] Tall, [redacted] S [redacted] F [redacted] DATA [redacted]

Job Name LONE STAR IND.

Run No. 1

Location #2 / Kiln Stack

Date ~~10/~~ 18 NOVEMBER 1981

Operator Alexander, Christian

Sample Box No. 4 Meter Box No. 1

Read and record at the start of each test point.

Purge to: 948.700

Purge time: 1552-1556

Ambient Temp. °F ~~74~~ 67

Assumed Moisture % ~~34~~ 25

Probe Length 5

C Factor - 28.5 to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 15.2 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF (ΔP_s)	Pitot in. H_2O	Orifice ΔH in. H_2O (P_m) Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m) Inlet	Dry Gas Temp. °F Outlet	Remarks
		878.037											
D 12	1050	~~873.662~~	0.35	1.00	1.00	6.0	348	263	226	76	69	67	
11	1052	879.16	0.40	1.15	1.15	6.0	348	244	244	57	70	67	
10	1054	880.31	0.41	1.20	1.20	6.0	348	251	268	54	71	67	
9	1056	881.50	0.48	1.40	1.40	7.0	349	254	260	55	72	67	
8	1058	882.76	0.45	1.30	1.30	7.0	349	253	265	56	73	67	
7	1100	884.02	0.48	1.40	1.40	7.0	348	259	272	55	73	68	
6	1102	885.28	0.48	1.40	1.40	7.3	348	261	270	55	74	68	
5	1104	886.58	0.48	1.40	1.40	7.5	348	262	270	55	75	68	
4	1106	887.88	0.50	1.40	1.40	7.5	349	263	267	55	76	68	
3	1108	889.18	0.47	1.35	1.35	7.5	347	263	253	56	76	69	
2	1110	890.50	0.45	1.30	1.30	7.5	347	261	233	58	77	69	
1	1112	891.72	0.43	1.20	1.20	7.0	342	261	236	60	77	69	
END	1114	892.953	—	—	—	—	—	—	—	—	—	—	
C 12	1118	892.953	0.39	1.10	1.10	6.0	350	271	248	72	76	70	
11	1120	894.05	0.40	1.15	1.15	6.0	349	269	255	63	77	71	~~draft~~
10	1122	895.22	0.40	1.15	1.15	6.2	352	267	264	58	78	71	
9	1124	896.41	0.42	1.20	1.20	6.5	352	265	254	58	79	71	
8	1126	897.59	0.43	1.20	1.20	6.8	350	265	250	58	79	71	

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 70.214 ft^3

Water Collected V_w 458.3 ml

Time of Test T_t 96 min.

Stack Pressure P_s -0.08 "H_2O

Baro. Press. P_b 30.32 "Hg

Probe Tip Dia. D_n 0.296 in.

% CO_2 12.4 % CO 0.0

% O_2 11.6 % N_2 76.0

Area Stack A_s ~~4,3~~ 4,357 in^2

Pitot Tube No. 7

Barometer No. 6

Probe Tip No. III-4

V_m = Dry Gas Meter Calibration Factor 1.027 X 68.546 - 0.178 = 68.368

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = ____ M_T = ____

Impinger Box No. 4

Impinger 1	Final Weight	858.6	
	Initial Weight	687.7	
	Increase	170.9	
Impinger 2	Final Weight	834.6	
	Initial Weight	646.9	
	Increase	187.7	
Impinger 3	Final Weight	753.0	
	Initial Weight	690.8	
	Increase	62.2	
Impinger 4	Final Weight	700.1	
	Initial Weight	681.0	
	Increase	19.1	
Impinger 5	Final Weight	465.3	
	Initial Weight	463.7	
	Increase	1.6	
Impinger 6	Final Weight	764.7	
	Initial Weight	747.1	
	Increase	17.6	
Filter # ___	Final Weight		
	Initial Weight		
	Increase		

Water Weight Gain

Impinger 1	170.9 ✓
Impinger 2	187.7 ✓
Impinger 3	62.2 ✓
Impinger 4	19.1 ✓
Impinger 5	1.6 ✓
Impinger 6	17.6 ✓
Total	459.1 = V_w ✓

V_w = 459.1
g SO_2 = - 0.8
V_w = 458.3

P_b = 30.32 ✓
V_m = 70.214 ✓
V_w = 458.3 ✓
P_m = ~~1.610~~ 1.658 ✓
Avg ΔP = ~~0.580~~ 0.592 ✓
Avg $\sqrt{\Delta P}$ = 0.760 ✓
C_p = 0.805 ✓
P_s = -0.08 ✓ "H_2O 30.31 ✓ "Hg
T_m = 77 ✓ °F 537 ✓ °R
T_s = 371 ✓ °F 831 ✓ °R

		Avg
$\%CO_2$ =	12.8, 12.0	12.4
$\%O_2$ =	11.6, 11.6	11.6
$\%CO$ =	0.0, 0.0	0.0
$\%N_2$ =	75.6, 76.4	76.0

A_s = 113457 ✓
D_n = 0.296 ✓
T_t = 96 ✓

Moisture Content: %M = 23.584 ✓ M_d = 0.7646 ✓ MW_d = 30.448 ✓ MW = 27.52 ✓

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 70.214 \left(\frac{30.32 + \frac{\cancel{1.610}\ 1.658}{13.6}}{77 + 460}\right) = \cancel{70.244}\ 70.253 \text{ sft}^3$$

0.732 ✓ scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 458.3 = 21.632 \text{ sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{21.632}{70.244 + 21.632} \times 100 = 23.584\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{831}{30.31 \times 27.52}} \times 0.760 = 3129 \text{ fpm}$$

$$\%I = \frac{1039 \times 831 \times 70.253}{0.7646 \times 30.31 \times 3129 \times 96 \times (0.296)^2} = 99.4\ \%$$

ACFM: 246 ~~550~~ ~~811~~ 766 ✓
SCFM: 121 ~~705~~ ~~834~~ 897 ✓
%EA: 135.8 ✓

Ru No. 7

PARTICULATE FIELD DATA

Location Kiln No. 2 Stack

Date ~~10~~ 11 November 1981

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks
7	1128	898.83	0.40	1.15	1.15	6.5	346	260	250	58	80	71	
6	1130	900.06	0.40	1.15	1.15	6.5	346	259	250	58	80	72	
5	1132	901.16	0.40	1.15	1.15	6.5	349	257	251	58	81	72	
4	1134	902.97	0.456	1.30	1.30	7.0	349	253	252	59	82	72	
3	1136	904.80	0.47	1.35	1.35	7.5	346	257	258	60	83	73	
2	1138	906.03	0.47	1.35	1.35	7.5	346	256	255	62	83	73	
1	1140	907.29	0.35	1.00	1.00	6.0	337	258	260	65	84	73	
END	1142	908.391	—	—	—	—	—	—	—	—	—	—	
12	1149	908.55	0.55	1.55	1.55	8.5	345	264	276	70	81	74	
11	1151	909.85	0.56	1.60	1.60	8.4	349	273	271	65	82	74	
10	1153	911.21	0.54	1.55	1.55	9.0	351	272	274	59	83	74	10 FAN
9	1155/1216	912.431/912.431	0.65	1.85	1.85	9.2	338	245	244	60	77	77	ADJUSTED
8	1218	913.88	0.70	2.00	2.00	9.2	338	246	246	52	78	75	
7	1508	915.59	0.76	2.20	2.20	11.0	423	270	266	80	80	79	stopped
6	1510	917.30	0.80	2.30	2.30	12.0	423	272	272	76	80	79	1219
5	1512	918.96	0.80	2.30	2.30	12.0	422	274	270	70	80	79	@914.072
4	1514	920.63	0.78	2.10	2.10	11.5	420	260	270	70	82	80	leak check
3	1516	922.27	0.72	1.95	1.95	10.8	418	251	271	69	82	79	Restart
2	1518	923.81	0.70	1.90	1.90	10.5	414	248	270	69	82	79	1507
1	1520	925.35	0.60	1.60	1.60	9.0	406	243	266	69	83	79	@914.850
END	1522	926.721	—	—	—	—	—	—	—	—	—	—	
12	1526	926.721	0.62	1.70	1.70	9.2	406	232	256	71	81	79	
11	1528	928.18	0.75	2.05	2.05	11.0	407	237	254	71	82	79	
10	1530	929.72	0.93	2.25	2.25	12.5	406	252	254	69	83	79	orsat
9	1532	931.40	0.88	2.40	2.40	13.5	405	258	254	68	84	79	
8	1534	933.03	0.93	2.50	2.50	14.0	406	259	255	69	84	79	
7	1536	934.77	0.95	2.60	2.60	14.8	404	259	255	67	85	80	
6	1538	936.55	0.95	2.60	2.60	15.2	403	259	254	66	85	80	
5	1540	938.35	0.91	2.50	2.50	14.7	402	257	256	66	86	80	
4	1542	940.15	0.88	2.40	2.40	14.4	401	259	256	66	86	80	
3	1544	941.88	0.88	2.40	2.40	14.4	400	258	257	65	86	80	
2	1546	943.63	0.72	1.95	1.95	11.3	396	256	256	66	86	80	

Ru No. 1

PARTICULATE FIELD DATA

Location Kiln #2 Stack

Date ~~10~~ 11 NOV 81

			ΔP_s	P_m			T_s				T_m		
Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
1	1548	945.20	0.60	1.60	1.60	10.0	386	251	257	68	86	80	
END	1550	946.583	—	—	—	—	—	—	—	—	—	—	
ALL													

MUL[illegible] EN[illegible]NM[illegible] T[illegible]NG

Part, CI, SO_2 F[illegible] DATA

Job 81-107

Job Name Lone Star Ind.

Run No. 2

Location #1 Kiln Stack

Date 12 November 1981

Operator Alexander, Christian

Sample Box No. 5 Meter Box No. 1

Read and record at the start of each test point.

Purge to: 1012.231

Purge time: 1457-1502

Ambient Temp. °F 70

Assumed Moisture % 25

Probe Length 5

C Factor — 1.12 to reference

Initial Leak @ 16.0 "Hg = 0.006 cfm

Final Leak @ 8.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s)	Orifice ΔH in. H_2O (P_m) Desired	Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m) Inlet	Outlet	Remarks
A 12	1308	964.362	0.65	0.80	0.80	5.0	365	264	272	61	72	72	
11	1310	965.45	0.75	0.88	0.88	5.2	367	268	272	54	73	72	
10	1312	966.45	0.89	1.05	1.05	6.0	368	273	270	52	73	71	
9	1314	967.57	0.95	1.10	1.10	6.8	369	258	267	51	74	71	
8	1316	968.67	0.99	1.10	1.10	6.9	370	248	273	51	74	71	
7	1318	969.81	1.00	1.10	1.10	6.9	370	250	263	50	75	71	
6	1320	971.00	0.99	1.10	1.10	6.9	371	249	259	50	75	72	
5	1322	972.19	0.94	1.05	1.05	6.5	371	248	253	50	76	72	
4	1324	973.35	0.90	1.00	1.00	6.0	371	245	248	50	76	72	
3	1326	974.40	0.85	0.96	0.96	6.0	371	242	244	50	76	72	
2	1328	975.60	0.77	0.87	0.87	5.7	370	240	240	51	77	72	
1	1330	976.50	0.66	0.75	0.75	5.0	367	246	238	51	77	72	
END	1332	977.423	—	—	—	—	—	—	—	—	—	—	
B 12	1336	977.423	0.61	0.68	0.68	4.9	363	262	252	59	75	72	
11	1338	978.29	0.65	0.73	0.73	5.0	368	264	257	55	75	72	
10	1340	979.29	0.68	0.77	0.77	5.0	368	260	261	54	76	72	
9	1342	980.20	0.72	0.81	0.81	5.0	368	260	260	54	76	72	reset
8	1344	981.20	0.78	0.88	0.88	5.6	368	259	259	54	77	72	

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 46.993' ft^3

Water Collected V_w 286.9 ml

Time of Test T_t 96 min.

Stack Pressure P_s -0.38 "H_2O

Baro. Press. P_b 30.20 "Hg

Probe Tip Dia. D_n 0.235 in.

% CO_2 12.3 % CO 0.0

% O_2 12.0 % N_2 75.7

Area Stack A_s 113457 in^2

Pitot Tube No. 7

Barometer No. 6

Probe Tip No. III-3

V_m = Dry Gas Meter Calibration Factor 1.027 X 45.758

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = ____ M_T = ____

Impinger Box No. 5

			Water Weight Gain	
Impinger 1	Final Weight	~~891.6~~ 895.4	Impinger 1	206.6
	Initial Weight	688.8		
	Increase	~~202.8~~ 206.6	Impinger 2	21.5
Impinger 2	Final Weight	~~657.7~~ 661.5	Impinger 3	40.3
	Initial Weight	640.0		
	Increase	~~17.7~~ 21.5	Impinger 4	8.4
Impinger 3	Final Weight	~~732.8~~ 737.0	Impinger 5	0.4
	Initial Weight	696.7		
	Increase	~~36.1~~ 40.3	Impinger 6	10.6
Impinger 4	Final Weight	666.0	Total	287.8 = V_w
	Initial Weight	657.6		
	Increase	~~3.6~~ 8.4		
Impinger 5	Final Weight	458.5		
	Initial Weight	458.1		
	Increase	0.4		
Impinger 6	Final Weight	752.6		
	Initial Weight	742.0		
	Increase	10.6		

V_w = 287.8
g SO_2 = - 0.9
V_w = 286.9

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b = 30.20
V_m = 46.993
V_w = 286.9
P_m = 0.736
Avg ΔP = 0.638
Avg $\sqrt{\Delta P}$ = 0.790
C_p = 0.805
P_s = -0.38 "H_2O 30.17 "Hg
T_m = 75 °F 535 °R
T_s = 367 °F 827 °R

		AVG.
$\%CO_2$ =	12.2, 12.4	12.3
$\%O_2$ =	12.0, 12.0	12.
%CO =	0.0, 0.0	0.0
$\%N_2$ =	75.8, 75.6	75.

A_s = 113457
D_n = 0.235
T_t = 96

Moisture Content: %M = 22.4~~6~~0 M_d = 0.77~~54~~60 MW_d = 30.418 MW = 27.6~~5~~6

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 46.993 \left(\frac{30.20 + \frac{0.736}{13.6}}{75 + 460}\right) = 46.904\ \text{sft}^3$$

0.489 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 28\cancel{7.8}6.9 = 13.5\cancel{84}42\ \text{sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{13.5\cancel{84}42}{46.904 + 13.5\cancel{84}42} \times 100 = 22.4\cancel{6}0\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{827}{30.17 \times 27.6\cancel{5}6}} \times 0.790 = 3244\ \text{fpm}$$

$$\%I = \frac{1039 \times 827 \times 46.904}{30.17 \times 0.77\cancel{54}60 \times 3244 \times 96 \times (0.235)^2} = 100.\cancel{2}1\ \%$$

ACFM: 25~~5,608~~ 878 32
SCFM: 128,~~052~~ 287
%EA: 148.9

PARTICULATE FIELD DATA

R No. C

Location Kiln #1 Stack

Date 12 NOV 81

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks
7	1346	982.25	0.84	0.94	0.94	6.0	369	256	257	54	77	72	
6	1348	983.30	0.82	0.93	0.93	6.0	369	257	256	54	78	73	
5	1350	984.37	0.84	0.95	0.95	6.0	370	256	256	54	78	73	
4	1352	985.42	0.80	0.90	0.90	5.7	369	257	253	55	78	73	
3	1354	986.47	0.75	0.84	0.84	5.5	369	256	251	56	79	73	
2	1356	987.52	0.68	0.77	0.77	5.3	367	254	250	56	79	73	
1	1358	988.45	0.61	0.68	0.68	4.7	355	255	249	57	79	73	
END	1400	989.368	—	—	—	—	—	—	—	—	—	—	
C-12	1404	989.368	0.40	0.45	0.45	4.0	363	248	238	68	76	73	
11	1406	990.12	0.45	0.51	0.51	4.1	367	242	233	62	76	73	
10	1408	990.92	0.45	0.51	0.51	4.1	367	252	235	60	77	73	
9	1410	991.72	0.45	0.54	0.54	4.2	368	250	242	60	77	73	
8	1412	992.53	0.47	0.56	0.56	4.2	368	250	242	60	77	73	
7	1414	993.36	0.48	0.58	0.58	4.2	368	245	241	61	78	73	
6	1416	994.20	0.50	0.60	0.60	4.7	368	243	242	62	78	73	
5	1418	995.07	0.52	0.62	0.62	4.8	368	241	244	63	78	73	
4	1420	995.94	0.52	0.62	0.62	4.8	368	241	245	63	78	74	
3	1422	996.72	0.48	0.58	0.58	4.7	365	241	256	63	78	74	
2	1424	997.67	0.45	0.54	0.54	4.3	361	241	258	63	78	74	
1	1426	998.50	0.35	0.42	0.42	4.0	352	239	255	66	78	74	
END	1428	999.256	—	—	—	—	—	—	—	—	—	—	
D-12	1432	999.256	0.38	0.46	0.46	4.0	361	263	272	74	76	74	
11	1434	1000.04	0.58	0.70	0.70	5.0	365	251	274	65	77	74	
10	1436	1000.97	0.49	0.58	0.58	4.7	367	246	273	60	78	74	
9	1438	1001.85	0.47	0.56	0.56	4.7	365	244	271	60	78	74	
8	1440	1002.70	0.48	0.57	0.57	4.7	366	244	268	59	78	74	
7	1442	1003.60	0.53	0.64	0.64	5.0	366	244	265	59	79	74	
6	1444	1004.51	0.50	0.60	0.60	5.0	366	248	263	58	79	74	
5	1446	1005.40	0.53	0.64	0.64	5.0	366	248	260	58	79	74	
4	1448	1006.34	0.56	0.68	0.68	5.2	366	250	257	59	80	74	
3	1450	1007.30	0.50	0.60	0.60	5.0	365	248	255	59	80	74	
2	1452	1008.25	0.50	0.60	0.60	5.0	364	250	253	60	81	75	

Run No. 2 PARTICULATE FIELD DATA

Location Kiln No-1 Stack

Date 12 NOV 81

			ΔP_s	P_m			T_s				T_m		
Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O	Orifice ΔH in. H_2O		Pump Vacuum In. Hg Gauge	Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F		Remarks
				Desired	Actual						Inlet	Outlet	
1	1454	1009.15	0.45	0.54	0.54	4.8	360	251	251	60	81	75	
END	1456	1010.12	—	—	—	—	—	—	—	—	—	—	
ALL													

[redacted] Job No. 81-707 [redacted] Part, CT, SC [redacted] F [redacted] DATA [redacted]

MULLINS ENVIRONMENTAL TESTING CO., INC.

Job Name LONE STAR IND.

Run No. 3

Location Kiln No. 1 Stack

Date 12 NOVEMBER 1981

Operator ALEXANDER, CHRISTIAN

Sample Box No. 4 Meter Box No. 1

Read and record at the start of each test point.

Purge to: 75.313

Purge time: 1837-1841

Ambient Temp. °F 68

Assumed Moisture % 23

Probe Length 5

C Factor — 12 to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 9.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s)	Orifice ΔH in. H_2O (P_m) Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m) Inlet	Dry Gas Temp. °F Outlet	Remarks
D 12	1639	27.198	0.35	0.42	0.42	4.0	~~234~~ 357	264	263	76	73	73	
11	1641	27.96	0.41	0.50	0.50	4.0	361	245	267	71	73	73	
10	1643	28.76	0.43	0.52	0.52	4.0	361	232	266	68	73	73	
9	1645	29.57	0.47	0.56	0.56	4.0	361	238	261	66	73	73	
8	1647	30.33	0.50	0.60	0.60	4.2	361	244	257	66	73	73	
7	1649	31.15	0.50	0.60	0.60	4.2	361	248	255	65	73	73	
6	1651	32.01	0.52	0.62	0.62	4.2	360	254	251	65	74	72	
5	1653	32.88	0.50	0.60	0.60	4.2	360	257	247	65	74	72	
4	1655	33.73	0.56	0.67	0.67	4.6	360	262	246	65	74	72	
3	1657	34.61	0.55	0.66	0.66	4.7	360	262	246	66	75	72	
2	1659	35.52	0.55	0.66	0.66	4.7	360	262	245	67	75	72	
1	1701	36.40	0.43	0.52	0.52	4.0	353	263	245	67	75	72	
END	1703	37.214	—	—	—	—	—	—	—	—	—	—	
C 12	1713	37.214	0.40	0.48	0.48	3.7	358	261	238	76	72	71	
11	1715	37.96	0.44	0.52	0.52	3.9	360	256	236	72	72	71	
10	1717	38.76	0.45	0.54	0.54	4.0	361	256	242	77	73	71	
9	1719	39.55	0.43	0.52	0.52	4.0	361	258	244	75	73	71	
8	1721	40.35	0.45	0.54	0.54	4.0	361	260	245	74	73	71	cont

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 47.244 ✓ ft^3

Water Collected V_w 312.8 ml

Time of Test T_t 96 min.

Stack Pressure P_s -0.16 "H_2O

Baro. Press. P_b 30.20 "Hg

Probe Tip Dia. D_n 0.235 in.

% CO_2 12.5 % CO 0.0

% O_2 11.6 % N_2 75.9

Area Stack A_s 13457 in^2

Pitot Tube No. 7

Barometer No. 6

Probe Tip No. III-3

V_m = Dry Gas Meter Calibration Factor 1.027 X 46.002

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = ____ M_T = ____

Impinger Box No. 4

Impinger 1	Final Weight	896.5	
	Initial Weight	688.6	
	Increase	207.9 ✓	
Impinger 2	Final Weight	696.5	
	Initial Weight	645.9	
	Increase	50.6 ✓	
Impinger 3	Final Weight	732.1	
	Initial Weight	694.1	
	Increase	38.0 ✓	
Impinger 4	Final Weight	690.2	
	Initial Weight	682.9	
	Increase	7.3 ✓	
Impinger 5	Final Weight	464.8	
	Initial Weight	464.4	
	Increase	0.4 ✓	
Impinger 6	Final Weight	769.8	
	Initial Weight	760.4	
	Increase	9.4 ✓	

Filter # ______ Final Weight ______
Initial Weight ______
Increase ______

Water Weight Gain

V_w = 313.6
g SO_2 = - 0.8
V_w = 312.8

P_b = 30.2[illegible]
V_m = 47.2[illegible]
V_w = 31[illegible]
P_m = 0.756
Avg ΔP = 0.62[illegible]
Avg $\sqrt{\Delta P}$ = 0.7[illegible]
C_p = 0.805 ✓
P_s = - 0.16 ✓
T_m = 73 ✓ °F
T_s = 359 ✓ °F

.9 ✓
.6 ✓
.0 ✓
.3 ✓
.4 ✓
.4 ✓
.6 ✓ = $V_{w\,AVG.}$
12.6 | 12.5 ✓
11.4 | 11.6 ✓
0.0 | 0.0 ✓
76 | 75.9 ✓
7 ✓
✓ "Hg
✓ °R
°R

Moisture Content: %M = ~~23.82~~ 23.78 ✓ M_d = ~~0.7618~~ 0.7622 ✓ MW_d = 30.464 ✓

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 47.244 \left(\frac{30.20 + \frac{0.756}{13.6}}{73 + 460}\right) =$$

ft³

cfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 313.6 = 14.\cancel{802}\,764\ \text{sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{14.\cancel{802}\,764}{47.334 + 14.\cancel{802}\,764} \times 100 = 23.\cancel{82}\,78$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{819}{30.19 \times 27.50}} \times 0.785 = 3216 \checkmark\ \text{fpm}$$

$$\%I = \frac{1039 \times 819 \times 47.334}{0.76\cancel{18}\,22 \times 30.19 \times 3216 \times 96 \times (0.235)^2} = 102.7 \checkmark\ \%$$

631 ✓
~~172~~
~~707~~
~~552~~ 221 ✓
~~322~~
3 ✓

R. No. 3

PARTICULATE FIELD DATA

Location Kiln No. 1 Stack

Date 12 NOV 81

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
7	1723	41.20	0.50	0.60	0.60	4.2	361	260	249	73	73	71	
6	1725	41.95	0.52	0.62	0.62	4.4	361	261	253	73	74	71	
5	1727	42.80	0.53	0.64	0.64	4.5	361	262	254	73	74	71	
4	1729	43.69	0.53	0.64	0.64	4.5	357	264	254	73	74	71	
3	1731	44.59	0.53	0.64	0.64	4.5	359	264	258	72	75	71	
2	1733	45.46	0.45	0.54	0.54	4.0	352	262	259	73	75	71	
1	1735	46.29	0.41	0.50	0.50	4.0	346	262	262	74	75	71	
END	1737	47.030		—	—	—	—	—	—	—	—	—	
12	1742	47.030	0.56	0.68	0.68	5.0	353	259	258	84	73	71	
11	1744	47.94	0.60	0.72	0.72	5.0	359	257	258	80	73	71	
10	1746	48.90	0.66	0.80	0.80	5.4	359	258	261	76	74	71	
9	1748	49.85	0.70	0.84	0.84	5.5	359	264	262	76	75	71	
8	1750	50.90	0.77	0.93	0.93	6.0	360	266	264	75	76	71	
7	1752	51.95	0.78	0.94	0.94	6.1	361	264	264	74	76	71	
6	1754	53.00	0.81	0.98	0.98	6.2	361	264	264	73	77	71	
5	1756	54.10	0.81	0.98	0.98	6.2	361	262	263	75	77	71	
4	1758	55.16	0.78	0.94	0.94	6.2	361	260	261	75	77	71	
3	1800	56.22	0.77	0.93	0.93	6.2	361	257	259	77	78	72	
2	1802	57.29	0.70	0.84	0.84	6.0	360	257	258	76	77	71	
1	1804	58.34	0.62	0.74	0.74	6.0	354	256	257	77	77	71	
END	1806	59.270	—	—	—	—	—	—	—	—	—	—	
12	1810	59.270	0.65	0.78	0.78	5.3	357	256	256	77	74	71	
11	1812	60.33	0.78	0.94	0.94	6.3	358	255	255	69	75	71	
10	1814	61.32	0.88	1.05	1.05	6.8	359	257	256	71	76	71	
9	1816	63.03	0.96	1.15	1.15	7.0	359	258	257	69	77	71	
8	1818	64.10	0.96	1.15	1.15	7.0	360	259	257	68	77	71	
7	1820	64.77	0.99	1.20	1.20	8.0	360	259	257	68	77	71	
6	1822	66.00	0.96	1.15	1.15	8.0	360	261	257	69	75	71	
5	1824	67.25	0.95	1.15	1.15	8.0	361	262	257	70	75	71	
4	1826	68.51	0.88	1.05	1.05	7.8	360	260	257	71	75	71	
3	1828	69.72	0.80	0.96	0.96	7.5	360	260	258	71	79	71	
2	1830	70.90	0.75	0.90	0.90	7.0	359	260	258	72	75	72	

R No. 3

PARTICULATE FIELD DATA

Location Kiln #1 Stack

Date 12 NOV 81

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks
1	1832	72.02	0.65	0.76	0.78	6.3	356	259	257	72	78	72	
END	1834	73.200	—	—	—	—	—	—	—	—	—	—	
ALL													

[redacted] MULLINS ENVIRONMENTAL TESTING CO. INC.

J[redacted]. [redacted]1-10[redacted]7 [redacted] 1/13 [redacted] F [redacted] DA[redacted]

Job Name LONE STAR IND.
Run No. 1A
Location Kiln No. 1 Stack
Date 12 NOVEMBER 1981
Operator Alexander, Christian
Sample Box No. 6 Meter Box No. 1

Read and record at the start of each test point.

Purge to: —
Purge time: —

Ambient Temp. °F 70
Assumed Moisture % 25
Probe Length 3
C Factor – – to reference
Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 6.2 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s)	Orifice ΔH in. H_2O (P_m) Desired	Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m) Inlet	Outlet	Remarks
BA 11	1134	948.967	0.33	0.80	0.80	5.5	400	249	251	64 51	69	67	
11	1139	951.42	0.33	0.80	0.80	5.2	396	258	275	60 45	70	67	oval
11	1144	953.95	0.35	0.84	0.84	5.5	394	268	265	44	71	68	
11	1149	956.42	0.30	0.73	0.73	5.1	387	264	271	46	72	68	
11	1154	958.78	0.33	0.80	0.80	5.2	386	265	268	53	73	69	
11	1159	961.22	0.33	0.80	0.80	5.2	388	272	238	56	75	69	
END	1204	963.780	—	—	—	—	—	—	—	—	—	—	
ALL													

Pitot Tube Calibration Factor C_p 0.808
Volume Collected V_m 15.213 ft^3
Water Collected V_w 99.4 ml
Time of Test T_t 30 min.
Stack Pressure P_s — "H_2O

Baro. Press. P_b 30.25 "Hg
Probe Tip Dia. D_n — in.
% CO_2 11.0 % CO 0.0
% O_2 12.2 % N_2 76.8
Area Stack A_s 61134 57 in^2

Pitot Tube No. 2 Barometer No. 6
Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.027 X 14.813

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = ____ M_T = ____

Impinger Box No. 6

			Water Weight Gain	
Impinger 1	Final Weight	773.6	Impinger 1	86.3
	Initial Weight	687.3		
	Increase	86.3	Impinger 2	8.7
Impinger 2	Final Weight	699.4	Impinger 3	0.0
	Initial Weight	690.7		
	Increase	8.7	Impinger 4	4.4
Impinger 3	Final Weight	483.4	Impinger 5	
	Initial Weight	483.4		
	Increase	0.0	Impinger 6	
Impinger 4	Final Weight	798.8	Total	99.4 ~~108.4~~ $= V_w$
	Initial Weight	794.4		
	Increase	4.4		
Impinger 5	Final Weight			
	Initial Weight			
	Increase			
Impinger 6	Final Weight			
	Initial Weight			
	Increase			

V_w =

g SO_2 = -

V_w =

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b = 30.25 $\quad$ $\%CO_2$ = 11.0

V_m = 15.213 $\quad$ $\%O_2$ = 12.2

V_w = 99.4 $\quad$ $\%CO$ = 0.0

P_m = 0.795 $\quad$ $\%N_2$ = 76.8

Avg ΔP = — $\quad$ A_s = 11345

Avg $\sqrt{\Delta P}$ = — $\quad$ D_n = —

C_p = 0.808 $\quad$ T_t = 30

P_s = — "H_2O ____ "Hg

T_m = 70 °F $\quad$ 530 °R

T_s = 392 °F $\quad$ 852 °R

Moisture Content: %M = 23.40 ~~24.99~~ $\quad$ M_d = 0.7660 ~~0.7501~~ $\quad$ MW_d = 30.248 $\quad$ MW = 27.38 ~~27.19~~

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 15.213 \left(\frac{30.25 + \frac{0.795}{13.6}}{70 + 460} \right) = 15.355\ \text{sft}^3$$

0.512 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times \underset{\cancel{108.4}}{99.4} = \underset{\cancel{5.116}}{4.692}\ \text{sft}^3$$

$$\text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{\underset{\cancel{5.116}}{4.692}}{15.355 + \underset{4.692}{\cancel{5.116}}} \times 100 = \underset{\cancel{24.99}}{23.40}\ \%$$

V_s = 5123.8 x ____ $\sqrt{\ \ \ x\ \ \ }$ x ____ = — fpm $\quad$ ACFM: —

SCFM: —

%I = $\frac{1039 \text{ x } \quad \text{ x}}{\text{x} \quad \text{x} \quad \text{x} \quad \text{x}(\quad)^2}$ = — % $\quad$ %EA: 149.7

MULLINS ENVIRONMENTAL TESTING CO.

[redacted] Job [redacted] . 81-107 [redacted] 1013 [redacted] F [redacted] DATA [redacted]

Job Name LONE STAR IND.

Run No. 2 A

Location Kiln #1 Stack

Date 12 NOVEMBER 1981

Operator Alexander, Christian

Sample Box No. 6 Meter Box No. 1

Read and record at the start of each test point.

Purge to: —

Purge time: —

Ambient Temp. °F 73

Assumed Moisture % 25

Probe Length 3

C Factor — — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 7.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s)	Orifice ΔH in. H_2O (P_m)		Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m)		Remarks
				Desired	Actual						Inlet	Outlet	
D-11	1532	12.342	—	0.80	0.80	5.2	361	257	228	74	78	77	
11	1537	14.85	—	0.75	0.75	5.0	365	273	262	63	78	76	draft
11	1542	17.28	—	0.75	0.75	5.0	368	268	263	63	78	76	
11	1547	19.46	—	0.75	0.75	5.1	368	255	240	62	79	76	
11	1552	21.97	—	0.75	0.75	5.1	307	242	233	62	79	76	
11	1557	24.35	—	0.75	0.75	5.1	367	240	236	60	79	75	
END	1602	26.750	—	—	—	—	—	—	—	—	—	—	
Acl													

Pitot Tube Calibration Factor C_p —

Volume Collected V_m 14.797 ft^3

Water Collected V_w 97.8 ml

Time of Test T_t 30 min.

Stack Pressure P_s — "H_2O

Baro. Press. P_b 30.20 "Hg

Probe Tip Dia. D_n 0 — in.

% CO_2 12.4 % CO 0.0

% O_2 12.0 % N_2 75.6

Area Stack A_s 11345 57 in^2

Pitot Tube No. —

Barometer No. 6

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.027 x 14.408

[Dry Gas Meter Reading ___ ft^3 - (T_t ___ min X Leak Rate ___ cfm)]

M_F = ___ M_T = ___

Impinger Box No. 6

Impinger 1	Final Weight	769.2	Impinger 1	85.7
	Initial Weight	683.5	Impinger 2	8.9
	Increase	85.7	Impinger 3	0.7
Impinger 2	Final Weight	705.0	Impinger 4	2.8
	Initial Weight	696.1	Impinger 5	
	Increase	8.9	Impinger 6	
Impinger 3	Final Weight	433.0	Total	97.8 = V_w
	Initial Weight	482.3		
	Increase	0.7		
Impinger 4	Final Weight	801.5		
	Initial Weight	799.0		
	Increase	2.5		
Impinger 5	Final Weight			
	Initial Weight			
	Increase			
Impinger 6	Final Weight			
	Initial Weight			
	Increase			

Water Weight Gain

V_w =

g SO_2 = -

V_w =

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b = 30.20		$\%CO_2$ = 12.4	
V_m = 14.797		$\%O_2$ = 12.0	
V_w = 97.8		$\%CO$ = 0.0	
P_m = 0.758		$\%N_2$ = 75.6	
Avg ΔP = —		A_s = 11345	
Avg $\sqrt{\Delta P}$ = —		D_n = —	
C_p = —		T_t = 30	
P_s = — "H_2O		— "Hg	
T_m = 77 °F		537 °R	
T_s = 367 °F		827 °R	

Moisture Content: %M = 23.88 M_d = 0.7612 MW_d = 30.464 MW = 27.49

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 14.797 \left(\frac{30.20 + \frac{0.758}{13.6}}{77 + 460}\right) = 14.715\ \text{sft}^3$$

0.490 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 97.8 = 4.616\ \text{sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.616}{14.715 + 4.616} \times 100 = 23.88\ \%$$

V_s = 5123.8 x ____ $\sqrt{\frac{\quad}{\quad x \quad}}$ x ____ = — fpm

$\%I = \frac{1039 \times \quad \times}{\quad x \quad x \quad x \quad x(\quad)^2}$ = — %

ACFM: —

SCFM: —

%EA: 149.4

MULLINS ENVIRONMENTAL TESTING CO.

[redacted]

Job Name LONE STAR IND
Run No. 3 A
Location Kiln No. 1 Stack
Date 12 NOVEMBER 81
Operator Alexander, Christian
Sample Box No. 6 Meter Box No. 1

Read and record at the start of each test point.

Purge to: —
Purge time: —

Ambient Temp. °F 63
Assumed Moisture % 25
Probe Length 3
C Factor — — to reference
Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 6.0 "Hg = 0.00 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s)	Orifice ΔH in. H_2O (P_m) Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m) Inlet	Dry Gas Temp. °F Outlet	Remarks
A 11	1923	75.528	0	0.78	0.78	5.2	365	248	228	71	69	69	
11	1928	78.05	—	0.78	0.78	5.2	362	271	266	71	70	69	orsat
11	1933	80.40	—	0.78	0.78	5.2	362	270	265	70	71	69	
11	1938	82.80	—	0.78	0.78	5.2	362	265	272	68	72	68	
11	1943	85.20	—	0.78	0.78	5.2	361	262	257	68	73	69	
11	1948	87.74	—	0.78	0.78	5.2	361	250	234	70	74	69	
END	1953	90.072	—	—	—	—	—	—	—	—	—	—	
Av													

Pitot Tube Calibration Factor C_p —
Volume Collected V_m 14.937 ft^3 Baro. Press. P_b 30.19 "Hg
Water Collected V_w 100.9 ml Probe Tip Dia. D_n 0.— in.
Time of Test T_t 30 min. % CO_2 12.6 % CO 0.0
Stack Pressure P_s — "H_2O % O_2 11.8 % N_2 75.6
Area Stack A_s 113~~45~~ 57 in^2

Pitot Tube No. — Barometer No. 6
Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.027 x 14.544

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = ____ M_T = ____

Impinger Box No. 6

Impinger 1	Final Weight	773.6	Water Weight Gain	Impinger 1 88.5
	Initial Weight	685.1		Impinger 2 8.8
	Increase	88.5		
Impinger 2	Final Weight	699.2		Impinger 3 0.6
	Initial Weight	690.4		Impinger 4 3.0
	Increase	8.8		
Impinger 3	Final Weight	483.4		Impinger 5
	Initial Weight	482.8		Impinger 6
	Increase	0.6		
Impinger 4	Final Weight	804.7		Total 100.9 = V_w
	Initial Weight	801.7		
	Increase	3.0		
Impinger 5	Final Weight			
	Initial Weight			
	Increase			
Impinger 6	Final Weight			
	Initial Weight			
	Increase			

V_w =

g SO_2 = -

V_w =

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b = 30.19		$\%CO_2$ = 12.6	
V_m = 14.937		$\%O_2$ = 11.8	
V_w = 100.9		$\%CO$ = 0.0	
P_m = 0.780		$\%N_2$ = 75.6	
Avg ΔP = —		A_s = 11345	
Avg $\sqrt{\Delta P}$ = —		D_n = —	
C_p = —		T_t = 30	
P_s = — "H_2O		"Hg	
T_m = 70 °F	530 °R		
T_s = 362 °F	822 °R		

Moisture Content: %M = 24.04 M_d = 0.7596 MW_d = 30.488 MW = 27.49

$$V_{m_{std}} = 17.65\, V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 14.937 \left(\frac{30.19 + \frac{0.780}{13.6}}{70 + 460}\right) = 15.046 \text{ sft}^3$$

0.502 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 100.9 = 4.762 \text{ sft}^3$$

$$\%\text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.762}{15.046 + 4.762} \times 100 = 24.04\,\%$$

V_s = 5123.8 x ____ $\sqrt{\frac{\quad}{\quad x}}$ x ____ = — fpm

ACFM: —

SCFM: —

$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times(\quad)^2}$ = — %

%EA: 143.3

[redacted] JOB [redacted] 81-70-1 [redacted] DATA [redacted] MULLINS ENVIRONMENTAL TESTING CO. [redacted]

Job Name Gener Lone Star Ind.
Run No. 1
Location Kiln No. 2 Stack
Date 13 NOVEMBER 81
Operator Alexander, Christian
Sample Box No. 4 Meter Box No. 1

Read and record at the start of each test point.

Purge to: 151,317
Purge time: 1037-1041

Ambient Temp. °F 59
Assumed Moisture % 31
Probe Length 5
C Factor - 23 to reference
Initial Leak @ 16.0 "Hg = 0.000 cfm
Final Leak @ 12.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s)	Orifice ΔH in. H_2O (P_m) Desired	Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m) Inlet	Outlet	Remarks
D 12	0848	90.496	0.44	1.00	1.00	5.2	390	233	240	82	62	61	
11	0850	91.60	0.48	1.10	1.10	5.0	391	235	238	74	63	61	
10	0852	92.81	0.54	1.25	1.25	6.0	391	239	232	70	64	61	
9	0854	93.85	0.54	1.25	1.25	6.0	391	242	234	68	65	61	
8	0856	95.07	0.59	1.40	1.40	6.3	392	250	237	68	65	62	
7	0858	96.38	0.60	1.40	1.40	6.3	394	252	244	68	667	62	
6	0900	97.65	0.60	1.40	1.40	6.3	393	257	247	68	67	62	
5	0902	98.86	0.65	1.50	1.50	6.5	394	239	240	69	68	63	
4	0904	100.27	0.62	1.45	1.45	6.7	392	238	238	68	69	63	
3	0906	101.60	0.58	1.35	1.35	6.5	390	236	242	70	70	63	
2	0908	102.85	0.55	1.30	1.30	6.2	389	237	249	71	70	63	
1	0910	104.15	0.50	1.15	1.15	6.0	385	238	260	73	71	63	
END	0912	105.421	—	—	—	—	—	—	—	—	—	—	
C 12	0915	105.421	0.32	0.75	0.75	4.1	387	245	272	70	69	64	
11	0917	106.37	0.30	0.70	0.70	4.0	390	249	274	73	70	64	
10	0919	107.28	0.29	0.64	0.64	4.0	388	250	271	71	70	64	
9	0921	108.20	0.28	0.66	0.66	4.0	386	252	270	70	71	64	
8	0923	109.10	0.34	0.78	0.78	4.2	387	254	268	70	71	65	

Pitot Tube Calibration Factor C_p 0.805
Volume Collected V_m 60.136 ft^3
Water Collected V_w 375.1 ml
Time of Test T_t 96 min.
Stack Pressure P_s - 0.32 "H_2O

Baro. Press. P_b 30.27 "Hg
Probe Tip Dia. D_n 0.296 in.
% CO_2 13.2 % CO 0.0
% O_2 10.9 % N_2 75.9
Area Stack A_s 11345 in^2

Pitot Tube No. 7 Barometer No. 6
Probe Tip No. III-4

V_m = Dry Gas Meter Calibration Factor 1.027 X 58.555

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = ____ M_T = ____

Impinger Box No. 4

Impinger 1	Final Weight	882.2	
	Initial Weight	691.8	
	Increase	190.4	
Impinger 2	Final Weight	761.3	
	Initial Weight	646.1	
	Increase	115.2	
Impinger 3	Final Weight	742.2	
	Initial Weight	695.4	
	Increase	46.8	
Impinger 4	Final Weight	694.5	
	Initial Weight	684.2	
	Increase	10.3	
Impinger 5	Final Weight	464.8	
	Initial Weight	464.4	
	Increase	0.4	
Impinger 6	Final Weight	782.3	
	Initial Weight	769.6	
	Increase	12.7	

Filter # _____ Final Weight _____
Initial Weight _____
Increase _____

Water Weight Gain

Impinger 1	190.4
Impinger 2	115.2
Impinger 3	46.8
Impinger 4	10.3
Impinger 5	0.4
Impinger 6	12.7
Total	375.8 = V_w

V_w = 375.8
g SO_2 = - 0.7
V_w = 375.1

P_b = 30.27
V_m = 60.136
V_w = 375.1
P_m = 1.247
Avg ΔP = 0.537
Avg $\sqrt{\Delta P}$ = 0.725
C_p = 0.805
P_s = -0.32 "H_2O 30.25 "Hg
T_m = 70 °F 530 °R
T_s = 391 °F 851 °R

$\%CO_2$ = 13.4, 13.0 13.2
$\%O_2$ = 11.2, 10.6 10.9
$\%CO$ = 0.0, 0.0 0.0
$\%N_2$ = 75.4, 76.4 ~~76.4~~ 75.9
A_s = ~~11375~~ 11357 11345
D_n = 0.296
T_t = 96

Moisture Content: %M = 22.55 M_d = 0.7745 MW_d = 30.548 MW = 27.72

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 60.136 \left(\frac{30.27 + \frac{1.247}{13.6}}{70 + 460}\right) = 60.804 \text{ sft}^3$$

0.633 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 375.8 = 17.705 \text{ sft}^3$$

$$\%\ Moisture = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{17.705}{60.807 + 17.705} \times 100 = 22.55\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{851}{27.71 \times 30.27}} \times 0.725 = 3013 \text{ fpm}$$

$$\%I = \frac{1039 \times 851 \times 60.807}{0.7745 \times 30.25 \times 3013 \times 96 \times (0.296)^2} = 90.5\ \%$$

ACFM: 237,341
SCFM: 115,751
%EA: 118.3

Rt. No. /

PARTICULATE FIELD DATA

Location Kiln No. 2 Stack

Date 13 NOVEMBER 81

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks
7	0925	110.02	0.34	0.78	0.78	4.0	388	256	265	~~81~~ 70	72	65	orsat
6	0927	111.00	0.40	0.94	0.94	4.8	386	257	260	70	73	66	
5	0929	111.97	0.36	0.84	0.84	4.4	386	258	257	70	73	66	
4	0931	113.00	0.38	0.89	0.89	4.8	384	258	251	71	74	66	
3	0933	114.02	0.35	0.82	0.82	4.6	383	261	249	~~8~~71	74	66	
2	0935	115.02	0.36	0.84	0.84	4.5	379	260	245	73	75	67	
1	0937	116.05	0.22	0.52	0.52	3.4	380	261	241	75	75	67	
END	0939	116.896	—	—	—	—	—	—	—	—	—	—	
B 12	0945	116.896	0.48	1.10	1.10	5.4	388	248	230	78	73	67	
11	0947	118.00	0.53	1.20	1.20	6.0	392	251	228	76	74	67	
10	0949	119.20	0.60	1.40	1.40	6.5	394	250	231	72	75	68	
9	0951	120.51	0.60	1.40	1.40	6.8	395	253	235	70	76	68	
8	0953	121.80	0.63	1.50	1.50	7.0	395	252	240	70	76	68	
7	0955	123.15	0.65	1.50	1.50	7.2	395	251	244	69	77	68	
6	0957	125.40	0.70	1.60	1.60	7.4	395	252	248	69	78	68	
5	0959	125.97	0.68	1.60	1.60	7.6	395	251	252	70	79	69	
4	1001	127.30	0.71	1.65	1.65	8.0	394	249	255	71	79	69	
3	1003	128.67	0.68	1.60	1.60	8.0	394	250	258	72	79	69	
2	1005	130.14	0.65	1.50	1.50	7.5	392	250	261	74	80	69	
1	1007	131.43	0.55	1.30	1.30	7.0	385	248	264	74	80	69	
END	1009	132.962	—	—	—	—	—	—	—	—	—	—	
A 12	1011	132.962	0.56	1.30	1.30	6.1	391	245	265	78	78	70	
11	1013	134.17	0.58	1.35	1.35	7.0	396	251	268	74	78	70	
10	1015	135.41	0.62	1.45	1.45	7.1	396	253	269	72	79	70	
9	1017	136.74	0.65	1.50	1.50	7.3	398	253	268	70	79	70	
8	1019	138.00	0.65	1.50	1.50	7.3	399	257	251	69	80	70	
7	1021	139.46	0.71	1.65	1.65	7.8	399	259	248	69	80	71	
6	1023	140.85	0.71	1.65	1.65	8.1	399	258	240	69	81	71	
5	1025	142.30	0.71	1.65	1.65	8.3	400	259	229	69	81	71	
4	1027	143.68	0.71	1.65	1.65	8.5	399	258	231	71	81	71	
3	1029	145.10	0.72	1.65	1.65 ~~1.75~~	8.5	396	258	238	73	82	72	
2	~~1027~~ 31	146.50	0.65	1.50	1.50	8.0	393	255	237	73	82	72	

Run No. ______

PARTICULATE FIELD DATA

Location Kiln #2 Stack

Date 13 NOV 81

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks
1	1029	147.87	0.40	0.94	0.94	5.8	388	249	255	75	81	72	
END	1035	149.051	—	—	—	—	—	—	—	—	—	—	
ALL													

[redacted]). [redacted] 81-407 [redacted] DATA [redacted]

Job Name LONE STAR IND.

Run No. 2

Location Kiln No. 2 Stack

Date 13 November 1981

Operator Alexander, Christian

Sample Box No. 5 Meter Box No. 1

Read and record at the start of each test point.

Purge to: 225.730

Purge time: 1443-1448

Ambient Temp. °F 69

Assumed Moisture % 23

Probe Length 5

C Factor — 25.5 to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 11.5 "Hg = 0.00 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s) 0.55	Orifice ΔH in. H_2O (P_m) Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m) Inlet	Dry Gas Temp. °F Outlet	Remarks
1-12	1207	166.569	~~1.40~~	1.40	1.40	9.0	390	246	241	72	72	71	
11	1209	167.90	0.55	1.40	1.40	9.0	398	237	247	61	72	71	
10	1211	169.20	0.59	1.50	1.50	9.0	399	231	240	59	73	71	
9	1213	170.55	0.64	1.60	1.60	9.5	398	237	235	58	73	71	
8	1215	171.95	0.65	1.65	1.65	10.0	398	243	232	58	74	71	
7	1217	173.29	0.68	1.70	1.70	10.5	398	245	229	59	75	71	
6	1219	174.77	0.68	1.70	1.70	10.7	398	247	231	60	75	71	
5	1221	176.25	0.68	1.70	1.70	10.7	398	246	236	61	76	71	
4	1223	177.62	0.72	1.80	1.80	11.0	397	248	240	63	76	71	
3	1225	179.10	0.67	1.70	1.70	11.2	393	246	248	64	77	71	
2	1227	180.62	0.62	1.60	1.60	11.0	388	244	250	65	78	71	
1	1229	182.00	0.52	1.30	1.30	8.7	374	241	252	67	78	71	
END	1231	183.255	—	—	—	—	—	—	—	—	—	—	
3-12	1233	183.253	0.35	0.90	0.90	6.0	363	236	272	76	75	71	restart
11	1235	183.34	0.30	0.76	0.76	5.0	387	243	274	60	76	71	1321
10	1237	185.352/185.352	0.49	1.25	1.25	7.3	389	253	247	57	71	70	
9	1323	186.57	0.53	1.35	1.35	8.0	390	254	252	50	71	70	
8	1325	187.84	0.54	1.40	1.40	8.1	391	255	254	48	72	70	

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 58.089 ft^3

Water Collected V_w 353.8 ml

Time of Test T_t 96 min.

Stack Pressure P_s -0.27 "H_2O

Baro. Press. P_b 30.20 "Hg

Probe Tip Dia. D_n 0.296 in.

% CO_2 12.4 % CO 0.0

% O_2 11.6 % N_2 76.0

Area Stack A_s 11345 in^2

Pitot Tube No. 7 Barometer No. 6

Probe Tip No. III-4

V_m = Dry Gas Meter Calibration Factor 1.027 X 56.562

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = ____ M_T = ____

Impinger Box No. 5

Impinger 1	Final Weight	813.9	
	Initial Weight	662.6	
	Increase	151.3	
Impinger 2	Final Weight	768.8	
	Initial Weight	631.5	
	Increase	137.3	
Impinger 3	Final Weight	745.2	
	Initial Weight	701.9	
	Increase	43.3	
Impinger 4	Final Weight	690.4	
	Initial Weight	680.8	
	Increase	9.6	
Impinger 5	Final Weight	454.0	
	Initial Weight	453.4	
	Increase	0.6	
Impinger 6	Final Weight	764.3	
	Initial Weight	752.2	
	Increase	12.1	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

Impinger 1	151.3
Impinger 2	137.3
Impinger 3	43.3
Impinger 4	9.6
Impinger 5	0.6
Impinger 6	12.1
Total	354.2 = V_w

V_w = 354.2

g SO_2 = - 0.4

V_w = 353.8

P_b = 30.20		$\%CO_2$ = 12.8 12.0	12.4
V_m = 58.089		$\%O_2$ = 11.4 11.8	11.6
V_w = 353.8		$\%CO$ = 0.0 0.0	0.0
P_m = 1.164		$\%N_2$ = 75.8 76.2	76.0
Avg ΔP = 0.459		A_s = 11345	
Avg $\sqrt{\Delta P}$ = 0.667		D_n = 0.296	
C_p = 0.805		T_t = 96	
P_s = -0.27 "H_2O	30.18 "Hg		
T_m = 73 °F	533 °R		
T_s = 387 °F	847 °R		

Moisture Content: %M = ~~22.30~~ 22.28 M_d = ~~0.7770~~ 0.7772 MW_d = 30.448 MW = 27.67

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 58.089 \left(\frac{30.20 + \frac{1.164}{13.6}}{73 + 460}\right) = 58.257 \text{ sft}^3$$

0.607 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 354.2 = 16.\cancel{718}\,699 \text{ sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{16.\cancel{718}\,699}{58.257 + 16.\cancel{718}\,699} \times 100 = 22.\cancel{30}\,28\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{847}{30.18 \times 27.67}} \times 0.667 = 27\cancel{62}\,71 \text{ fpm}$$

$$\%I = \frac{1039 \times 847 \times 58.257}{0.777\cancel{0}\,2 \times 30.18 \times 27\cancel{62}\,71 \times 96 \times (0.296)^2} = \cancel{94.1}\ 93.8\ \%$$

ACFM: ~~217,635~~ 218,290

SCFM: ~~106,706~~ 107,082

%EA: 135.8

RL No. 2

PARTICULATE FIELD DATA

Location Kiln No 2 Stack

Date 13 NOV 81

			ΔP_s	P_m			T_s				T_m		
Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
7	1327	189.13	0.56	1.40	1.40	8.3	392	256	254	48	72	70	orsat
6	1329	190.67	0.62	1.60	1.60	9.2	392	256	257	47	73	70	
5	1331	191.84	0.64	1.60	1.60	9.8	393	257	258	47	73	70	
4	1333	193.32	0.64	1.60	1.60	9.8	393	259	258	47	74	70	
3	1335	194.70	0.65	1.65	1.65	10.0	393	262	259	48	74	70	
2	1337	196.08	0.61	1.55	1.55	10.0	391	262	262	48	75	70	
1	1339	197.50	0.50	1.30	1.30	9.1	385	260	262	49	76	70	
END	1341	198.740	—	—	—	—	—	—	—	—	—	—	
12	1346	198.740	0.32	0.82	0.82	5.6	389	252	256	58	73	70	
11	1348	199.70	0.30	0.77	0.77	5.8	389	254	257	53	73	70	
10	1350	200.69	0.29	0.74	0.74	5.5	386	256	257	54	74	70	
9	1352	201.63	0.30	0.77	0.77	5.4	386	255	254	52	74	71	
8	1354	202.61	0.32	0.82	0.82	5.8	385	258	256	51	74	71	
7	1356	203.62	0.33	0.84	0.84	6.0	385	259	260	50	75	71	
6	1358	204.63	0.35	0.90	0.90	6.0	384	258	258	49	75	71	
5	1400	205.70	0.31	0.80	0.80	6.0	382	254	259	49	75	71	
4	1402	206.65	0.25	0.64	0.64	5.0	378	253	260	50	75	71	
3	1404	207.50	0.21	0.54	0.54	4.6	373	251	261	50	75	71	
2	1406	208.35	0.21	0.54	0.54	4.6	370	250	260	51	75	71	
1	1408	209.20	0.17	0.44	0.44	4.4	366	250	261	51	75	71	
END	1410	209.925	—	—	—	—	—	—	—	—	—	—	
12	1416	209.925	0.32	0.82	0.82	5.6	385	246	257	58	73	70	
11	1418	210.91	0.33	0.84	0.84	5.7	385	248	257	55	73	70	
10	1420	211.90	0.36	0.92	0.92	6.0	386	249	254	53	74	70	orsat
9	1422	213.02	0.36	0.92	0.92	6.0	386	251	245	53	74	70	
8	1424	214.15	0.41	1.05	1.05	6.0	386	250	246	54	75	71	
7	1426	215.10	0.40	1.00	1.00	7.0	386	251	247	54	75	71	
6	1428	216.20	0.45	1.15	1.15	7.5	386	247	244	54	76	71	
5	1430	217.40	0.42	1.05	1.05	7.2	384	244	241	54	76	71	
4	1432	218.53	0.44	1.10	1.10	7.3	384	247	234	55	77	71	
3	1434	219.72	0.43	1.10	1.10	7.3	382	245	235	56	77	71	
2	1436	220.85	0.42	1.05	1.05	7.0	380	247	237	56	77	71	

PARTICULATE FIELD DATA

Run No. 2

Location Kiln No 2 Stack

Date 13 NOV 81

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks
1	1439	222.07	0.34	0.84	0.84	6.5	380	246	231	58	77	71	
END	1440	223.131	—	—	—	—	—	—	—	—	—	—	
ALL													

Impinger Box No. 4

Impinger 1	Final Weight	867.3	Water Weight Gain	Impinger 1 166.9
	Initial Weight	~~795~~ 700.4		Impinger 2 155.8
	Increase	166.9		
Impinger 2	Final Weight	802.7		Impinger 3 61.1
	Initial Weight	646.9		Impinger 4 16.3
	Increase	155.8	V_w = 419.5	
Impinger 3	Final Weight	754.3	g SO_2 = - 0.1	Impinger 5 1.6
	Initial Weight	693.2	V_w = 419.4	Impinger 6 17.8
	Increase	61.1		
Impinger 4	Final Weight	697.4		Total 419.5 = V_w AVG
	Initial Weight	681.1		
	Increase	16.3		
Impinger 5	Final Weight	465.8		
	Initial Weight	464.2		
	Increase	1.6		
Impinger 6	Final Weight	815.9		
	Initial Weight	798.1		
	Increase	17.8		

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b = 30.20		%CO_2 = 12.2, 13.0	12.6
V_m = 64.497		%O_2 = 12.0, 11.4	11.7
V_w = 419.4		%CO = 0.0, 0.0	0.0
P_m = 1.400		%N_2 = 75.8, 75.4	75.6
Avg ΔP = 0.521		A_s = 11345	
Avg $\sqrt{\Delta P}$ = 0.716		D_n = 0.296	
C_p = 0.805		T_t = 96	
P_s = -0.21 "H_2O	30.18 "Hg		
T_m = 73 °F	533 °R		
T_s = 380 °F	840 °R		

Moisture Content: %M = 23.4~~3~~2 M_d = 0.765~~7~~8 MW_d = 30.484 MW = 27.5~~4~~6

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 64.497 \left(\frac{30.20 + \frac{1.400}{13.6}}{73 + 460}\right) = 64.720\ \text{sft}^3$$

0.674 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 419.\cancel{5}4 = \cancel{19.800}\ 19.796\ \text{sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{19.\cancel{800}796}{64.720 + 19.\cancel{800}796} \times 100 = 23.4\cancel{3}2\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{840}{27.5\cancel{4}6 \times 30.18}} \times 0.716 = 296\cancel{4}8\ \text{fpm}$$

ACFM: 233,~~906~~821

SCFM: 113,9~~73~~54

$$\%I = \frac{1039 \times 840 \times 64.720}{0.765\cancel{7}8 \times 30.18 \times 296\cancel{4}8 \times 96 \times (0.296)^2} = 97.9\ \%$$

%EA: 139.9

PARTICULATE FIELD DATA

Run No. B 3

Location Kiln No 2 Stack

Date 13 NOV 81

Point	Clock Time	Dry Gas Meter, CF	ΔPs: Pitot in. H_2O	Pm: Orifice ΔH in. H_2O Desired	Pm: Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Ts: Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Tm: Dry Gas Temp. °F Inlet	Tm: Dry Gas Temp. °F Outlet	Remarks
1647	1648	261.04	0.35	0.96	0.96	5.5	376	274	262	53	74	70	
6	1650	262.10	0.44	1.20	1.20	7.0	377	268	256	51	76	70	
5	1652	263.29	0.45	1.20	1.20	7.0	376	267	256	51	76	70	
4	1654	264.35	0.45	1.20	1.20	7.0	375	263	253	51	76	70	
3	1656	265.27	0.41	1.10	1.10	6.5	373	261	252	51	77	70	
2	1658	267.00	0.30	0.83	0.83	5.3	367	260	248	52	77	70	
1	1700	268.06	0.27	0.74	0.74	5.0	366	257	246	53	77	70	
END	1702	269.078	—	—	—	—	—	—	—	—	—	—	
B 12	1706	269.078	0.45	1.20	1.20	6.5	380	267	252	54	74	70	
11	1708	270.35	0.49	1.35	1.35	7.2	381	259	244	51	75	70	
10	1710	271.65	0.55	1.50	1.50	8.0	382	246	238	49	76	70	
9	1712	273.00	0.58	1.60	1.60	8.5	383	239	245	47	76	70	
8	1714	274.25	0.61	1.70	1.70	9.0	353	244	251	47	77	70	
7	1716	275.70	0.61	1.70	1.70	9.0	383	249	257	47	78	70	
6	1718	277.15	0.64	1.75	1.75	9.5	382	252	262	48	78	70	
5	1720	278.60	0.65	1.80	1.80	10.0	382	250	266	48	78	70	
4	1722	280.20	0.66	1.80	1.80	10.0	381	249	270	49	79	70	
3	1724	281.57	0.63	1.70	1.70	10.0	380	250	270	50	79	70	
2	1726	283.10	0.63	1.70	1.70	10.0	378	248	267	50	79	70	
1	1728	284.56	0.55	1.50	1.50	9.0	371	243	264	50	79	71	
END	1730	286.103	—	—	—	—	—	—	—	—	—	—	
A 12	1732	286.103	0.55	1.50	1.50	8.0	375	237	256	58	76	71	
11	1734	287.40	0.61	1.70	1.70	9.0	380	245	226	57	77	71	
10	1736	288.77	0.63	1.70	1.70	9.2	380	248	228	56	77	70	
9	1738	290.17	0.63	1.70	1.70	9.2	380	252	231	55	77	70	
8	1740	291.59	0.68	1.85	1.85	11.0	381	258	240	56	78	70	
7	1742	293.00	0.68	1.85	1.85	11.0	381	259	253	59	78	70	
6	1744	294.57	0.70	1.90	1.90	11.5	380	255	254	61	78	70	
5	1746	296.10	0.70	1.90	1.90	11.5	380	257	249	62	78	70	
4	1748	297.62	0.74	2.00	2.00	11.6	380	255	240	63	78	70	
3	1750	299.18	0.70	1.90	1.90	12.0	379	255	239	64	78	70	
2	1752	300.71	0.65	1.80	1.80	11.5	375	255	239	66	78	70	

PARTICULATE FIELD DATA

RL No. [illegible]

Location Kiln No. 2 Stack

Date 13 NOV 81

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	Outlet	Remarks
1	1754	302.27	0.57	1.60	1.60	10.4	367	251	239	67	78	70	
END	1756	303.715	—	—	—	—	—	—	—	—	—	—	
ALL													

[redacted] Job [redacted] . 01- 10[redacted] 11/13 [redacted] F [redacted] DATA [redacted]

MUL[redacted]NS EN[redacted]ONMENTAL T[redacted]ING CO. INC.

Job Name LONE STAR IND

Run No. 1A

Location Kiln No. 2 Stack

Date 13 NOVEMBER 1981

Operator Alexander, Christian

Sample Box No. 6 Meter Box No. 1

Read and record at the start of each test point.

Purge to: —

Purge time: —

Ambient Temp. °F 63

Assumed Moisture % 31

Probe Length 3

C Factor — — to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 6.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s)	Orifice ΔH in. H_2O (P_m) Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m) Inlet	Dry Gas Temp. °F Outlet	Remarks
A-11	1106	151.516	0.78	0.78	0.78	5.5	399	262	228	79	72	71	
11	1111	154.00	—	0.78	0.78	5.5	399	274	228	75	74	72	Orsat
11	1116	156.50	—	0.78	0.78	5.5	401	275	248	77	75	71	
11	1121	159.10	—	0.78	0.78	5.5	400	274	245	80	76	72	
11	1126	161.30	—	0.78	0.78	5.5	400	275	255	81	76	72	
11	1131	163.74	—	0.78	0.78	5.5	400	255	249	81	77	72	
END	1136	166.200	—	—	—	—	—	—	—	—	—	—	
ALL													

Pitot Tube Calibration Factor C_p —

Volume Collected V_m 15.080 ft^3

Water Collected V_w 98.7 ml

Time of Test T_t 30 min.

Stack Pressure P_s — "H_2O

Baro. Press. P_b 30.27 "Hg

Probe Tip Dia. D_n — in.

% CO_2 12.0 % CO 0.0

% O_2 12.0 % N_2 76.0

Area Stack A_s 11345 in^2

Pitot Tube No. — Barometer No. 6

Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.027 X 14.684

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = ____ M_T = ____

Impinger Box No. 6

Impinger 1	Final Weight	769.7	**Water Weight Gain**	Impinger 1	86.6 ✓
	Initial Weight	683.1		Impinger 2	8.7 ✓
	Increase	86.6 ✓		Impinger 3	0.5 ✓
Impinger 2	Final Weight	703.8		Impinger 4	2.9 ✓
	Initial Weight	695.1	V_w =	Impinger 5	
	Increase	8.7	g SO_2 = -	Impinger 6	
Impinger 3	Final Weight	483.0	V_w =	Total	98.7 ✓ = V_w
	Initial Weight	482.5			
	Increase	0.5			
Impinger 4	Final Weight	807.2			
	Initial Weight	804.3			
	Increase	2.9			
Impinger 5	Final Weight				
	Initial Weight				
	Increase				
Impinger 6	Final Weight				
	Initial Weight				
	Increase				
Filter #	Final Weight				
	Initial Weight				
	Increase				

P_b = 30.27 ✓ $\qquad$ $\%CO_2$ = 12.0 ✓

V_m = 15.080 ✓ $\qquad$ $\%O_2$ = 12.0 ✓

V_w = 98.7 ✓ $\qquad$ $\%CO$ = 0.0 ✓

P_m = 0.280 ✓ $\qquad$ $\%N_2$ = 76.0 ✓

Avg ΔP = — $\qquad$ A_s = 11345 ✓

Avg $\sqrt{\Delta P}$ = — $\qquad$ D_n = —

C_p = 0 — $\qquad$ T_t = 30 ✓

P_s = — "H_2O $\qquad$ "Hg

T_m = 73 ✓ °F $\qquad$ 533 °R

T_s = 400 ✓ °F $\qquad$ 860 ✓ °R

Moisture Content: %M = 23.53 ✓ $\quad M_d$ = 0.7647 ✓ $\quad MW_d$ = 30.400 ✓ $\quad$ MW = 27.48 ✓

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 15.080 \left(\frac{30.27 + \frac{0.78}{13.6}}{73 + 460}\right) = 15.144\ \text{sft}^3 \checkmark$$

0.505 ✓ scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 98.7 = 4.659\ \checkmark\ \text{sft}^3$$

$$\text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.659}{15.144 + 4.659} \times 100 = 23.53\ \checkmark\ \%$$

$V_s = 5123.8 \times \underline{\quad} \sqrt{\frac{\quad}{\times}} \times \underline{\quad} = $ — fpm $\qquad$ ACFM: —

SCFM: —

$\%I = \frac{1039 \times \quad \times}{\times \quad \times \quad \times \quad \times(\quad)^2} = $ — % $\qquad$ %EA: 147.4 ✓

[redacted] Jo[redacted] o. [redacted] 1-7[redacted]7 [redacted] N[redacted]3 [redacted] F[redacted] DATA [redacted]

Job Name LONE STAR IND.
Run No. 2A
Location Kiln No 2 Stack
Date 13 NOV 81
Operator ALEXANDER CHRISTIAN
Sample Box No. 6 Meter Box No. 1

Read and record at the start of each test point.

Purge to: —
Purge time: —

Ambient Temp. °F 65
Assumed Moisture % 23
Probe Length 3
C Factor — — to reference
Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 10.2 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s)	Orifice ΔH in. H_2O (P_m) Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m) Inlet	Dry Gas Temp. °F Outlet	Remarks
D-11	1510	225.857	—	0.77	0.77	6.0	381	270	230	64	70	70	
11	1515	228.60	—	0.77	0.77	6.0	354	228	246	64	72	70	OK
11	1520	231.00	—	0.77	0.77	5.6	385	276	265	60	73	70	
11	1525	233.40	—	0.77	0.77	6.0	385	262	235	58	73	70	
11	1530	235.65	—	0.77	0.77	6.0	383	262	234	60	74	70	
11	1535	238.10	—	0.77	0.77	6.0	384	232	241	62	74	70	
END	1540	240.465	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p —
Volume Collected V_m 14.975 ft^3
Water Collected V_w 95.5 ml
Time of Test T_t 30 min.
Stack Pressure P_s — "H_2O

Baro. Press. P_b 30.20 "Hg
Probe Tip Dia. D_n — in.
% CO_2 13.2 % CO 0.0
% O_2 11.4 % N_2 75.4
Area Stack A_s 11345 in^2

Pitot Tube No. — Barometer No. 6
Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.027 X 14.581

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = ____ M_T = ____

Impinger Box No. 6

Impinger 1	Final Weight	774.9	**Water Weight Gain**	Impinger 1: 83.0
	Initial Weight	691.9		
	Increase	83.0		Impinger 2: 8.1
Impinger 2	Final Weight	701.7		Impinger 3: 0.6
	Initial Weight	693.6		
	Increase	8.1		Impinger 4: 3.8
Impinger 3	Final Weight	483.3	V_w =	Impinger 5:
	Initial Weight	482.7	g SO_2 = -	
	Increase	0.6	V_w =	Impinger 6:
Impinger 4	Final Weight	810.2		Total 95.5 = V_w
	Initial Weight	806.4		
	Increase	3.8		
Impinger 5	Final Weight			
	Initial Weight			
	Increase			
Impinger 6	Final Weight			
	Initial Weight			
	Increase			

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b = 30.20 %CO_2 = 13.2

V_m = 14.975 %O_2 = 11.4

V_w = 95.5 %CO = 0.0

P_m = 0.770 %N_2 = 75.4

Avg ΔP = — A_s = —

Avg $\sqrt{\Delta P}$ = — D_n = —

C_p = — T_t = 30

P_s = — "H_2O — "Hg

T_m = 71 °F 531 °R

T_s = 384 °F 844 °R

Moisture Content: %M = 23.04 M_d = 0.7696 MW_d = 30.~~480~~ 568 MW = 27.6~~9~~ 7

$$V_{m_{std}} = 17.65\, V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 14.975 \left(\frac{30.20 + \frac{0.770}{13.6}}{71 + 460}\right) = 15.060 \text{ sft}^3$$

0.502 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 95.5 = 4.508 \text{ sft}^3$$

$$\%\text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.508}{15.060 + 4.508} \times 100 = 23.04\ \%$$

V_s = 5123.8 x ____ $\sqrt{\frac{\quad}{\text{x}}}$ x ____ = — fpm ACFM: —

SCFM: —

%I = $\frac{1039 \text{ x} \quad\quad \text{x}}{\text{x} \quad \text{x} \quad \text{x} \quad \text{x}(\quad)^2}$ = — % %EA: 132.9

MU NS E RON AL NC

[redacted]). [redacted] 81- [redacted] 7 [redacted] F [redacted] DA [redacted]

Job Name Lone Star Industries
Run No. 3A
Location Kiln No. 2 Stack
Date 13 NOVEMBER 1981
Operator Alexander, Christian
Sample Box No. 6 Meter Box No. 1

Read and record at the start of each test point.

Purge to: —
Purge time: —

Ambient Temp. °F 58
Assumed Moisture % 22
Probe Length 3
C Factor — — to reference
Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 6.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s)	Orifice ΔH in. H_2O (P_m) Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F (T_m) Inlet	Dry Gas Temp. °F Outlet	Remarks
A-11	1832	306.477	—	0.77	0.77	5.5	381	276	232	81	69	69	
11	1837	308.72	—	0.77	0.77	5.0	380	261	252	70	70	68	reset
11	1842	311.40	—	0.77	0.77	5.0	380	257	242	67	71	68	
11	1847	313.80	—	0.77	0.77	5.0	379	258	233	65	71	65	
11	1852	316.25	—	0.77	0.77	5.0	380	254	233	67	72	68	
END 11	1857	318.68	—	0.77	0.77	5.0	381	256	233	73	73	68	
END	1902	321.073	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p —
Volume Collected V_m 14.990 ft^3 Baro. Press. P_b 30.20 "Hg
Water Collected V_w 101.4 ml Probe Tip Dia. D_n — in.
Time of Test T_t 36 min. % CO_2 13.4 % CO 0.0
Stack Pressure P_s — "H_2O % O_2 11.4 % N_2 75.2
Area Stack A_s 11345 in^2

Pitot Tube No. — Barometer No. 6
Probe Tip No. —

V_m = Dry Gas Meter Calibration Factor 1.027 X 14.596

[Dry Gas Meter Reading ____ ft^3 - (T_t ____ min X Leak Rate ____ cfm)]

M_F = ____ M_T = ____

Impinger Box No. 6

				Water Weight Gain	
Impinger 1	Final Weight	761.8		Impinger 1	86.2
	Initial Weight	~~775.2~~ 675.6			
	Increase	86.2		Impinger 2	9.0
Impinger 2	Final Weight	704.2		Impinger 3	0.9
	Initial Weight	695.2			
	Increase	9.0		Impinger 4	5.3
Impinger 3	Final Weight	484.3	V_w =	Impinger 5	
	Initial Weight	483.4	g SO_2 = -		
	Increase	0.9	V_w =	Impinger 6	
Impinger 4	Final Weight	780.5		Total	101.4 = V_w
	Initial Weight	775.2			
	Increase	5.3			
Impinger 5	Final Weight				
	Initial Weight				
	Increase				
Impinger 6	Final Weight				
	Initial Weight				
	Increase				

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b = 30.20		$\%CO_2$ =	13.4
V_m = 14.990		$\%O_2$ =	11.4
V_w =		$\%CO$ =	0.0
P_m = 0.770		$\%N_2$ =	75.2
Avg ΔP = -		A_s =	11345
Avg $\sqrt{\Delta P}$ = -		D_n =	-
C_p = -		T_t =	30
P_s = - "H_2O	- "Hg		
T_m = 70 °F	530 °R		
T_s = 380 °F	840 °R		

Moisture Content: %M = 24.06 M_d = 0.7594 MW_d = 30.680 MW = 27.57

$$V_{m_{std}} = 17.65\, V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 14.990 \left(\frac{30.20 + \frac{0.770}{13.6}}{70 + 460}\right) = 15.104 \text{ sft}^3$$

0.503 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 101.4 = 4.786 \text{ sft}^3$$

$$\%\text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{4.786}{15.104 + 4.786} \times 100 = 24.06\ \%$$

V_s = 5123.8 x ____ $\sqrt{\frac{\quad}{x}}$ x ____ = - fpm

ACFM: -

SCFM: -

$\%I = \frac{1039 \times \quad\quad \times}{\times \quad \times \quad \times \quad \times(\quad)^2}$ = - %

%EA: 133.7

METCO

APPENDIX E

Analytical Data

81-107

Mullins Environmental Testing Co., Inc.

Particulate Analysis Summary

Job Number 81-107

Job Name Lone Star IND.

Location New Orleans, LA

Date Analysis Completed 11/20/81

Unit Tested Kiln #1 Stack

Run No.	1	2	3		
Particulate on Filter (mg)	68.3	33.5	33.7		
Particulate in Front Wash (mg)*	18.3	18.3	13.3		
MF (mg)	86.6	51.8	47.0		
Particulate in Impinger #1 (mg)**	—	—	—		
MT (mg)	86.6	51.8	47.0		

Charlie P. Price

Analyst

* Less Acetone Residue

** Less Ammonium Sulfate

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Stack Filters

Job Number 81-107 Location New Orleans LA.

Job Name Lone Star Ind Unit Tested Kiln #1 Stack

Desiccator Time In	1600 11/17/81	0900 11/19/81			
Desiccator Time Out	0845 11/19/81	1630 11/20/81			

Run No. 1	Filter No. E-39				
Filter & Particulate + Tare Weight (g)	2.4794	2.4804			
Tare Weight (g)	1.7564	1.7577			
Filter & Particulate (g)	0.7230	0.7227	✓		

Filter & Particulate Average (g) 0.7229

Initial Filter Weight (g) 0.6546 ✓

Total Particulate (mg) 68.3

Run No. 2	Filter No. E-63				
Filter & Particulate + Tare Weight (g)	2.4561	2.4577			
Tare Weight (g)	1.7563	1.7578			
Filter & Particulate (g)	0.6998	0.6999	✓		

Filter & Particulate Average (g) 0.6999

Initial Filter Weight (g) 0.6664 ✓

Total Particulate (mg) 33.5

Run No. 3	Filter No. E-40				
Filter & Particulate + Tare Weight (g)	2.4537	2.4549			
Tare Weight (g)	1.7562	1.7578			
Filter & Particulate (g)	0.6975	0.6971	✓		

Filter & Particulate Average (g) 0.6973

Initial Filter Weight (g) 0.6636 ✓

Total Particulate (mg) 33.7

Cherie S Price

Analyst

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Front Wash

Job Number 81-107 Location New Orleans, LA

Job Name Lone Star Ind Unit Tested Kiln #1 Stack

Desiccator Time In	0900 11/8/81	0915 [illegible]		
Desiccator Time Out	0900 [illegible]	1615 [illegible]		

Run No. 1	Volume (ml) 207			
Final Weight (g)	163.4719	163.4715		
Initial Weight (g)	163.4523	163.4523		
Particulate Weight (g)	0.0196	0.0192 ✓		

Particulate Average (mg) 19.4 ✓
Less Acetone Blank (mg) – 1.1
Total Particulate (mg) 18.3

Run No. 2	Volume (ml) 185			
Final Weight (g)	149.6809	149.6808		
Initial Weight (g)	149.6617	149.6617		
Particulate Weight (g)	0.0192	0.0191 ✓		

Particulate Average (mg) 19.2
Less Acetone Blank (mg) – 0.9 ✓
Total Particulate (mg) 18.3

Run No. 3	Volume (ml) 290			
Final Weight (g)	150.9786	150.9783		
Initial Weight (g)	150.9637	150.9637		
Particulate Weight (g)	0.0149	0.0146 ✓		

Particulate Average (mg) 14.8 ✓
Less Acetone Blank (mg) – 1.5
Total Particulate (mg) 13.3

Acetone Blank	Volume (ml) 530			
Final Weight (g)	148.7375	148.7370		
Initial Weight (g)	148.7346	148.7346		
Difference (g)	0.0029	0.0024 ✓		

Average (mg) 2.7
* mg/l 5.1

* Note: If greater than 7.9 mg/l, use 7.9 mg/l.

Cheri L Price
Analyst

Mullins Environmental Testing Co., Inc.

Particulate Analysis Summary

Job Number 21-107
Job Name Lone Star Ind.
Location New Orleans, LA

Date Analysis Completed 11/20/81
Unit Tested Kiln #2 Stack

Run No.	1	2	3		
Particulate on Filter (mg)	59.4	50.2	40.9		
Particulate in Front Wash (mg)*	40.5	8.9	14.1		
MF (mg)	99.9	59.1	55.0		
Particulate in Impinger #1 (mg)**	—	—	—		
MT (mg)	99.9	59.1	55.0		

Cherie L Price
Analyst

* Less Acetone Residue

** Less Ammonium Sulfate

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Stack Filters

Job Number 81-107 Location New Orleans LA

Job Name Lone Star Ind Unit Tested Kiln #2 Stack

Desiccator Time In	1600 11/10/81	0900 11/9/81			
Desiccator Time Out	0845 11/9/81	1630 11/9/81			

Run No. 1	Filter No. E-65				
Filter & Particulate + Tare Weight (g)	2.4792	2.4801			
Tare Weight (g)	1.7565	1.7577			
Filter & Particulate (g)	0.7227	0.7224	✓		

Filter & Particulate Average (g) 0.7226

Initial Filter Weight (g) 0.6632 ✓

Total Particulate (mg) 59.4

Run No. 2	Filter No. E-64				
Filter & Particulate + Tare Weight (g)	2.4699	2.4710			
Tare Weight (g)	1.7565	1.7579			
Filter & Particulate (g)	0.7134	0.7131	✓		

Filter & Particulate Average (g) 0.7133

Initial Filter Weight (g) 0.6631 ✓

Total Particulate (mg) 50.2

Run No. 3	Filter No. E-85				
Filter & Particulate + Tare Weight (g)	2.4653	2.4665			
Tare Weight (g)	1.7565	1.7579			
Filter & Particulate (g)	0.7088	0.7086	✓		

Filter & Particulate Average (g) 0.7087

Initial Filter Weight (g) 0.6678 ✓

Total Particulate (mg) 40.9

Charles L. Price

Analyst

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Front Wash

Job Number 81-107 Location New Orleans, LA

Job Name Lone Star Ind Unit Tested Kiln #2 Stack

Desiccator Time In	0900 1/8/81	0915 1/9/81			
Desiccator Time Out	0900 1/9/81	1615 1/9/81			

Run No. 1	Volume (ml) 280				
Final Weight (g)	160.1545	160.1540			
Initial Weight (g)	160.1127	160.1127			
Particulate Weight (g)	0.0418	0.0413 ✓			

Particulate Average (mg) 41.6

Less Acetone Blank (mg) – 1.1 ✓

Total Particulate (mg) 40.5

Run No. 2	Volume (ml) 185				
Final Weight (g)	147.5551	147.5547			
Initial Weight (g)	147.5452	147.5452			
Particulate Weight (g)	0.0099	0.0095 ✓			

Particulate Average (mg) 9.7

Less Acetone Blank (mg) – 0.8 ✓

Total Particulate (mg) 8.9

Run No. 3	Volume (ml) 200				
Final Weight (g)	146.1449	146.1444			
Initial Weight (g)	146.1298	146.1298			
Particulate Weight (g)	0.0151	0.0146 ✓			

Particulate Average (mg) 14.9

Less Acetone Blank (mg) 0.8 ✓

Total Particulate (mg) 14.1

Acetone Blank	Volume (ml) 850				
Final Weight (g)	151.1166	151.1162			
Initial Weight (g)	151.1129	151.1129			
Difference (g)	0.0037	0.0033 ✓			

Average (mg) 3.5 ✓

* mg/l 4.1

* Note: If greater than 7.9 mg/1, use 7.9 mg/1.

Cherie L Price

Analyst

Cl Analysis

Job Number 81-107
Client Lone Star

Unit Kiln #1 + #2 Stk
Date 2/2/81

Analysis

Sample Number	Run Number	Impinger Number	Absorbance	µg Cl^-/ml	Total mg Cl^-	ppm
1	1	1 (vol-413)	0.410	30.8 x 1.5 = 46.2	47.7 10.9	15.8
2	2	1 (vol-500)	0.500	33.5 x 1.5 = 50.3	62.9 22.7	31.2
3	3	1 (vol-568)	0.450	30.3 x 1.5 = 45.5	64.6 22.7	31.8
					18.8	
4	1	1 (vol-455)	0.600	40.3 x 1.5 = 60.5	68.8 17.3	26.4
5	2	1 (vol-420)	0.325	25.8 x 1.5 = 32.7	46.4 11.3	18.5
6	3	1 (vol-423)	0.280	18.8 x 1.5 = 28.2	34.1 7.9	12.3
					12.2	

* 2 ml aliquots

1.5 dilution factor

Standards

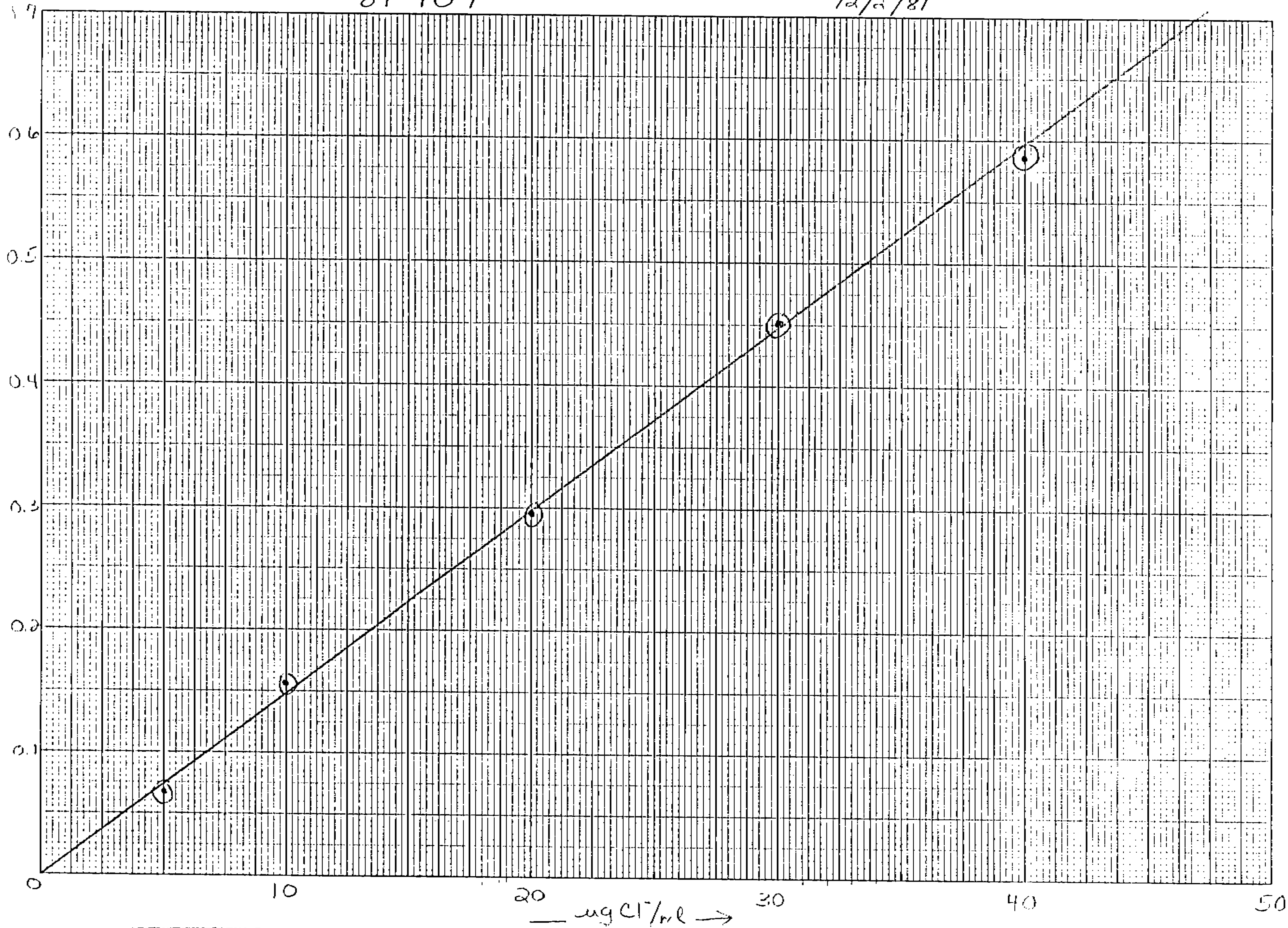
Standard	ml Stock Solution/ 100 ml H_2O	µg Cl^-/ml	Absorbance
1 (blank)	0.0	—	—
2	0.5	5	0.068
3	1.0	10	0.155
4	2.0	20	0.295
5	3.0	30	0.450
6	4.0	40	0.585
7	5.0	50	0.750

$$\text{Total mg } Cl^- = \frac{\mu g\ Cl^-/ml \times \frac{5\ ml}{ml\ aliquot} \times (vol)\ ml}{1000\ \frac{\mu g}{mg}}$$

KEUFFEL & ESSER CO. MADE IN U.S.A. 46 1240

Lone Star
81-107

Kiln #1 & Kiln #2
12/2/81



121957 METCO

Net meq

S.	Ly	Na	K	NH_4	SO_4	Cl
1 R-1	2	0284	0562	0010	0653	0646
R-2	3	0261	0333	0	0574	0359
R-3	4	0406	0333	0019	0344	0324
2 R-1	5	0144	0278	0068	1319	0097
R-2	6	0161	0278	0016	0374	0097
R-3	7	0150	0288	0001	0336	0387
1 R-1	9	3763	2112	0036	2735	04497
R-2	10	2553	0672	0044	0056	4025
R-3	11	2449	0328	0024	0341	3232
2 R-1	12	3371	2529	0054	3070	5125
R-2	13	4235	1740	0054	2404	0067
R-3	14	2919	1094	0022	1387	3771

121957 Total METCO

umeg

Sx	Na	K	SO_4	NH_4	Cl	
Ace Blank	0072	.0011	0014	0025	<0065	
Kiln 1-R1	0356	0573	0667	0035	0711 ~~<0065~~	
2	0333	0394	0588	0025	0454 ~~0711~~	
3	0478	0844	0348	0044	0389 ~~0454~~	
2-R1	0216	0309	1333	0093	0162 ~~0389~~	
2	0233	0309	0388	0041	0162 ~~0162~~	
3	0222	0297	0400	0026	0454	
Blank filter	1109	<0011	<0013	0004	<0065	
K-1 R-1	4872	2123	2938	0040	4542	
2	3662	0683	1069	0043	4090	
3	3558	0639	0854	0028	3893	
K-2 R-1	4480	2340	3083	0053	5190	
2	5394	1951	2417	0053	5134	
3	3828	1105	1400	0021	3836	

121957

0

Total mg

	Sx	Cl	K	Na	SO4	$(NH_4)_2SO_4$ NH_4Cl NH_3-N as NH_4
Our Blank	1	~~2.52~~	—	—		
Ac Blank	2	~~7.67~~ <.23	.042	.166	<.065	.045
R1	3	2.52	2.24	.818	~~.864~~ 3.20	.063
R2	4	1.61	1.54	.765	2.82	.045 .080
R3	5	1.38	3.30	1.10	1.67	.080
2 R1	6	.575	1.21	.477	6.4	.167
R2	7	.575	1.21	.535	1.86	.073
R3	8	1.61	1.17	.510	1.92	.046
Blank Filter	9	<.23	—	2.55	<.065	.008
R-1	10	16.1	8.30	11.2	14.1	.072
R-2	11	14.5	2.67	8.42	5.13	.086
R-3	12	13.7	2.50	8.18	4.10	.050
R-1	13	13.4	9.15	10.3	14.8	.106
R-2	14	18.2	7.63	12.4	11.6	.106
R-3	15	13.6	4.32	8.80	6.72	.047

APPENDIX E

Analysis of Deionized Water Impinger
from Particulate Samples
(total milligrams)

	Ammonium	Potassium	Sodium
Kiln Number 1			
Run Number 1	26.7	0.090	0.012
Run Number 2	11.9	0.266	0.035
Run Number 3	11.2	0.057	0.017
Kiln Number 2			
Run Number 1	16.3	0.030	0.014
Run Number 2	18.8	0.104	0.576
Run Number 3	13.7	0.008	0.005

APPENDIX E

Ammonium Emissions
"Back-half" Analysis

	Total Milligrams	parts per million	pounds per hour
Kiln Number 1			
Run Number 1	1.12	1.93	1.23
Run Number 2	0.84	1.51	0.96
Run Number 3	2.05	3.62	2.29
Kiln Number 2			
Run Number 1	0.87	1.52	0.88
Run Number 2	0.74	1.30	0.70
Run Number 3	0.63	1.11	0.63

Chloride Emissions
"Back-half" Analysis

	Total Milligrams	parts per million	pounds per hour
Kiln Number 1			
Run Number 1	47.7	15.8	10.9
Run Number 2	62.9	31.2	22.7
Run Number 3	64.6	31.8	22.7
Kiln Number 2			
Run Number 1	68.8	26.4	17.3
Run Number 2	46.4	18.5	11.3
Run Number 3	34.1	12.3	7.9

SO_2 EMISSION DATA

Client Lone Star

Unit Tested Kiln #1 Stack

Job Number 81-107

O.I. Irp

Run Number	1	2	3			
Date	11/11/81	11/12/81	11/12/81			
Time	1050–1550	1308–1456	1639–1834			
N - normality of $BaCl_2$	0.0100	0.0100	0.0100			
ML_I - ml in impinger #1	413	500	568			
ML_I - ml in impinger #2	—	—	—			
ML_I - ml in impinger #3	—	—	—			
ML_A - ml in aliquot #1	10	10	10			
ML_A - ml in aliquot #2	—	—	—			
ML_A - ml in aliquot #3	—	—	—			
ML_B - ml of $BaCl_2$ to titrate #1	3.15	1.25	0.85			
ML_B - ml of $BaCl_2$ to titrate #2	—	—	—			
ML_B - ml of $BaCl_2$ to titrate #3	—	—	—			
ML_{BB} - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05			
T_m - average gas meter temp., °F	77	75	73			
V_m - volume of dry gas sampled @ meter conditions, ft.^{3}	70.214	46.993	47.244			
P_b - barometric pressure, "Hg Abs.	30.32	30.20	30.20			
Q_s - Stack gas volume dry @ standard conditions, *SCFM	121,897	128,287	126,221			
C_I - SO_4 in impinger #1, mgs	41.0	19.2	14.5			
C_I - SO_2 in impinger #2, mgs	—	—	—			
C_I - SO_2 in impinger #3, mgs	—	—	—			
C_T - total SO_4 in impingers, mgs	41.0	19.2	14.5			
ppm SO_4	7.8	5.4	4.1			
C_{SO_2} - emission rate of SO_4, lbs/day	226.6	166.9	123.2			
C_s - emission rate of S, lbs/day	—	—	—			

*68°F, 29.92 "Hg (20°C, 760 mm Hg)

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times N \times 32}{ML_A}$$

$$C_T = C_I\#1 + C_I\#2 + C_I\#3$$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m P_b}$$

$$C_{SO_2} = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-6}$$

$$C_s = \frac{C_{SO_2}}{2}$$

SO_2 EMISSION DATA

Client Lone Star

Unit Tested Kiln #2 Stack

D.I Imp

Job Number 81-107

Run Number	1	2	3			
Date	11/13/81	11/13/81	11/13/81			
Time	0848-1035	1207-1440	1609-1756			
N - normality of $BaCl_2$	0.0100	0.0100	0.0100			
ML_I - ml in impinger #1	455	480	483			
ML_I - ml in impinger #2	—	—	—			
ML_I - ml in impinger #3	—	—	—			
ML_A - ml in aliquot #1	10	10	10			
ML_A - ml in aliquot #2	—	—	—			
ML_A - ml in aliquot #3	—	—	—			
ML_B - ml of $BaCl_2$ to titrate #1	0.70	0.65	0.60			
ML_B - ml of $BaCl_2$ to titrate #2	—	—	—			
ML_B - ml of $BaCl_2$ to titrate #3	—	—	—			
ML_{BB} - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05			
T_m - average gas meter temp., °F	70	73	73			
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$	60.136	58.089	64.497			
P_b - barometric pressure, "Hg Abs.	30.27	30.20	30.20			
Q_s - Stack gas volume dry @ standard conditions, *SCFM	115,751	107,082	113,954			
C_I - SO_2 in impinger #1, mgs	9.5	9.2	8.5			
C_I - SO_2 in impinger #2, mgs	—	—	—			
C_I - SO_2 in impinger #3, mgs	—	—	—			
C_T - total SO_2 in impingers, mgs	9.5	9.2	8.5			
ppm SO_2	2.1	2.1	1.7			
C_{SO_2} - emission rate of SO_2, lbs/day	57.3	53.9	47.6			
C_S - emission rate of S, lbs/day	—	—	—			

*68°F, 29.92 "Hg (20°C, 760 mm Hg)

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 32}{ML_A}$$

$$C_T = C_I\ \#1 + C_I\ \#2 + C_I\ \#3$$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m\ P_b}$$

$$C_{SO_2} = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-6}$$

$$C_s = \frac{C_{SO2}}{2}$$

SO_2 EMISSION DATA

[redacted]lient Lone Star

Job Number 81-107

[redacted]nit Tested Kiln #1 Stack

[redacted]un Number	1	2	3			
[redacted]te	11/11/81	11/12/81	11/12/81			
[redacted]ime	1050-1550	1308-1456	1639-1834			
[redacted] - normality of $BaCl_2$	0.0100	0.0100	0.0100			
ML_I - ml in impinger #1	—	—	—			
[redacted]L_I - ml in impinger #3	283	302	308			
[redacted]L_I - ml in impinger #4	262	294	325			
ML_A - ml in aliquot #1	—	—	—			
[redacted]L_A - ml in aliquot #3	2	2	2			
ML_A - ml in aliquot #4	10	10	10			
[redacted]L_B - ml of $BaCl_2$ to titrate #1	—	—	—			
[redacted]L_B - ml of $BaCl_2$ to titrate #3	16.50	17.50	15.90			
ML_B - ml of $BaCl_2$ to titrate #4	1.40	1.25	1.20			
[redacted]$_{BB}$ - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05			
[redacted]$_m$ - average gas meter temp., °F	77	75	73			
[redacted]$_m$ - volume of dry gas sampled @ meter conditions, $ft.^3$	70.214	46.993	47.244			
[redacted]$_b$ - barometric pressure, "Hg Abs.	30.32	30.20	30.20			
Q_s - Stack gas volume dry @ standard conditions, *SCFM	121,897	128,287	126,221			
[redacted]$_I$ - SO_2 in impinger #1, mgs	—	—	—			
[redacted]$_I$ - SO_2 in impinger #3, mgs	744.9	843.2	781.1			
[redacted]$_I$ - SO_2 in impinger #4, mgs	11.3	11.3	12.0			
[redacted]$_T$ - total SO_2 in impingers, mgs	756.2	854.5	793.1			
ppm SO_2	143.3	242.0	222.6			
[redacted]$_{SO_2}$ - emission rate of SO_2, lbs/day	4178.4	7426.2	6720.2			
[redacted]$_s$ - emission rate of S, lbs/day	2089.2	3713.1	3360.1			

[redacted] 68°F, 29.92 "Hg (20°C, 760 mm Hg)

[redacted]$_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 32}{ML_A}$

[redacted]$_T = C_I \#1 + C_I \#2 + C_I \#3$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m P_b}$$

$$C_{SO_2} = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-6}$$

$$C_s = \frac{C_{SO_2}}{2}$$

METCO

SULFUR TRIOXIDE EMISSION DATA

Job Number 81-107 Location New Orleans, LA.

Job Name Lone Star Unit Tested Kiln #1 Stack

Run Number	1	2	3	
Date	11/11/81	11/12/81	11/12/81	
Time	1059-1550	1308-1456	1639-1834	
$\underline{N}$ - normality of $BaCl_2$	0.0100	0.0100	0.0100	
ML_I - ml in impinger	380	238	305	
ML_A - ml in aliquot	10	10	10	
ML_B - ml of $BaCl_2$ to titrate	2.45	2.25	0.65	
ML_{BB} - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05	
T_m - average gas meter temp., °F	77	75	73	
V_m - volume of dry gas sampled @ meter conditions, ft.^{3}	70.214	46.993	47.244	
P_b - barometric pressure, "Hg Abs.	30.32	30.20	30.20	
Q_s - stack gas volume dry @ standard conditions, *SCFM	121,897	128,287	126,221	
C_I - SO_3 in impinger, mgs	36.5	20.9	7.3	
ppm SO_3	5.5	4.8	1.6	
C_{SO_3} - emission rate of SO_3, lbs/day	202.0	182.4	62.2	
C_S - emission rate of S, lbs/day	80.8	73.0	24.9	

*68°F, 29.92 "Hg (20°C, 760 mm Hg)

$$\text{ppm } SO_3 = \frac{0.6021 \times C_I \times (T_m + 460)}{V_m P_b}$$

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 40}{ML_A}$$

$$C_{SO_3} = \text{ppm } SO_3 \times Q_s \times 299.1 \times 10^{-6}$$

$$C_S = \frac{C_{SO_3}}{2.5}$$

SO$_2$ EMISSION DATA

[redacted]lient Lone Star

Unit Tested Kiln #2 Stack

Job Number 91-107

[redacted]un Number	1	2	3			
[redacted]te	11/13/81	11/13/81	11/13/81			
[redacted]ime	0848–1035	1207–1440	1609–1756			
[redacted] - normality of $BaCl_2$	0.0100	0.0100	0.0100			
ML_I - ml in impinger #1	—	—	—			
[redacted]L_I - ml in impinger #3	287	325	365			
[redacted]L_I - ml in impinger #4	255	255	365			
ML_A - ml in aliquot #1	—	—	—			
[redacted]L_A - ml in aliquot #3	2	2	2			
ML_A - ml in aliquot #4	10	10	10			
[redacted]L_B - ml of $BaCl_2$ to titrate #1	—	—	—			
[redacted]L_B - ml of $BaCl_2$ to titrate #3	15.00	6.35	1.90			
ML_B - ml of $BaCl_2$ to titrate #4	1.05	0.55	0.25			
[redacted]$_{BB}$ - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05			
T_m - average gas meter temp., °F	70	73	73			
[redacted]$_m$ - volume of dry gas sampled @ meter conditions, ft.^{3}	60.136	58.089	64.497			
[redacted]$_b$ - barometric pressure, "Hg Abs.	30.27	30.20	30.20			
Q_s - Stack gas volume dry @ standard conditions, *SCFM	115,751	107,082	113,954			
[redacted]$_I$ - SO_2 in impinger #1, mgs	—	—	—			
C_I - SO_2 in impinger #3, mgs	686.5	343.2	108.0			
[redacted]$_I$ - SO_2 in impinger #4, mgs	8.2	5.7	2.3			
[redacted]$_T$ - total SO_2 in impingers, mgs	694.7	348.9	110.3			
ppm SO_2	152.0	79.6	22.7			
[redacted]$_{SO_2}$ - emission rate of SO_2, lbs/day	4207.3	2039.8	618.2			
C_s - emission rate of S, lbs/day	2103.6	1019.9	309.1			

[redacted] 68°F, 29.92 "Hg (20°C, 760 mm Hg)

[redacted]$_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 32}{ML_A}$

[redacted]$_T = C_I \#1 + C_I \#2 + C_I \#3$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m P_b}$$

$$C_{SO_2} = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-6}$$

$$C_s = \frac{C_{SO_2}}{2}$$

METCO

SULFUR TRIOXIDE EMISSION DATA

Job Number 81-107

Job Name Lone Star

Location New Orleans LA

Unit Tested Kiln #2 Stack

Run Number	1	2	3	
Date	11/13/81	11/13/81	11/13/81	
Time	0848-1035	1207-1440	1609-1756	
$\underline{N}$ - normality of $BaCl_2$	0.0100	0.0100	0.0100	
ML_I - ml in impinger	313	367	398	
ML_A - ml in aliquot	10	10	10	
ML_B - ml of $BaCl_2$ to titrate	0.55	0.50	0.85	
ML_{BB} - ml of $BaCl_2$ to titrate blank	0.05	0.05	0.05	
T_m - average gas meter temp., °F	70	73	73	
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$	60.136	58.089	64.497	
P_b - barometric pressure, "Hg Abs.	30.27	30.20	30.20	
Q_s - stack gas volume dry @ standard conditions, *SCFM	115,751	107,082	113,954	
C_I - SO_3 in impinger, mgs	6.3	6.6	12.7	
ppm SO_3	1.1	1.2	2.1	
C_{SO_3} - emission rate of SO_3, lbs/day	38.0	38.7	71.5	
C_S - emission rate of S, lbs/day	15.2	15.5	28.6	

*68°F, 29.92 "Hg (20°C, 760 mm Hg)

$$\text{ppm } SO_3 = \frac{0.6021 \times C_I \times (T_m + 460)}{V_m P_b}$$

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 40}{ML_A}$$

$$C_{SO_3} = \text{ppm } SO_3 \times Q_s \times 299.1 \times 10^{-6}$$

$$C_S = \frac{C_{SO_3}}{2.5}$$

METCO

APPENDIX F

Chain of Custody

MULLINS ENVIRONMENTAL TESTING CO., INC.

Chain of Custody

Job Number 81-107 Date(s) Sampled 11/11,12/81

Job Name LONE STAR INDUSTRIES Number of Tests 111

Location New Orleans, Louisiana

Unit Tested Kiln No. 1 Stack (Part, Cl, SO_2)

Sample Containers

Description	No. of Containers	Remarks
Front Wash	111	
Back Wash		
Impinger No. 1	111	
Impinger No. 2	111	
Impinger No. 3	111	
'ilter Container	111	
Impinger No. 4	111	
Acetone Blank	1	

Sample No. 1 Recovered by Don C Alford Date: 11/11/81 Time: 1645 Location: VAN

Sample No. 2 Recovered by: Don C Alford Date: 11/12/81 Time: 1530 Location: VAN

Sample No. 3 Recovered by: Don C Alford Date: 11/12/81 Time: 2015 Location: VAN

Samples Received by Don C Alford for Transport Date: 11/13/81 Time: 2030

Samples Received at Lab by: Cherie L Price Date: 11/16/81 Time: 0800

Samples Analyzed by: Cherie L Price Date: 12/2/81 Time: 1400

MULLINS ENVIRONMENTAL TESTING CO., INC.

Chain of Custody

Job Number 81-107

Date(s) Sampled 11/12/81

Job Name LONE STAR INDUSTRIES

Number of Tests 3

Location New Orleans, Louisiana

Unit Tested Kiln No 1 Stack

(NH_3)

Sample Containers

Description	No. of Containers	Remarks
Front Wash		
Back Wash		
Impinger No. 1	111	
Impinger No. 2	111	
Impinger No. 3		
ilter Container		

Sample No. 1A Recovered by: Don C Alford Date: 11/12/81 Time: 1230 Location: VAN

Sample No. 2A Recovered by: Don C Alford Date: 11/12/81 Time: 1630 Location: VAN

Sample No. 3A Recovered by: Don C Alford Date: 11/12/81 Time: 2030 Location: VAN

Samples Received by: Don C. Alford for Transport Date: 11/13/81 Time: 2030

Samples Received at Lab by: Cherie L Price Date: 11/16/81 Time: 0800

Samples Analyzed by: Cherie L Price Date: 12/2/81 Time: 1400

MULLINS ENVIRONMENTAL TESTING CO., INC.

Chain of Custody

Job Number 81-107

Date(s) Sampled 11/13/81

Job Name LONE STAR IND.

Number of Tests 1

Location ~~Kiln No 2 Stack~~ New Orleans, Louisiana

Unit Tested Kiln No 2 Stack

Sample Containers

Description	No. of Containers	Remarks
Front Wash	11'	
Back Wash		
Impinger No. 1	111	
Impinger No. 2	111	
Impinger No. 3	111	
ilter Container	111	
Impinger No. 4	111	
Acetone Blank	1	

Sample No. 1 Recovered by: Don C Alexander Date: 11/13/81 Time: 1345 Location: VAN

Sample No. 2 Recovered by: Don C Alexander Date: 11/13/81 Time: 1700 Location: VAN

Sample No. 3 Recovered by: Don C Alexander Date: 11/13/81 Time: 1940 Location: VAN

Samples Received by: Don C Alexander for Transport Date: 11/13/81 Time: 2030

Samples Received at Lab by: Cherie L Price Date: 11/16/81 Time: 0800

Samples Analyzed by: Cherie L Price Date: 12/2/81 Time: 1400

MULLINS ENVIRONMENTAL TESTING CO., INC.

Chain of Custody

Job Number 81-107

Date(s) Sampled 11/13/81

Job Name LONE STAR INDUSTRIES

Number of Tests 1

Location NEW ORLEANS, LA.

Unit Tested Kiln No. 7 Stack

Sample Containers

Description	No. of Containers	Remarks
Front Wash		
Back Wash		
Impinger No. 1	11	
Impinger No. 2	11	
Impinger No. 3		
ilter Container		

Sample No. 1A Recovered by: Don C Alford Date: 11/13/81 Time: 1400 Location: VAN

Sample No. 2A Recovered by: Don C Alford Date: 11/13/81 Time: 1715 Location: VAN

Sample No. 3A Recovered by: Don C Alford Date: 11/13/81 Time: 1950 Location: VAN

Samples Received by: Don C Alford for Transport Date: 11/13/81 Time: 2030

Samples Received at Lab by: Cherie L Price Date: 11/16/81 Time: 0800

Samples Analyzed by: Cherie L Price Date: 12/2/81 Time: 1400

APPENDIX G

Resumes of Test Personnel

MULLINS ENVIRONMENTAL TESTING CO., INC.
P.O. Box 598
Addison, Tx 75001
(214) 931-7127

METCO

BILLY J. MULLINS, JR., President

Education	Post Graduate Study in Environmental Engineering at Southern Methodist University, Dallas, Texas, 1970.
	M.S. 1969, New York University, New York, New York, in Civil Engineering (Air Resources).
	B.S. 1968, Texas Tech University, Lubbock, Texas, in Civil Engineering (Water Resources).
	Studies in Engineering at U.S. Naval Academy, Annapolis, Maryland, 1963-1964.
Professional Training Courses	Attended Short Course on Air Pollution Engineering at the University of Texas at Austin, February 1970.
	Attended four-week management course presented by the American Management Association, 1976.
Certification	Registered Professional Engineer Certified Visible Emissions Evaluator Certified Fallout Shelter Analyst Licensed Private Pilot (Multi-Engine - Land, Instrument)
Professional Memberships	Air Pollution Control Association - Past Chairman, Southwest Section, Chairman - Consultants Committee Source Evaluation Society - President American Society of Civil Engineers Texas Society of Professional Engineers National Society of Professional Engineers American Management Association Technical Association of the Pulp and Paper Industry
Technical Experience	Directed and performed stack sampling on over 850 sources of which over 100 were sampled simultaneously using more than one sampling train at several points in the flue gas stream. 1972-present.

Directed and performed over 100 short-term ambient air studies using mobile sampling vans and various ambient air sampling equipment. 1972-present.

Designed, directed and operated over 20 permanent ambient air networks of various size and duration for a variety of parameters. 1972-present.

Designed surface and underground drainage systems for residential subdivisions, public works projects, and shopping centers. 1969-1972.

Designed several residential subdivisions including lot layout, street design, drainage design, and utility design. 1969-1972.

Research Projects

Supervised and conducted a study made by the Hawaiian Sugar Planters' Association to characterize the emissions for several bagasse-fired boilers. April-May 1976.

Supervised and conducted a study made by the Rio Grande Valley Sugar Growers, Inc. to determine the area affected by the burning of sugarcane fields prior to harvesting. November 1974-April 1975.

Supervised and conducted a study by a lightweight aggregate manufacturer to develop a material balance around the process through sampling and analysis of several parameters. November 1973.

Conducted a study in New York City to attempt to develop a correlation in the ambient air between carbon dioxide and sulfur dioxide to provide a tool for predicting air pollution episodes. January-May 1969.

Publications

Co-authored "Sulfur Compound Emissions of the Petroleum Production Industry," December 1974.

Co-authored "Field Procedure for Stabilizing Hydrogen Sulfide Samples to be Analyzed Using Modified Methylene Blue Technique," presented at the Conference on Ambient Air Quality Measurements, Austin, Texas, March 1975.

Co-authored "Atmospheric Emissions Survey of the Sour Gas Industry," October 1975.

Co-authored "Technique for Insuring the Validity of Samples for High Concentrations of Sulfur Dioxide Using the EPA Method 5 Sampling Train," presented at the Third National Conference on Energy and the Environment, College Corner, Ohio, September 1975.

Teaching Experience

Served as a lecturer in the Environmental Protection Agency's training course number 450, "Source Sampling for Particulate Pollutants" for two years from January 1974 to October 1975.

Conducted a two-day training course entitled "Technical Assistance in Source Sampling" at Iowa State University, Ames, Iowa for the Environmental Protection Agency, October 1974.

Conducted EPA's training course number 450, "Source Sampling for Particulate Pollutants" for the EPA at Research Triangle Park, North Carolina, September 1975.

Conducted a two-day short course entitled "Performing and Observing Source Sampling" at Dallas, Texas, July 1976, May 1977, October 1977; at Lake Charles, Louisiana, May 1977; and at Casper, Wyoming, May 1977.

Served as a lecturer in the Environmental Protection Agency's two-day seminar entitled "Asphalt Industry Environmental Solutions," presented in Dallas, Texas on March 21 and 22, 1979.

Conducted a two-day short course entitled "Performing and Observing Source Sampling" in Lincoln, Nebraska in March 1980 for the State of Nebraska, Air Quality Control Division.

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(214) 931-7127

METCO

DON C. ALEXANDER, Field Testing Supervisor

Education	B.S. 1978, Angelo State University, San Angelo, Texas, in Biology with a minor in Chemistry.
Certification	Certified Visible Emissions Evaluator
Technical Experience	Participated in the sampling of over 225 sources, including several which were sampled simultaneously using more than one sampling train and has supervised the sampling of over 60 sources. Familiar with calibration techniques for all field testing equipment.

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STEPHEN J. CHRISTIAN, JR., Environmental Field Technician

Education

B.S. 1979, Slippery Rock State College, Slippery Rock, Pennsylvania, in Environmental Science.

Associate Degree, 1976, Pennsylvania State University, Du Bois, Pennsylvania, in Wildlife Technology.

Technical Experience

Participated in the sampling of over 50 sources, including several which were sampled simultaneously using more than one sampling train.

Maintained a permanent seven-station sulfur dioxide sampling network in East Texas.

Familiar with the installation, operation and routine maintenance of Lear Siegler, Inc. SM1000 Ambient SO_2 Monitor, Calibrated Instruments Ultragas SO_2 Monitor, Meloy 285E SO_2 Analyzer and Analytical Instrument Development, Inc. Model 340A Calibration System.