Background Report Reference

AP-42 Section Number: 12.11

Background Chapter: 2

Reference Number: 32

Title: Source Emission Survey of Quemetco Inc., Indianapolis, IN

Metco Environmental

October 1988

METCO ENVIRONMENTAL
P.O. Box 598
Addison, TX 75001
(214) 931-7127

#37

SOURCE EMISSIONS SURVEY OF QUEMETCO INCORPORATED INDIANAPOLIS, INDIANA

OCTOBER 1988

FILE NUMBER 88-141

METCO ENVIRONMENTAL

TABLE OF CONTENTS

SOURCE EMISSIONS SURVEY
QUEMETCO INCORPORATED
INDIANAPOLIS, INDIANA
FILE NUMBER 88-141

INTRODUCTION

METCO Environmental, Dallas, Texas, conducted a source emissions survey of Quemetco Incorporated located in Indianapolis, Indiana, on October 3, 4, 5, 10, 11, 12, 13, and 14, 1988. The purpose of these tests was to determine the concentrations of particulate matter and lead being emitted to the atmosphere via the Electric Arc Furnace Baghouse Exhaust Duct, the Reverberatory Furnace Stack, the Baghouse 039 Stack, and the Baghouse 040 Stack. The concentrations of sulfur dioxide and carbon monoxide were also determined at the Electric Arc Furnace Baghouse Exhaust Duct and the Reverberatory Furnace Stack.

The sampling followed the procedures set forth in the Appendix A to the Code of Federal Regulations, Title 40, Chapter I, Part 60, Methods 1, 2, 3, 4, 5, 6, 10, and 12.

SUMMARY OF RESULTS

Source	Particulate Emissions (gr/dscf)	Particulate Emissions (lbs/hr)	Lead Emissions (gr/dscf)	Lead Emissions (lbs/hr)	Sulfur Dioxide Emissions (ppm)	Sulfur Dioxide Emissions (lbs/hr)	Carbon Monoxide Emissions (ppm)	Carbon Monoxide Emissions (lbs/hr)
Electric Arc Furnace Baghouse Stack	0.0020	0.39	1.33×10^{-4}	0.026	20.0	4.7	25.7 ~~26.7~~	2.50
Reverberatory Furnace Stack	0.0055	2.10	1.00×10^{-3}	0.383 .409	480.6	229.5	429.3	83.9
Baghouse 039 Stack	0.0028	0.49	2.14×10^{-4}	0.038	-----	-----	-----	----
Baghouse 040 Stack	0.0038	0.54	1.27×10^{-4}	0.018	-----	-----	-----	----

SUMMARY OF RESULTS

Electric Arc Furnace Baghouse Exhaust Duct

Sulfur Dioxide Emissions

Run Number	1	2	3
Stack Flow Rate - ACFM	29,203	27,769	27,577
Stack Flow Rate - DSCFM*	23,991	23,586	23,286
% Water Vapor - % Vol.	2.40	1.21	0.90
% CO_2 - % Vol.	0.0	0.4	0.4
% O_2 - % Vol.	20.8	20.6	20.4
% Excess Air @ Sampling Point	------	------	------
Sulfur Dioxide Concentration - ppm	20.1	17.4	22.5
Sulfur Dioxide Emissions - lbs/hr	4.8	4.1	5.2

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Electric Arc Furnace Baghouse Exhaust Duct

Run Number	4	5	6
Stack Flow Rate - ACFM	26,523	27,589	28,088
Stack Flow Rate - DSCFM*	21,992	22,987	23,802
% Water Vapor - % Vol.	1.07	0.81	0.96
% CO_2 - % Vol.	0.5	0.6	0.3
% O_2 - % Vol.	20.4	20.4	20.9
% Excess Air @ Sampling Point	------	------	------
Particulates Probe, Cyclone & Filter Catch grains/dscf*	0.0024	0.0016	0.0020
grains/cf @ Stack Conditions	0.0020	0.0013	0.0017
lbs/hr	0.45	0.32	0.40
Total Lead Content - mgs	0.495	0.382	0.382
Lead Concentration - grains/dscf*	1.61×10^{-4}	1.19×10^{-4}	1.18×10^{-4}
Total Lead Emissions - lbs/hr	0.030	0.023	0.024

• 29.92 "Hg, 68°F (760 mm Hg, 20°C)

Fld Temp - 133°F

$\frac{\text{lb Pb}}{\text{lb Part}} \times 100$

1	2	3
6.7	7.2	6.0

Avg 6.63

SUMMARY OF RESULTS

Electric Arc Furnace Baghouse Exhaust Duct

Run Number		4	5	6
Carbon Monoxide - parts per million	Chart	56	16	5
	Actual	56	16	5
Carbon Monoxide Emissions -	lbs/hr	5.37	1.60	0.52

$$\text{Actual ppm CO} = \text{ppm CO (chart)} \times \left[1 - \frac{\%\ CO_2}{100}\right]$$

$$\text{CO (lbs/hr)} = \frac{\text{ppm CO} \times 28 \times 60 \times \text{DSCFM*}}{385.1 \times 10^6}$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

SUMMARY OF RESULTS

Reverberatory Furnace Stack

Sulfur Dioxide Emissions

Run Number	2	3	4
Stack Flow Rate - ACFM	64,133	65,474	65,472
Stack Flow Rate - DSCFM*	47,175	49,061	48,541
% Water Vapor - % Vol.	6.10	4.94	5.23
% CO_2 - % Vol.	2.4	2.6	2.5
% O_2 - % Vol.	19.1	19.4	19.4
% Excess Air @ Sampling Point	1,122	1,528	1,496
Sulfur Dioxide Concentration - ppm	844.6	510.5	86.6
Sulfur Dioxide Emissions - lbs/hr	397.1	249.6	41.9

*29.92 "Hg, 68°F (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Reverberatory Furnace Stack

Run Number	8	9	10
Stack Flow Rate - ACFM	63,032	63,436	62,889
Stack Flow Rate - DSCFM*	44,417	44,919	45,086
% Water Vapor - % Vol.	7.05	6.59	6.02
% CO_2 - % Vol.	2.9	2.3	2.5
% O_2 - % Vol.	19.0	19.5	19.4
% Excess Air @ Sampling Point	1,120	1,594	1,496
Particulates Probe, Cyclone & Filter Catch grains/dscf*	0.0068	0.0049	0.0047
grains/cf @ Stack Conditions	0.0048	0.0035	0.0034
lbs/hr	2.60	1.89	1.82
Total Lead Content - mgs	2.65	2.07	1.61
Lead Concentration - grains/dscf*	1.28×10^{-3}	9.67×10^{-4}	7.52×10^{-4}
Total Lead Emissions - lbs/hr	0.486	0.372	0.291

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

$\frac{\text{lb Pb}}{\text{lb Part}} \times 100$

8	9	10
18.7	19.7	16.0

18.1

SUMMARY OF RESULTS

Reverberatory Furnace Stack

Run Number		8	9	10
Carbon Monoxide - parts per million	Chart	444	440	438
	Actual	431	430	427
Carbon Monoxide Emissions -	lbs/hr	83.5	84.3	84.0

$$\text{Actual ppm CO} = \text{ppm CO (chart)} \times \left[1 - \frac{\%\ CO_2}{100}\right]$$

$$\text{CO (lbs/hr)} = \frac{\text{ppm CO} \times 28 \times 60 \times \text{DSCFM*}}{385.1 \times 10^6}$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Baghouse 039 Stack

Run Number	1	2	3
Stack Flow Rate - ACFM	22,729	22,379	22,575
Stack Flow Rate - DSCFM*	21,400	20,414	20,663
% Water Vapor - % Vol.	0.77	2.27	1.78
% CO_2 - % Vol.	0.3	0.0	0.0
% O_2 - % Vol.	19.7	20.8	21.0
% Excess Air @ Sampling Point	------	------	------
Particulates Probe, Cyclone & Filter Catch grains/dscf*	0.0031	0.0027	0.0025
grains/cf @ Stack Conditions	0.0029	0.0024	0.0022
lbs/hr	0.57	0.47	0.44
Total Lead Content - mgs	0.428	0.579	0.408
Lead Concentration - grains/dscf*	1.91×10^{-4} ✓	2.65×10^{-4} ✓	1.86×10^{-4} ✓
Total Lead Emissions - lbs/hr	0.035 ✓	0.046 ✓	0.033 ✓

• 29.92 "Hg, 68°F (760 mm Hg, 20°C)

$T_{AVG} = 20.3$

$\frac{Pb}{Particulate} \times 100$

1	2	3
6.1	7.9	7.5

7.2

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Baghouse 040 Stack

Run Number	1	2	3
Stack Flow Rate - ACFM	18,351	18,153	18,224
Stack Flow Rate - DSCFM*	16,395	16,266	16,016
% Water Vapor - % Vol.	0.99	1.05	1.24
% CO_2 - % Vol.	0.3	0.3	0.4
% O_2 - % Vol.	20.6	20.7	20.6
% Excess Air @ Sampling Point	------	------	------
Particulates Probe, Cyclone & Filter Catch grains/dscf*	0.0047	0.0029	0.0039
grains/cf @ Stack Conditions	0.0042	0.0026	0.0034
lbs/hr	0.66	0.41	0.54
Total Lead Content - mgs	0.304	0.353	0.444
Lead Concentration - grains/dscf*	1.06×10^{-4}	1.21×10^{-4}	1.53×10^{-4}
Total Lead Emissions - lbs/hr	0.015	0.017	0.021

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

$T_{AIR} = 122$

$\frac{Pb}{Part.} \times 100$

1	2	3
2.3	4.2	3.9

3.5

DISCUSSION OF RESULTS

The tests for particulate matter and lead taken on the stacks appeared to be valid representations of the actual emissions during the testing. The indicative parameters calculated from the field data were in close agreement. The moisture percentages for the three tests on each source were in close agreement. The measured flow rates (Q_s) for the three tests on each stack were also in close agreement. The rates of sampling for all of the tests taken were well within the specified limits.

Sulfur dioxide and sulfur trioxide were determined separately on the Reverberatory Furnace Stack and the Electric Arc Furnace Baghouse Exhaust Duct. 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 three tests for the carbon monoxide on the Reverberatory Furnace Stack and the Electric Arc Furnace Baghouse Exhaust Duct appeared to be valid representations of the actual emissions during the tests.

DESCRIPTION OF SAMPLING LOCATIONS

The sampling ports on the Electric Arc Furnace Baghouse Exhaust Duct are located approximately 17 feet above the ground. The sampling was done from two ports on the circular duct located 6 feet (2.05 stack diameters) downstream from a bend in the duct and 1 foot 8 inches (0.57 stack diameters) upstream from a bend in the duct.

The sampling ports on the Reverberatory Furnace Stack are located approximately 88 feet above the ground. The sampling was done from two ports on the circular stack located 55 feet (11.87 stack diameters) downstream from the inlet to the stack and greater than 2.00 stack diameters upstream from the outlet of the stack.

The sampling ports on the Baghouse 039 Stack are located approximately 50 feet above the ground. The sampling ports on the stack are located 7 feet (2.58 equivalent stack diameters) downstream from a bend in the stack and 18 inches (0.55 equivalent stack diameters) upstream from the outlet of the stack.

The sampling ports on the Baghouse 040 Stack are located approximately 50 feet above the ground. The sampling ports are located 4 feet 5 1/2 inches (2.11 equivalent stack diameters) downstream from a bend in the stack and 18 inches (0.71 equivalent stack diameters) upstream from the outlet of the stack.

SAMPLING AND ANALYTICAL PROCEDURES

The sampling followed the procedures outlined in Appendix A to the Code of Federal Regulations, Title 40, Chapter I, Part 60, Methods 1, 2, 3, 4, 5, 6, 10, and 12.

A preliminary velocity traverse was made at each of the ports on each source tested, in order to determine the uniformity and magnitude of the flow prior to testing. Several traverse points were checked for cyclonic flow on each source tested and none was found. Twelve traverse points were sampled from each of the two ports for a total of twenty-four traverse points on the Electric Arc Furnace Baghouse Exhaust Duct. Samples of three-minute duration were taken isokinetically at each of the twenty-four traverse points on each source using an EPA-type, heated, glass-lined probe.

Six traverse points were sampled from each of the two ports for a total of twelve traverse points on the Reverberatory Furnace Stack. Samples of five-minute duration were taken isokinetically at each of the twelve traverse points using an EPA-type, heated, glass-lined probe.

Six traverse points were sampled from each of the five ports for a total of thirty traverse points on both the Baghouse 039 Stack and the

Baghouse 040 Stack. Samples of two-minute duration were taken isokinetically at each of the thirty traverse points on each stack using an EPA-type, heated, glass-lined probe.

On all 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 done 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 a pressure. The lines were also checked for clearance and the manometer was 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 for all the particulate tests performed contained 0.1 N nitric acid to absorb lead and silica gel to absorb moisture. The "back-half" of the sampling train for all the sulfur dioxide tests performed contained 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 isopropyl alcohol solution was checked for hydrogen peroxide contamination and none was found.

At the conclusion of each sulfur dioxide test, the sampling train was purged for fifteen minutes with ambient air at the same rate at which the sample was taken.

The samples for particulate matter were digested and analyzed for lead according to EPA Method 12.

The carbon monoxide samples were analyzed using a Thermo Electron Model 48 Air Quality Carbon Monoxide Analyzer System according to EPA Method 10. The instrument was operated at the ranges of 0 to 100 parts per million and 0 to 1,000 parts per million. The samples were collected in a tedlar bag integrated over a one-hour period during the tests on the Electric Arc Furnace Baghouse Exhaust Duct. The concentrations of carbon monoxide were monitored continuously during each one-hour particulate matter test on the Reverberatory Furnace Stack.

The analyzer was calibrated with the following calibration gases:

30 ppm CO in N_2
50 ppm CO in N_2
90 ppm CO in N_2
248 ppm CO in N_2
497 ppm CO in N_2

DESCRIPTION OF TESTS

Personnel from METCO Environmental arrived at the plant at 6:00 p.m. on Monday, October 3, 1988. The sampling equipment was moved onto the Electric Arc Furnace Baghouse Exhaust Duct before securing for the night at 9:30 p.m.

On Tuesday, October 4, work began at 7:00 a.m. The sampling equipment was prepared for testing and the first test for sulfur dioxide on the Electric Arc Furnace Baghouse Exhaust Duct began at 8:50 a.m. Testing continued without difficulty until the completion of three tests for sulfur dioxide at 12:08 p.m. The first test for particulate matter and carbon monoxide began at 1:51 p.m. Testing continued until the completion of three tests for particulate matter and carbon monoxide at 7:15 p.m. The samples were recovered and the carbon monoxide samples were analyzed on-site. The sampling equipment was moved off of the Electric Arc Furnace Baghouse Exhaust Duct and loaded into the sampling van. Operations were completed by 9:30 p.m.

On Wednesday, October 5, work began at 8:00 a.m. The sampling equipment was moved onto the Reverberatory Furnace Stack before securing for the day at 10:30 a.m.

Personnel arrived back at the plant at 1:30 p.m. on Monday, October 10, 1988. The sampling equipment was prepared for testing and the first test for sulfur dioxide on the Reverberatory Furnace Stack began at 3:15 p.m. The test was completed without difficulty at 3:45 p.m. Further testing wad delayed due to operational problems with the Reverberatory Furnace. The sampling equipment was secured for the night at 6:30 p.m.

On Tuesday, October 11, work began at 7:00 a.m. The sampling equipment was prepared for testing and the second test for sulfur dioxide on the Reverberatory Furnace Stack began at 7:35 a.m. Testing continued without difficulty until the completion of the fourth test for sulfur dioxide at 10:14 a.m. The sampling equipment was prepared for sampling particulate matter but testing was delayed due to plant operational problems. The first test for particulate matter (Run Number 5) began at 2:42 p.m. and continued until its completion at 3:45 p.m. The sample was recovered and the equipment was secured for the night at 5:30 p.m.

On Wednesday, October 12, work began at 7:00 a.m. The sampling equipment was prepared for testing and the second test for particulate matter on the Reverberatory Furnace Stack (Run Number 6) began at 8:15 a.m. Testing continued without difficulty until the completion of the sixth test for particulate matter (Run Number 10) at 4:18 p.m.

The sampling equipment was moved off of the Reverberatory Furnace Stack and onto the Baghouse 039 Stack. The equipment was secured for the night at 8:00 p.m.

On Thursday, October 13, work began at 7:00 a.m. The equipment was prepared for testing but testing was delayed due to plant operational problems. The first test for particulate matter on the Baghouse 039 Stack began at 9:04 a.m. Testing continued until the completion of three tests at 1:44 p.m. The samples were recovered and the equipment was moved over to the Baghouse 040 Stack. The first test for particulate matter on the Baghouse 040 Stack began at 4:44 p.m. Testing continued until completion of three tests at 9:28 p.m.

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

Operations at Quemetco, Inc., located in Indianapolis, Indiana, were completed at 12:30 a.m. on Friday, October 14, 1988.

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

METCO ENVIRONMENTAL

APPENDICES

A. Location of Sampling Points

B. Source Emissions Calculations

C. Calibration Data

D. Field Testing Data

E. Analytical Data

F. Lead Analysis

G. Carbon Monoxide Data

H. Chain of Custody

I. Resumes of Test Personnel

APPENDIX A

Location of Sampling Points

Electric Arc Furnace Baghouse Exhaust Duct

The sampling ports are located 6 feet (2.05 stack diameters) downstream from a bend in the duct and 1 foot 8 inches (0.57 stack diameters) upstream from a bend in the duct. The locations of the sampling points were calculated as follows:

Port and Wall Thickness = 5 9/16 inches

Inside Stack Diameter = 35 1/8 inches

Point Number	Percent of Diameter From Wall	Distance From Wall
1	2.1	1 "
2	6.7	2 3/8 "
3	11.8	4 1/8 "
4	17.7	6 3/16"
5	25.0	8 3/4 "
6	35.6	12 1/2 "
7	64.4	22 5/8 "
8	75.0	26 3/8 "
9	82.3	28 15/16"
10	88.2	31 "
11	93.3	32 3/4 "
12	97.9	34 1/8 "

APPENDIX A

Location of Sampling Points

Reverberatory Furnace Stack

The sampling ports are located 55 feet (11.87 stack diameters) downstream from the inlet to the stack and greater than 2.00 stack diameters upstream from the outlet of the stack. The locations of the sampling points were calculated as follows:

Port and Wall Thickness = 6 1/4 inches

Inside Stack Diameter = 55 5/8 inches

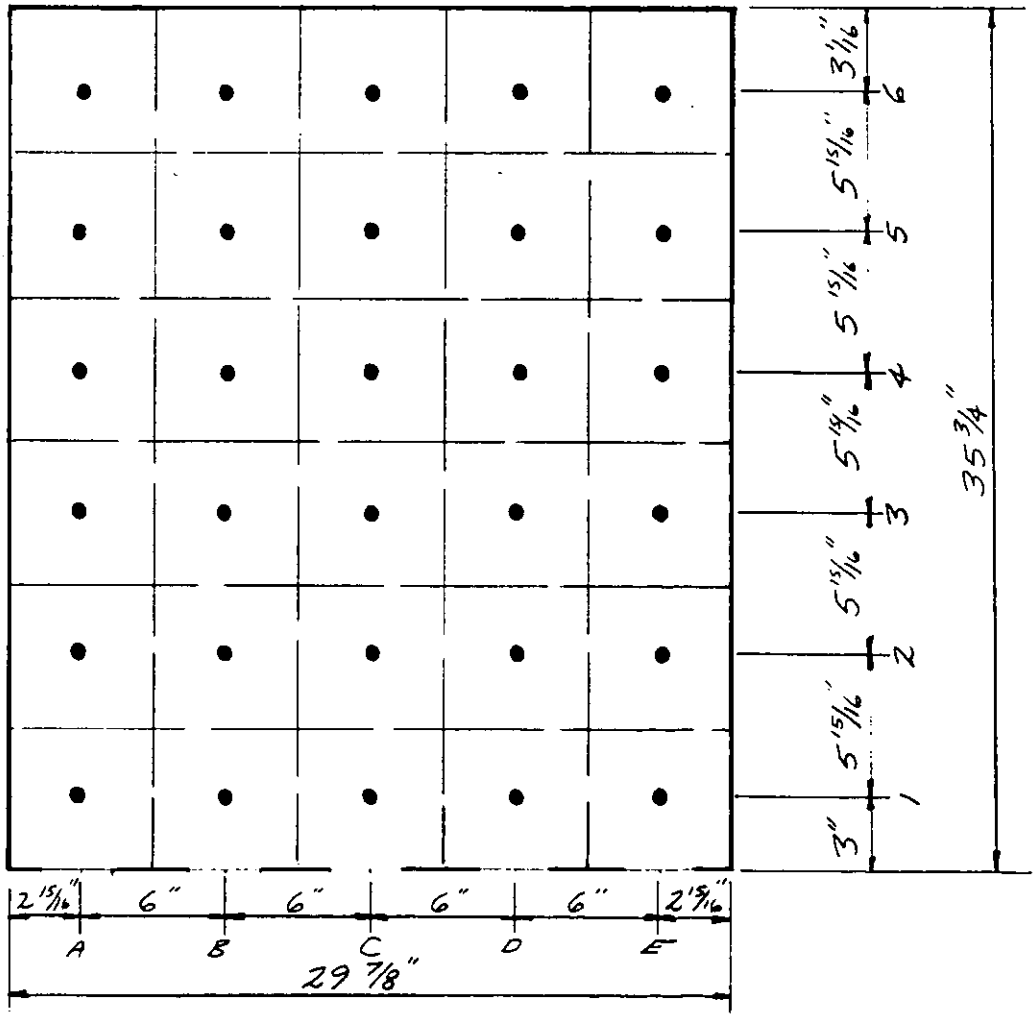
Point Number	Percent of Diameter From Wall	Distance From Wall
1	4.4	2 7/16"
2	14.6	8 1/8 "
3	29.6	16 7/16"
4	70.4	39 3/16"
5	85.4	47 1/2 "
6	95.6	53 3/16"

APPENDIX A

Location of Sampling Points

Baghouse 039 Stack

The sampling ports are located 7 feet (2.58 equivalent stack diameters) downstream from a bend in the stack and 18 inches (0.55 equivalent stack diameters) upstream from the outlet of the stack. The locations of the sampling points were calculated as follows:

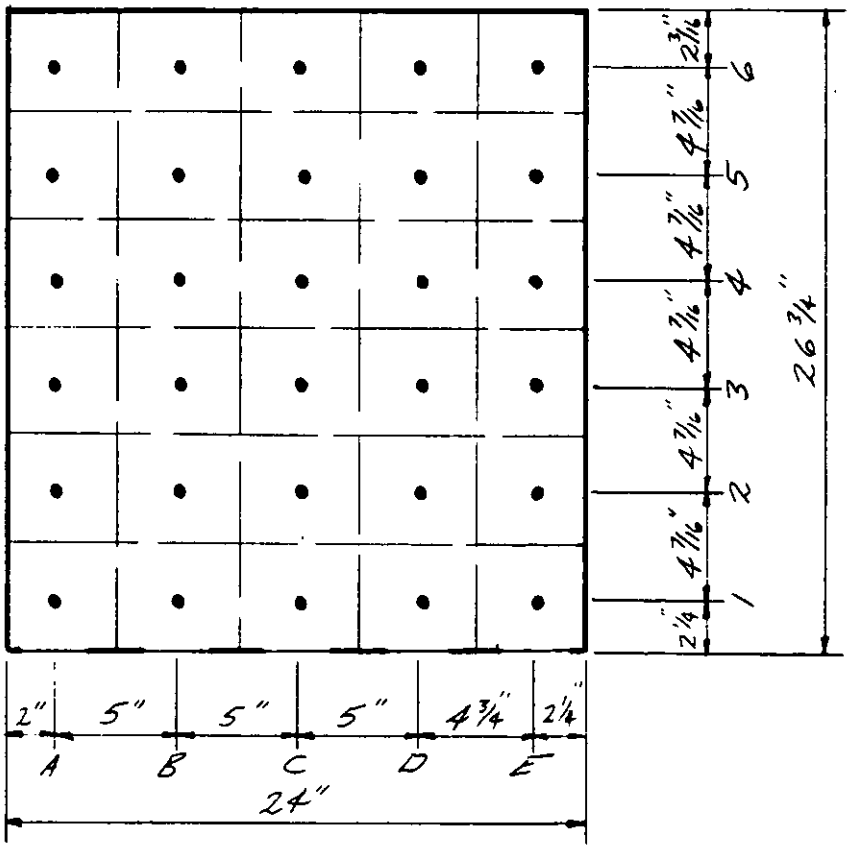


APPENDIX A

Location of Sampling Points

Baghouse 040 Stack

The sampling ports are located 4 feet 5 1/2 inches (2.11 equivalent stack diameters) downstream from a bend in the stack and 18 inches (0.71 equivalent stack diameters) upstream from the outlet of the stack. The locations of the sampling points were calculated as follows:



METCO ENVIRONMENTAL

APPENDIX B

Nomenclature and Equations

for

Calculation of Source Emissions

METCO ENVIRONMENTAL

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
m_t	mg	mg	Particulate - total

• 29.92 "Hg, 528°R (760 mm Hg, 20°C)

Symbol	English Units	Metric Units	Description
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	"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 at meter conditions
$V_{m_{std}}$	dscf*	dscm*	Volume of dry gas sampled @ standard conditions
V_s	fpm	m/sec	Stack velocity @ stack conditions
V_w	ml	ml	Total Water Collected in Impingers and Silica Gel

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

Symbol	English Units	Metric Units	Description
$V_{w_{gas}}$	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: 29.92 "Hg, 68°F (760 mm Hg, 20°C)

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

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.*

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

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

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

3. Percent moisture in stack gas.

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

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

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.

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

8. Stack Pressure.

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

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

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

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.*

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

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

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

11. Actual stack gas volume at stack conditions.

$$Q_a = \frac{V_s \times A_s}{144} = \text{ACFM}$$

$$Q_a = \text{ACFM} \times 1.6990 = \text{m}^3/\text{hr}$$

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

12. Percent isokinetic.

$$\%I = \frac{V_{m_{std}} \times (T_s + 460) \times P_{std} \times 100 \times 144}{M_d \times T_{std} \times P_s \times T_t \times V_s \times \frac{\pi D_n^2}{4}}$$

$$\%I = \frac{1039\ V_{m_{std}} \times (T_s + 460)}{M_d \times P_s \times T_t \times V_s \times D_n^2}$$

13. Particulate - probe, cyclone and filter.

$$C_{an} = \frac{m_f}{V_{m_{std}}} \times \frac{1\ gr}{64.8\ mg}$$

$$C_{an} = 0.0154 \frac{m_f}{V_{m_{std}}} = gr/dscf^*$$

$$C_{an} = gr/dscf \times 2.290 = g/dscm^*$$

14. Particulate total.

$$C_{ao} = 0.0154 \times \frac{m_t}{V_{m_{std}}} = gr/dscf^*$$

$$C_{ao} = gr/dscf \times 2.290 = g/dscm^*$$

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

15. Particulate - probe, cyclone and filter at stack conditions.

$$C_{at} = C_{an} \times \frac{P_s}{P_{std}} \times \frac{(T_{std})}{(T_s + 460)} \times M_d$$

$$C_{at} = \frac{17.65 \times C_{an} \times P_s \times M_d}{T_s + 460} = \text{gr/CF}$$

$$C_{at} = \text{gr/CF} \times 2.290 = \text{g/m}^3$$

16. Particulate - total, at stack conditions.

$$C_{au} = \frac{17.65 \times C_{ao} \times P_s \times M_d}{T_s + 460} = \text{gr/CF}$$

$$C_{au} = \text{gr/CF} \times 2.290 = \text{g/m}^3$$

17. Particulate - probe, cyclone and filter.

$$C_{aw} = C_{an} \times Q_s \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ lb}}{7000 \text{ gr}}$$

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = \text{lbs/hr}$$

$$C_{aw} = \text{lbs/hr} \times 0.4536 = \text{kg/hr}$$

18. Particulate - total.

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = \text{lbs/hr}$$

$$C_{ax} = \text{lbs/hr} \times 0.4536 = \text{kg/hr}$$

* 29.92 "Hg, 528°R (760 mm Hg, 20°C)

SOURCE EMISSION SURVEY

JOB NUMBER: 88-141
JOB NAME: QUEMETCO
LOCATION: INDIANAPOLIS, IN
UNIT TESTED: ELECTRIC ARC FURNACE BAGHOUSE EXHAUST DUCT

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3
DATE			10/4/88	10/4/88	10/4/88
BEGIN TIME			850	1018	1132
END TIME			926	1054	1208
P(b)	BAROMETRIC PRESSURE	"Hg Abs.	29.31	29.31	29.31
		(mm Hg)	(744)	(744)	(744)
P(m)	ORIFICE PRESSURE DROP	"H2O	1.671	1.408	1.500
		(mm H2O)	(42.4)	(35.8)	(38.1)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3	27.600	25.446	26.582
		(m^3)	(0.782)	(0.721)	(0.753)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F	59	68	74
		(DEG.C)	(15)	(20)	(23)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF	27.626	25.019	25.849
		(DSCM)	(0.782)	(0.708)	(0.732)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	14.4	6.5	5.0
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF	0.680	0.307	0.236
		(SCM)	(0.019)	(0.009)	(0.007)
%M	MOISTURE IN STACK GAS BY VOLUME	%	2.40	1.21	0.90

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO
INDIANAPOLIS, IN
ELECTRIC ARC FURNACE BAGHOUSE EXHAUST DUCT

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.9760	0.9879	0.9910
CO2		%	0.0	0.4	0.4
O2		%	20.8	20.6	20.4
CO		%	0.0	0.0	0.0
N2		%	79.2	79.0	79.2
%EA	EXCESS AIR @ SAMPLING POINT	%	-----	-----	-----
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.83 (28.83)	28.89 (28.89)	28.88 (28.88)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.57 (28.57)	28.76 (28.76)	28.78 (28.78)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	1.525 (38.7)	1.408 (35.8)	1.384 (35.2)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	141 (61)	128 (53)	132 (56)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	28.56 (725)	28.54 (725)	28.48 (723)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	4,340 (22.05)	4,127 (20.97)	4,098 (20.82)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	969 (0.63)	969 (0.63)	969 (0.63)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	23,991 (40,761)	23,586 (40,073)	23,286 (39,563)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	29,203 (49,616)	27,769 (47,180)	27,577 (46,853)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO
INDIANAPOLIS, IN
ELECTRIC ARC FURNACE BAGHOUSE EXHAUST DUCT

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	36	36	36
Dn	SAMPLING NOZZLE DIAM.	IN.	0.190	0.190	0.190
		(m)	(0.005)	(0.005)	(0.005)
%I	PERCENT ISOKINETIC	%	109.7	101.1	105.8
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	-----	-----	-----
Mt	PARTICULATE - TOTAL	mg	-----	-----	-----
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF*	-----	-----	-----
		(g/DSCM)	(-----)	(-----)	(-----)
Cao	PARTICULATE - TOTAL	gr/DSCF*	-----	-----	-----
		(g/DSCM)	(-----)	(-----)	(-----)
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF	-----	-----	-----
		(g/m3)	(-----)	(-----)	(-----)
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF	-----	-----	-----
		(g/m3)	(-----)	(-----)	(-----)
Caw	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR	-----	-----	-----
		(Kg/HR)	(-----)	(-----)	(-----)
Cax	PARTICULATE - TOTAL	LBS/HR	-----	-----	-----
		(Kg/HR)	(-----)	(-----)	(-----)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SULFUR DIOXIDE EMISSION DATA

JOB NUMBER:	88-141		
JOB NAME:	QUEMETCO		
LOCATION:	INDIANAPOLIS, IN		
UNIT TESTED:	ELECTRIC ARC FURNACE BAGHOUSE EXHAUST DUCT		
RUN NUMBER	1	2	3
DATE	10/4/88	10/4/88	10/4/88
START TIME	850	1018	1132
END TIME	926	1054	1208
N - NORMALITY OF Ba(ClO4)2	0.0099	0.0099	0.0099
ML(I)- ml IN IMPINGER 2	340	327	296
ML(I)- ml IN IMPINGER 3	345	285	340
ML(A)- ml IN ALIQUOT #2	1.00	1.00	1.00
ML(A)- ml IN ALIQUOT #3	10.00	10.00	10.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #2	0.42	0.35	0.50
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #3	0.22	0.23	0.18
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05	0.05	0.05
Tm - AVERAGE GAS METER TEMPERATURE, DEG.F	59	68	74
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	27.600	25.446	26.582
Pb - BAROMETRIC PRESSURE, "Hg Abs.	29.31	29.31	29.31
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	23,991	23,586	23,286
C(I) - SO2 IN IMPINGER #2 IN mgs	39.85	31.08	42.20
C(I) - SO2 IN IMPINGER #3 IN mgs	1.86	1.63	1.40
C(T) - TOTAL SO2 IN IMPINGERS, IN mgs	41.7	32.7	43.6
ppm SO2	20.1	17.4	22.5
C(SO2) - EMISSION RATE OF SO2, lbs/day	115.4	98.1	125.0
C(SO2) - EMISSION RATE OF SO2, lbs/hr	4.8	4.1	5.2
Cs - EMISSION RATE OF SULFUR, lbs/day	57.7	49.1	62.5

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

C(I) = ML(I) * [ML(B) - ML(BB)] * N * 32 / ML(A)
C(T) = C(I) #2 + C(I) #3
ppm SO2 = 0.7513 * C(T) * [Tm + 460] / Vm * Pb
C(SO2) = ppm SO2 * Qs * 0.0002392

SULFUR TRIOXIDE EMISSION DATA

JOB NUMBER:	88-141
JOB NAME:	QUEMETCO
LOCATION:	INDIANAPOLIS, IN
UNIT TESTED:	ELECTRIC ARC FURNACE BAGHOUSE EXHAUST DUCT

RUN NUMBER	1	2	3
DATE	10/4/88	10/4/88	10/4/88
START TIME	850	1018	1132
END TIME	926	1054	1208
N - NORMALITY OF Ba(ClO4)2	0.0099	0.0099	0.0099
ML(I) - ml IN IMPINGER	190	225	235
ML(A) - ml IN ALIQUOT	10.00	10.00	10.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE	0.37	0.50	0.48
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05	0.05	0.05
Tm - AVERAGE GAS METER TEMPERATURE, DEG.F	59	68	74
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	27.600	25.446	26.582
Pb - BAROMETRIC PRESSURE, "Hg Abs.	29.31	29.31	29.31
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	23,991	23,586	23,286
C(I) - SO3 IN IMPINGERS IN mgs	2.4	4.0	4.0
ppm SO3	0.9	1.7	1.7
C(SO3) - EMISSION RATE OF SO3, lbs/day	6.7	12.1	11.5
Cs - EMISSION RATE OF SULFUR, lbs/day	2.7	4.8	4.6

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

$C(I) = ML(I) * [ML(B) - ML(BB)] * N * 40 / ML(A)$

$ppm\ SO3 = 0.6021 * C(I) * [Tm + 460] / Vm * Pb$

$C(SO3) = ppm\ SO3 * Qs * 0.0002991$

$Cs = C(SO3) / 2.5$

SOURCE EMISSION SURVEY

JOB NUMBER:	88-141
JOB NAME:	GUEMETCO
LOCATION:	INDIANAPOLIS, IN
UNIT TESTED:	ELECTRIC ARC FURNACE BAGHOUSE EXHAUST DUCT

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			4	5	6
DATE			10/4/88	10/4/88	10/4/88
BEGIN TIME			1351	1606	1801
END TIME			1506	1720	1915
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.31 (744)	29.34 (745)	29.34 (745)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	1.256 (31.9)	1.363 (34.6)	1.438 (36.5)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	48.850 (1.383)	50.730 (1.437)	50.753 (1.437)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	76 (24)	73 (23)	68 (20)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	47.296 (1.339)	49.457 (1.400)	49.957 (1.415)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	10.8	8.6	10.3
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	0.510 (0.014)	0.406 (0.011)	0.486 (0.014)
%M	MOISTURE IN STACK GAS BY VOLUME	%	1.07	0.81	0.96

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO
INDIANAPOLIS, IN
ELECTRIC ARC FURNACE BAGHOUSE EXHAUST DUCT

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.9893	0.9919	0.9904
CO2		%	0.5	0.6	0.3
O2		%	20.4	20.4	20.6
CO		%	0.0	0.0	0.0
N2		%	79.1	79.0	79.1
%EA	EXCESS AIR @ SAMPLING POINT	%	-----	-----	-----
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.90 (28.90)	28.91 (28.91)	28.87 (28.87)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.78 (28.78)	28.82 (28.82)	28.77 (28.77)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	1.256 (31.9)	1.363 (34.6)	1.438 (36.5)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	142 (61)	142 (61)	131 (55)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	28.49 (724)	28.55 (725)	28.55 (725)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	3,941 (20.02)	4,100 (20.83)	4,174 (21.20)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	969 (0.63)	969 (0.63)	969 (0.63)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	21,992 (37,364)	22,987 (39,055)	23,802 (40,440)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	26,523 (45,063)	27,589 (46,874)	28,088 (47,722)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO
INDIANAPOLIS, IN
ELECTRIC ARC FURNACE BAGHOUSE EXHAUST DUCT

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	72	72	72
Dn	SAMPLING NOZZLE DIAM.	IN.	0.190	0.190	0.190
		(m)	(0.005)	(0.005)	(0.005)
%I	PERCENT ISOKINETIC	%	102.5	102.5	100.0
Mf	PARTICULATE - PROBE,	mg	7.4	5.2	6.4
	CYCLONE AND FILTER				
Mt	PARTICULATE - TOTAL	mg	-----	-----	-----
Can	PARTICULATE - PROBE,	gr/DSCF*	0.0024	0.0016	0.0020
	CYCLONE AND FILTER	(g/DSCM)	(0.0055)	(0.0037)	(0.0045)
Cao	PARTICULATE - TOTAL	gr/DSCF*	NA	NA	NA
		(g/DSCM)	NA	NA	NA
Cat	PARTIC.-PROBE, CYCLONE	gr/CF	0.0020	0.0013	0.0017
	AND FILTER @ STACK COND.	(g/m3)	(0.0046)	(0.0031)	(0.0038)
Cau	PARTICULATE - TOTAL @	gr/CF	NA	NA	NA
	STACK CONDITIONS	(g/m3)	NA	NA	NA
Can	PARTICULATE - PROBE,	LBS/HR	0.45	0.32	0.40
	CYCLONE AND FILTER	(Kg/HR)	(0.21)	(0.14)	(0.18)
Cax	PARTICULATE - TOTAL	LBS/HR	NA	NA	NA
		(Kg/HR)	NA	NA	NA

0.37

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION SURVEY

JOB NUMBER: 88-141
JOB NAME: QUEMETCO
LOCATION: INDIANAPOLIS, IN
UNIT TESTED: REVERB STACK

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			2	3	4
DATE			10/11/88	10/11/88	10/11/88
BEGIN TIME			735	843	944
END TIME			805	913	1014
P(b)	BAROMETRIC PRESSURE	"Hg Abs.	29.09	29.09	29.09
		(mm Hg)	(739)	(739)	(739)
P(m)	ORIFICE PRESSURE DROP	"H2O	0.275	0.272	0.270
		(mm H2O)	(7.0)	(6.9)	(6.9)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3	8.481	8.774	8.987
		(m^3)	(0.240)	(0.248)	(0.254)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F	53	68	75
		(DEG.C)	(12)	(20)	(24)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF	8.494	8.538	8.631
		(DSCM)	(0.241)	(0.242)	(0.244)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	11.7	9.4	10.1
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF	0.552	0.444	0.477
		(SCM)	(0.016)	(0.013)	(0.014)
%M	MOISTURE IN STACK GAS BY VOLUME	%	6.10	4.94	5.23

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO
INDIANAPOLIS, IN
REVERB STACK

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.9390	0.9506	0.9477
CO2		%	2.4	2.6	2.5
O2		%	19.1	19.4	19.4
CO		%	0.0	0.0	0.0
N2		%	78.5	78.0	78.1
%EA	EXCESS AIR @ SAMPLING POINT	%	1,121.9	1,527.6	1,496.3
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	29.15 (29.15)	29.19 (29.19)	29.18 (29.18)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.47 (28.47)	28.64 (28.64)	28.59 (28.59)
DELTA P	VELOCITY HEAD OF STACK GAS	"H20 (mm H20)	1.077 (27.4)	1.138 (28.9)	1.127 (28.6)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	199 (93)	195 (91)	200 (93)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.15 (740)	29.15 (740)	29.15 (740)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	3,800 (19.30)	3,880 (19.71)	3,880 (19.71)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	2,430 (1.57)	2,430 (1.57)	2,430 (1.57)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	47,175 (80,150)	49,061 (83,355)	48,541 (82,471)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	64,133 (108,962)	65,474 (111,240)	65,472 (111,237)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO
INDIANAPOLIS, IN
REVERB STACK

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	30	30	30
Dn	SAMPLING NOZZLE DIAM.	IN.	0.190	0.190	0.190
		(m)	(0.005)	(0.005)	(0.005)
%I	PERCENT ISOKINETIC	%	51.6	49.9	51.0
Mf	PARTICULATE - PROBE,	mg	-----	-----	-----
	CYCLONE AND FILTER				
Mt	PARTICULATE - TOTAL	mg	-----	-----	-----
Can	PARTICULATE - PROBE,	gr/DSCF*	-----	-----	-----
	CYCLONE AND FILTER	(g/DSCM)	(-----)	(-----)	(-----)
Cao	PARTICULATE - TOTAL	gr/DSCF*	-----	-----	-----
		(g/DSCM)	(-----)	(-----)	(-----)
Cat	PARTIC.-PROBE, CYCLONE	gr/CF	-----	-----	-----
	AND FILTER @ STACK COND.	(g/m3)	(-----)	(-----)	(-----)
Cau	PARTICULATE - TOTAL @	gr/CF	-----	-----	-----
	STACK CONDITIONS	(g/m3)	(-----)	(-----)	(-----)
Caw	PARTICULATE - PROBE,	LBS/HR	-----	-----	-----
	CYCLONE AND FILTER	(Kg/HR)	(-----)	(-----)	(-----)
Cax	PARTICULATE - TOTAL	LBS/HR	-----	-----	-----
		(Kg/HR)	(-----)	(-----)	(-----)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SULFUR DIOXIDE EMISSION DATA

JOB NUMBER:	88-141
JOB NAME:	QUEMETCO
LOCATION:	INDIANAPOLIS, IN
UNIT TESTED:	REVERB STACK

RUN NUMBER	2	3	4
DATE	10/11/88	10/11/88	10/11/88
START TIME	735	843	944
END TIME	805	913	1014
N - NORMALITY OF Ba(ClO4)2	0.0099	0.0099	0.0099
ML(I)- ml IN IMPINGER 2	273	352	248
ML(I)- ml IN IMPINGER 3	295	260	285
ML(A)- ml IN ALIQUOT #2	1.00	1.00	1.00
ML(A)- ml IN ALIQUOT #3	15.00	15.00	15.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #2	6.22	2.97	0.75
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #3	1.18	0.57	0.27
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05	0.05	0.05
Tm - AVERAGE GAS METER TEMPERATURE, DEG.F	53	68	75
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	8.481	8.774	8.987
Pb - BAROMETRIC PRESSURE, "Hg Abs.	29.09	29.09	29.09
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	47,175	49,061	48,541
C(I) - SO2 IN IMPINGER #2 IN mgs	533.62	325.62	55.00
C(I) - SO2 IN IMPINGER #3 IN mgs	7.04	2.86	1.32
C(T) - TOTAL SO2 IN IMPINGERS, IN mgs	540.7	328.5	56.3
ppm SO2	844.6	510.5	86.6
C(SO2) - EMISSION RATE OF SO2, lbs/day	9,531.0	5,991.1	1,005.4
C(SO2) - EMISSION RATE OF SO2, lbs/hr	397.1	249.6	41.9
Cs - EMISSION RATE OF SULFUR, lbs/day	4,765.5	2,995.5	502.7

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

C(I) = ML(I) * [ML(B) - ML(BB)] * N * 32 / ML(A)
C(T) = C(I) #2 + C(I) #3
ppm SO2 = 0.7513 * C(T) * [Tm + 460] / Vm * Pb
C(SO2) = ppm SO2 * Qs * 0.0002392

SULFUR TRIOXIDE EMISSION DATA

JOB NUMBER:	88-141
JOB NAME:	QUEMETCO
LOCATION:	INDIANAPOLIS, IN
UNIT TESTED:	REVERB STACK

RUN NUMBER	2	3	4
DATE	10/11/88	10/11/88	10/11/88
START TIME	735	843	944
END TIME	805	913	1014
N - NORMALITY OF Ba(ClO4)2	0.0099	0.0099	0.0099
ML(I) - ml IN IMPINGER	225	263	224
ML(A) - ml IN ALIQUOT	15.00	15.00	15.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE	0.50	0.48	0.43
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05	0.05	0.05
Tm - AVERAGE GAS METER TEMPERATURE, DEG.F	53	68	75
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	8.481	8.774	8.987
Pb - BAROMETRIC PRESSURE, "Hg Abs.	29.09	29.09	29.09
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	47,175	49,061	48,541
C(I) - SO3 IN IMPINGERS IN mgs	2.7	3.0	2.2
ppm SO3	3.3	3.7	2.8
C(SO3) - EMISSION RATE OF SO3, lbs/day	47.2	54.6	40.2
Cs - EMISSION RATE OF SULFUR, lbs/day	18.9	21.8	16.1

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

$C(I) = ML(I) * [ML(B) - ML(BB)] * N * 40 / ML(A)$

$ppm\ SO3 = 0.6021 * C(I) * [Tm + 460] / Vm * Pb$

$C(SO3) = ppm\ SO3 * Qs * 0.0002991$

$Cs = C(SO3) / 2.5$

SOURCE EMISSION SURVEY

JOB NUMBER: 88-141
JOB NAME: QUEMETCO
LOCATION: INDIANAPOLIS, IN
UNIT TESTED: REVERB STACK

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			8	9	10
DATE			10/12/88	10/12/88	10/12/88
BEGIN TIME			1149	1334	1517
END TIME			1251	1435	1618
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.39 (747)	29.43 (748)	29.43 (748)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	1.018 (25.9)	1.076 (27.3)	1.062 (27.0)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	32.598 (0.923)	33.813 (0.957)	33.722 (0.955)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	70 (21)	74 (23)	73 (23)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	31.986 (0.906)	32.979 (0.934)	32.951 (0.933)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	51.4	49.3	44.7
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	2.426 (0.069)	2.327 (0.066)	2.110 (0.060)
%M	MOISTURE IN STACK GAS BY VOLUME	%	7.05	6.59	6.02

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION CALCULATIONS

QUEMETCO
INDIANAPOLIS, IN
REVERB STACK

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.9295	0.9341	0.9398
CO2		%	2.9	2.3	2.5
O2		%	19.0	19.5	19.4
CO		%	0.0	0.0	0.0
N2		%	78.1	78.2	78.1
%EA	EXCESS AIR @ SAMPLING POINT	%	1,120.0	1,594.4	1,496.3
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	29.22 (29.22)	29.15 (29.15)	29.18 (29.18)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.43 (28.43)	28.41 (28.41)	28.50 (28.50)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	1.006 (25.6)	1.019 (25.9)	1.012 (25.7)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	228 (109)	229 (109)	225 (107)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.45 (748)	29.49 (749)	29.50 (749)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	3,735 (18.97)	3,759 (19.10)	3,727 (18.93)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	2,430 (1.57)	2,430 (1.57)	2,430 (1.57)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	44,417 (75,464)	44,919 (76,317)	45,086 (76,601)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	63,032 (107,091)	63,436 (107,778)	62,889 (106,848)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO
INDIANAPOLIS, IN
REVERB STACK

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	60	60	60
Dn	SAMPLING NOZZLE DIAM.	IN.	0.190	0.190	0.190
		(m)	(0.005)	(0.005)	(0.005)
%I	PERCENT ISOKINETIC	%	103.2	105.3	104.8
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	14.2	10.5	10.1
Mt	PARTICULATE - TOTAL	mg	-----	-----	-----
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF*	0.0068	0.0049	0.0047
		(g/DSCM)	(0.0157)	(0.0112)	(0.0108)
Cao	PARTICULATE - TOTAL	gr/DSCF*	NA	NA	NA
		(g/DSCM)	NA	NA	NA
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF	0.0048	0.0035	0.0034
		(g/m3)	(0.0110)	(0.0079)	(0.0077)
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF	NA	NA	NA
		(g/m3)	NA	NA	NA
Caw	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR	2.60	1.89	1.82
		(Kg/HR)	(1.18)	(0.86)	(0.83)
Cax	PARTICULATE - TOTAL	LBS/HR	NA	NA	NA
		(Kg/HR)	NA	NA	NA

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER:	88-141
JOB NAME:	QUEMETCO INC.
LOCATION:	INDIANAPOLIS, IN
UNIT TESTED:	BAGHOUSE 039 STACK

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3
DATE			10/13/88	10/13/88	10/13/88
BEGIN TIME			904	1100	1240
END TIME			1008	1204	1344
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.60 (752)	29.60 (752)	29.60 (752)
P(m)	ORIFICE PRESSURE DROP	"H20 (mm H20)	1.162 (29.5)	1.097 (27.9)	1.122 (28.5)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	34.409 (0.974)	33.988 (0.962)	34.682 (0.982)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	62 (17)	70 (21)	78 (26)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	34.537 (0.978)	33.594 (0.951)	33.773 (0.956)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	5.7	16.5	13.0
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	0.269 (0.008)	0.779 (0.022)	0.614 (0.017)
%M	MOISTURE IN STACK GAS BY VOLUME	%	0.77	2.27	1.78

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO INC.
INDIANAPOLIS, IN
BAGHOUSE 039 STACK

SYMBOL	DESCRIPTION	UNITS				
Md	MOL FRACTION OF DRY GAS		0.9923	0.9773	0.9822	
CO2		%	0.3	0.0	0.0	
O2		%	19.7	20.8	21.0	
CO		%	0.0	0.0	0.0	
N2		%	80.0	79.2	79.0	
%EA	EXCESS AIR @ SAMPLING POINT	%	-----	-----	-----	
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.84 (28.84)	28.83 (28.83)	28.84 (28.84)	
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.75 (28.75)	28.59 (28.59)	28.65 (28.65)	
DELTA P	VELOCITY HEAD OF STACK GAS	"H20 (mm H20)	0.857 (21.8)	0.812 (20.6)	0.826 (21.0)	
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	93 (34)	102 (39)	103 (39)	95
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.62 (752)	29.62 (752)	29.62 (752)	
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	3,065 (15.57)	3,017 (15.33)	3,044 (15.46)	
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	1,068 (0.69)	1,068 (0.69)	1,068 (0.69)	
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	21,400 (36,359)	20,414 (34,683)	20,663 (35,106)	20,826
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	22,729 (38,617)	22,379 (38,022)	22,575 (38,355)	

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO INC.
INDIANAPOLIS, IN
BAGHOUSE 039 STACK

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	60	60	60
Dn	SAMPLING NOZZLE DIAM.	IN.	0.190	0.190	0.190
		(m)	(0.005)	(0.005)	(0.005)
%I	PERCENT ISOKINETIC	%	101.7	103.7	103.0
Mf	PARTICULATE - PROBE,	mg	7.0	5.8	5.4
	CYCLONE AND FILTER				
Mt	PARTICULATE - TOTAL	mg	-----	-----	-----
Can	PARTICULATE - PROBE,	gr/DSCF*	0.0031	0.0027	0.0025
	CYCLONE AND FILTER	(g/DSCM)	(0.0071)	(0.0061)	(0.0056)
Cao	PARTICULATE - TOTAL	gr/DSCF*	NA	NA	NA
		(g/DSCM)	NA	NA	NA
Cat	PARTIC.-PROBE, CYCLONE	gr/CF	0.0029	0.0024	0.0022
	AND FILTER @ STACK COND.	(g/m3)	(0.0067)	(0.0055)	(0.0051)
Cau	PARTICULATE - TOTAL @	gr/CF	NA	NA	NA
	STACK CONDITIONS	(g/m3)	NA	NA	NA
Can	PARTICULATE - PROBE,	LBS/HR	0.57	0.47	0.44
	CYCLONE AND FILTER	(Kg/HR)	(0.26)	(0.21)	(0.20)
Cax	PARTICULATE - TOTAL	LBS/HR	NA	NA	NA
		(Kg/HR)	NA	NA	NA

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER:	88-141
JOB NAME:	QUEMETCO
LOCATION:	INDIANAPOLIS, IN
UNIT TESTED:	BAGHOUSE 040 STACK

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3
DATE			10/13/88	10/13/88	10/13/88
BEGIN TIME			1644	1829	2024
END TIME			1748	1933	2128
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.51 (750)	29.51 (750)	29.51 (750)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	1.878 (47.7)	1.843 (46.8)	1.830 (46.5)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	44.885 (1.271)	44.852 (1.270)	43.676 (1.237)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	73 (23)	61 (16)	52 (11)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	44.067 (1.248)	45.045 (1.276)	44.634 (1.264)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	9.3	10.1	11.9
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	0.439 (0.012)	0.477 (0.014)	0.562 (0.016)
%M	MOISTURE IN STACK GAS BY VOLUME	%	0.99	1.05	1.24

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO
INDIANAPOLIS, IN
BAGHOUSE 040 STACK

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.9901	0.9895	0.9876
CO2		%	0.3	0.3	0.4
O2		%	20.6	20.7	20.6
CO		%	0.0	0.0	0.0
N2		%	79.1	79.0	79.0
%EA	EXCESS AIR @ SAMPLING POINT	%	-----	-----	-----
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.87 (28.87)	28.88 (28.88)	28.89 (28.89)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.76 (28.76)	28.76 (28.76)	28.75 (28.75)
DELTA P	VELOCITY HEAD OF STACK GAS	"H20 (mm H20)	1.473 (37.4)	1.447 (36.8)	1.438 (36.5)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	120 (49)	118 (48)	128 (53)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.55 (751)	29.55 (751)	29.54 (750)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	4,116 (20.91)	4,072 (20.69)	4,088 (20.77)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	642 (0.41)	642 (0.41)	642 (0.41)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	16,395 (27,855)	16,266 (27,636)	16,016 (27,211)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	18,351 (31,178)	18,153 (30,842)	18,224 (30,963)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

QUEMETCO
INDIANAPOLIS, IN
BAGHOUSE 040 STACK

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	60	60	60
Dn	SAMPLING NOZZLE DIAM.	IN.	0.190	0.190	0.190
		(m)	(0.005)	(0.005)	(0.005)
%I	PERCENT ISOKINETIC	%	101.8	104.9	105.6
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	13.5	8.6	11.3
Mt	PARTICULATE - TOTAL	mg	-----	-----	-----
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF*	0.0047	0.0029	0.0039
		(g/DSCM)	(0.0108)	(0.0067)	(0.0089)
Cao	PARTICULATE - TOTAL	gr/DSCF*	NA	NA	NA
		(g/DSCM)	NA	NA	NA
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF	0.0042	0.0026	0.0034
		(g/m3)	(0.0096)	(0.0060)	(0.0078)
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF	NA	NA	NA
		(g/m3)	NA	NA	NA
Caw	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR	0.66	0.41	0.54
		(Kg/HR)	(0.30)	(0.19)	(0.24)
Cax	PARTICULATE - TOTAL	LBS/HR	NA	NA	NA
		(Kg/HR)	NA	NA	NA

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

APPENDIX C

Calibration Data

Equipment	Calibration Factor	Calibration Date
Pitot Tube #1	0.803	6/28/88
Pitot Tube #5	0.805	8/ 4/88
Probe Tip #II-11	0.190	6/28/88
Dry Gas Meter #2	1.023	6/13/88
Stack Unit Orifice #2		6/13/88
Digital Temperature Indicator #2		6/14/88
Dry Gas Meter #4	1.046	8/ 5/88
Stack Unit Orifice #4		8/ 8/88
Digital Temperature Indicator #4		8/ 5/88
Carbon Monoxide Monitor		10/ 4/88 10/12/88

PITOT TUBE CALIBRATION

Date: 6/28/88

Time: 1100

Pitot No. 1

P_b: 29.36 "Hg P_s: — "H_2O

T_s: 78 °F C_{pstd}: 0.99

Motor Setting	fps mark	CALIBRATOR STANDARD START	END	$\sqrt{\text{STANDARD}}$ AVERAGE	HIGH	$\sqrt{\text{HIGH}}$	CAL. FACTOR	LOW	$\sqrt{\text{LOW}}$	CAL. FACTOR
39	20	0.10	0.10	0.316	0.15	0.387	0.808 ✓	0.15	0.387	0.808 ✓
48	30	0.23	0.22	0.474	0.34	0.583	0.805 ✓	0.34	0.583	0.805 ✓
55	40	0.36	0.36	0.600	0.55	0.742	0.801 ✓	0.55	0.742	0.801 ✓
63	50	0.59	0.60	0.771	0.93	0.964	0.792 ✓	0.92	0.959	0.796 ✓
70	60	0.79	0.79	0.888	1.20	1.095	0.803 ✓	1.20	1.095	0.803 ✓
76	70	1.00	1.00	1.000	1.50	1.225	0.808 ✓	1.50	1.225	0.808 ✓
84	80	1.40	1.40	1.183	2.15	1.466	0.799 ✓	2.15	1.466	0.799 ✓
100	90	1.60	1.60	1.265	2.40	1.549	0.808 ✓	2.40	1.549	0.805 ✓
63	50	0.59	0.59	0.768	0.92	0.959	0.793 ✓	0.92	0.959	0.793 ✓
63	50	0.59	0.59	0.768	0.92	0.959	0.793 ✓	0.92	0.959	0.793 ✓
Average							0.803 ✓			0.804 ✓

Summary of Results:

Normal high side calibration factor 0.803 ✓

variation −1.3%, +0.6%

Normal low side calibration factor 0.804 ✓

variation −1.0%, +0.5%

Greg [illegible]

Signature of Calibrator

PITOT TUBE CALIBRATION

Date: 8/4/88

Time: 0950-1020

Pitot No. 5

P_b: 29.44 "Hg P_s: - "H_2O

T_s: 73 °F C_{pstd}: 0.99

Motor Setting	fps mark	CALIBRATOR STANDARD START	END	$\sqrt{\text{STANDARD}}$ AVERAGE	HIGH	$\sqrt{\text{HIGH}}$	CAL. FACTOR	LOW	$\sqrt{\text{LOW}}$	CAL. FACTOR
39	20	0.10	0.10	0.316	0.15	0.387	0.808	0.15	0.387	0.808
48	30	0.21	0.21	0.458	0.31	0.557	0.815	0.31	0.557	0.815
55	40	0.33	0.33	0.574	0.51	0.714	0.796	0.50	0.707	0.804
63	50	0.53	0.53	0.728	0.81	0.900	0.801	0.80	0.894	0.806
70	60	0.79	0.80	0.892	1.20	1.095	0.806	1.20	1.095	0.806
76	70	1.00	1.00	1.000	1.50	1.225	0.808	1.50	1.225	0.808
84	80	1.30	1.30	1.140	2.00	1.414	0.798	2.00	1.414	0.798
100	90	1.60	1.60	1.265	2.40	1.549	0.808	2.40	1.549	0.808
63	50	0.54	0.54	0.735	0.82	0.906	0.803	0.81	0.900	0.808
63	50	0.54	0.55	0.738	0.82	0.906	0.807	0.82	0.906	0.807
Average							0.805			0.807

Summary of Results:

Normal high side calibration factor 0.805

variation -1.12% +1.24%

Normal low side calibration factor 0.807

variation -1.12%, +0.99%

John R. Smith

Signature of Calibrator

METCO

NOZZLE CALIBRATION

Nozzle Set No. II

Date 6-28-88 Calibrator: Robert Glynn

	1	2	3	4	5	6
Reading 1	0.189	0.140	0.255	0.252	0.315	0.336
Reading 2	0.187	0.141	0.255	0.253	0.313	0.337
Reading 3	0.188	0.140	0.253	0.252	0.316	0.336
Reading 4	0.186	0.143	0.257	0.254	0.314	0.337
Reading 5	0.189	0.142	0.256	0.253	0.313	0.337
Reading 6	0.188	0.140	0.257	0.253	0.313	0.337
Reading 7	0.188	0.139	0.256	0.252	0.313	0.336
Reading 8	0.190	0.140	0.255	0.253	0.316	0.338
Reading 9	0.188	0.139	0.256	0.251	0.316	0.336
Reading 10	0.187	0.143	0.255	0.253	0.314	0.337
Average	0.188	0.141	0.256	0.253	0.314	0.337

	7	8	9	10	11
Reading 1	0.359	0.426	0.508	0.506	0.189
Reading 2	0.360	0.427	0.505	0.508	0.191
Reading 3	0.360	0.426	0.506	0.508	0.189
Reading 4	0.357	0.426	0.506	0.507	0.189
Reading 5	0.359	0.426	0.507	0.507	0.190
Reading 6	0.357	0.427	0.508	0.508	0.190
Reading 7	0.359	0.427	0.508	0.507	0.191
Reading 8	0.360	0.426	0.505	0.508	0.191
Reading 9	0.360	0.427	0.505	0.506	0.190
Reading 10	0.359	0.426	0.506	0.506	0.190
Average	0.359	0.426	0.506	0.507	0.190

METCO

Dry Gas Meter Calibration

Dry Gas Meter Number 2

Date: 13 JUNE, 1988

ΔH ("H_2O)	C_{DG}
0.5	1.010 ✓
1.0	1.016 ✓
1.5	1.023 ✓
2.0	1.028 ✓
3.0	1.032 ✓
4.0	1.029 ✓
Average	1.023 ✓

Variation: + 0.88

- 1.27

Calibrator: John R. Smith

Checked by: JRA

C_{DG} @ 2 liters/min. = 1.029 ✓

METCO

DRY GAS METER CALIBRATION

Meter Number: 2 Calibrator: John R Smith

Date: 6/13/88

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

Run No.: 1 @ 0.50 P_b: 29.46 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1448.11	5.002 cf	73 °F	-1.10 "H_2O	370.830 cf	84 °F	84 °F	0.50 "H_2O
Start	1435	0.000 cf	73 °F	-1.10 "H_2O	365.800 cf	83 °F	83 °F	0.50 "H_2O
	13.11	5.002 cf	73 °F	-1.10 "H_2O	5.030 cf	84 °F	84 °F	0.50 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 5.002 \left(\frac{29.46 + \frac{(-1.10)}{13.6}}{73 + 460} \right) \times \underset{(C_f)}{0.999} = 4.861 \text{ dscf} \checkmark$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 5.030 \left(\frac{29.46 + \frac{0.50}{13.6}}{84 + 460} \right) = 4.814 \text{ dscf} \checkmark$$

$$C_{DG} = \frac{4.861}{4.814} = \boxed{1.010 \checkmark}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 2 Calibrator: John R. Smith

Date: 6/13/88

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

Run No.: 1 @ 1.00 P_b: 29.45 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1501.41	5.000 cf	73 °F	-1.55 "H_2O	376.193 cf	86 °F	84 °F	1.00 "H_2O
Start	1452	0.000 cf	73 °F	-1.55 "H_2O	371.206 cf	84 °F	83 °F	1.00 "H_2O
	9.41	5.000 cf	73 °F	-1.55 "H_2O	4.987 cf	85 °F	84 °F	1.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 5.000 \left(\frac{29.45 + \frac{(-1.55)}{13.6}}{73 + 460} \right) \times \underset{(C_f)}{0.999} = 4.852 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 4.987 \left(\frac{29.45 + \frac{1.00}{13.6}}{84 + 460} \right) = 4.777 \text{ dscf}$$

$$C_{DG} = \frac{4.852}{4.777} = \boxed{1.016}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 2 Calibrator: John R. Smith

Date: 6/13/88

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

Run No.: 1@1.50 P_b: 29.45 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1519.41	10.000 cf	73 °F	-1.90 "H_2O	386.370 cf	90 °F	84 °F	1.50 "H_2O
Start	1504	0.000 cf	73 °F	-1.90 "H_2O	376.451 cf	86 °F	84 °F	2.50 "H_2O
	15.41	10.000 cf	73 °F	-1.90 "H_2O	9.919 cf	88 °F	84 °F	1.50 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.000 \left(\frac{29.45 + \frac{(-1.90)}{13.6}}{73 + 460} \right) \times \underset{(C_f)}{0.999} = 9.696 \checkmark \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.919 \left(\frac{29.45 + \frac{1.50}{13.6}}{86 + 460} \right) = 9.478 \checkmark \text{ dscf}$$

$$C_{DG} = \frac{9.696}{9.478} = \boxed{1.023 \checkmark}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 2 Calibrator: John R. Smith

Date: 6/13/88

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

Run No.: 1 @ 2.00 P_b: 29.44 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	15:36:32	9.996 cf	73 °F	-2.40 "H_2O	396.578 cf	93 °F	85 °F	2.00 "H_2O
Start	15:23	0.000 cf	73 °F	-2.40 "H_2O	386.701 cf	89 °F	84 °F	2.00 "H_2O
	13.32	9.996 cf	73 °F	-2.40 "H_2O	9.877 cf	91 °F	85 °F	2.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 9.996 \left(\frac{29.44 + \frac{(-2.40)}{13.6}}{73 + 460} \right) \times \underset{(C_f)}{0.999} = 9.677 \text{ dscf} \checkmark$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.877 \left(\frac{29.44 + \frac{2.00}{13.6}}{88 + 460} \right) = 9.412 \text{ dscf} \checkmark$$

$$C_{DG} = \frac{9.677}{9.412} = \boxed{1.028} \checkmark$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 2 Calibrator: John R. Smith

Date: 6/13/88

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

Run No.: 1 @ 3.00 P_b: 29.43 "Hg

Control Module Vacuum 4.9 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1550.86	10.005 cf	73 °F	-3.10 "H_2O	407.045 cf	96 °F	86 °F	3.00 "H_2O
Start	1540	0.000 cf	73 °F	-3.10 "H_2O	397.200 cf	91 °F	85 °F	3.00 "H_2O
	10.86	10.005 cf	73 °F	-3.10 "H_2O	9.845 cf	94 °F	86 °F	3.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.005 \left(\frac{29.43 + \frac{(-3.10)}{13.6}}{73 + 460} \right) \times \underset{(C_f)}{0.999} = 9.665 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.845 \left(\frac{29.43 + \frac{3.00}{13.6}}{90 + 460} \right) = 9.368 \text{ dscf}$$

$$C_{DG} = \frac{9.665}{9.368} = \boxed{1.032}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 2 Calibrator: [signature]

Date: 6/13/88

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

Run No.: 1 @ 4.00 P_b: 29.43 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1602.46	10.000 cf	73 °F	-3.90 "H_2O	417.448 cf	99 °F	85 °F	4.00 "H_2O
Start	1553	0.000 cf	73 °F	-3.90 "H_2O	407.604 cf	94 °F	85 °F	4.00 "H_2O
	9.46	10.000 cf	73 °F	-3.90 "H_2O	9.844 cf	97 °F	86 °F	4.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.000 \left(\frac{29.43 + \frac{(-3.90)}{13.6}}{73 + 460} \right) \times \underset{(C_f)}{0.999} = 9.641 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.844 \left(\frac{29.43 + \frac{4.00}{13.6}}{91 + 460} \right) = 9.373 \text{ dscf}$$

$$C_{DG} = \frac{9.641}{9.373} = \boxed{1.029}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 2 Calibrator: John R. Smith

Date: 6/13/88

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

Run No.: 1@2 l/m P_b: 29.42 "Hg

Control Module Vacuum 0.5 "Hg

	WET TEST METER (No. 1)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1646.58	2.000 cf	74 °F	-0.75 "H_2O	419.611 cf	85 °F	85 °F	0.00 "H_2O
Start	1619	0.000 cf	74 °F	-0.75 "H_2O	417.611 cf	91 °F	88 °F	0.00 "H_2O
	27.58	2.000 cf	74 °F	-0.75 "H_2O	2.000 cf	88 °F	87 °F	0.00 "H_2O

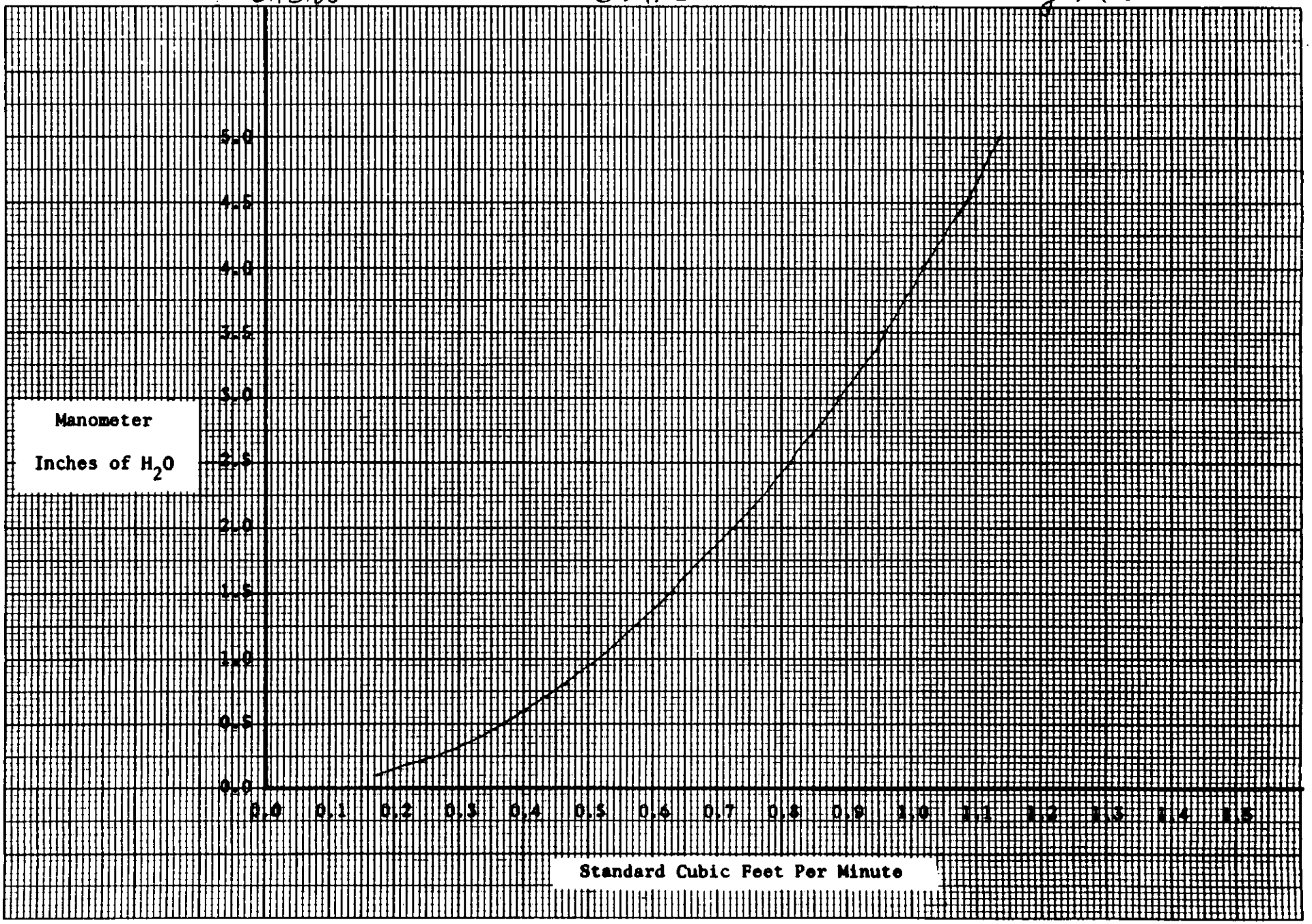
$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 2.000 \left(\frac{29.42 + \frac{(-0.75)}{13.6}}{74 + 460} \right) \times \underset{(C_f)}{1.007} = 1.955 \text{ dscf} \checkmark$$

2.007 lpm

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 2.000 \left(\frac{29.42 + \frac{0.00}{13.6}}{87 + 460} \right) = 1.899 \text{ dscf} \checkmark$$

$$C_{DG} = \frac{1.955}{1.899} = \boxed{1.029 \checkmark}$$

6/13/88 C.M. 2 ERS



METCO

DIGITAL TEMPERATURE INDICATOR NO. 2

CALIBRATION DATA

Date: 6/14/88

Media	Time	Mercury Thermometer (°F)	DTI (°F)
Ice Bath	0840	34	34
Ambient Air	0733	72	72
Boiling Water	0834	212	217
Oven	0744	157	159
Oven	0758	258	260
Oven	0810	343	345
Oven	0830	400	403

Meter Adjusted? Yes _____ No ✓

John R. Smith
Signature of Calibrator

METCO

Dry Gas Meter Calibration

Dry Gas Meter Number 4

Date: 5 August 1988

ΔH ("H_2O)	C_{DG}
0.5	1.035 ✓
1.0	1.042 ✓
1.5	1.043 ✓
2.0	1.059 ✓
3.0	1.050 ✓
4.0	1.050 ✓
Average	1.046 ✓

Variation: + 0.76

- 1.059 ✓

Calibrator: Greg Dove

Checked by: JRM

C_{DG} @ 2 liters/min. = 1.061 ✓

METCO

DRY GAS METER CALIBRATION

Meter Number: 4 Calibrator: Greg Orr

Date: 5 August 1988

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

Run No.: 1 @ 0.50 P_b: 29.92 "Hg

Control Module Vacuum 4.8 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1012.41	5.002 cf	71 °F	-1.00 "H_2O	438.999 cf	99 °F	89 °F	0.50 "H_2O
Start	1000	0.000 cf	71 °F	-1.00 "H_2O	434.000 cf	92 °F	86 °F	0.50 "H_2O
	12.41	5.002 cf	71 °F	-1.00 "H_2O	4.999 cf	96 °F	88 °F	0.50 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 5.002 \left(\frac{29.92 + \frac{-1.00}{13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.999} = 4.874 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 4.999 \left(\frac{29.92 + \frac{0.50}{13.6}}{92 + 460} \right) = 4.708 \text{ dscf}$$

$$C_{DG} = \frac{4.874}{4.708} = \boxed{1.035}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 4 Calibrator: Greg Derr

Date: 5 August 1988

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

Run No.: 1 @ 1.00 P_b: 29.92 "Hg

Control Module Vacuum 4.6 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1025.8	5.010 cf	71 °F	-1.55 "H_2O	444.525 cf	101 °F	90 °F	1.00 "H_2O
Start	1016	0.000 cf	71 °F	-1.55 "H_2O	439.530 cf	101 °F	90 °F	1.00 "H_2O
	9.8	5.010 cf	71 °F	-1.55 "H_2O	4.995 cf	101 °F	90 °F	1.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 5.010 \left(\frac{29.42 + \frac{-1.55}{13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.999} = 4.875 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 4.995 \left(\frac{29.92 + \frac{1.00}{13.6}}{96 + 460} \right) = 4.677 \text{ dscf}$$

$$C_{DG} = \frac{4.875}{4.677} = \boxed{1.042}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 4 Calibrator: Greg Derr

Date: 5 August 1988

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

Run No.: 1 @ 1.50 P_b: 29.92 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1043.5	10.020 cf	71 °F	-2.05 "H_2O	454.982 cf	110 °F	92 °F	1.50 "H_2O
Start	1029	0.000 cf	71 °F	-2.05 "H_2O	445.000 cf	97 °F	88 °F	1.50 "H_2O
	14.5	10.020 cf	71 °F	-2.05 "H_2O	9.982 cf	104 °F	90 °F	1.50 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.020 \left(\frac{29.92 \overset{-2.05}{+ 13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.999} = 9.739 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.982 \left(\frac{29.92 \overset{1.50}{+ 13.6}}{97 + 460} \right) = 9.341 \text{ dscf}$$

$$C_{DG} = \frac{9.739}{9.341} = \boxed{1.043}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 4 Calibrator: Greg Dove

Date: 5 August 1988

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

Run No.: 1 @ 2.00 P_b: 29.92 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1059.8	10.008 cf	71 °F	-3.00 "H_2O	465.550 cf	119 °F	95 °F	2.00 "H_2O
Start	1047	0.000 cf	71 °F	-3.00 "H_2O	455.602 cf	109 °F	92 °F	2.00 "H_2O
	12.8	10.008 cf	71 °F	-3.00 "H_2O	9.948 cf	114 °F	94 °F	2.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.008 \left(\frac{29.42 + \frac{-3.00}{13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.999} = 9.704 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.948 \left(\frac{29.42 + \frac{2.00}{13.6}}{104 + 460} \right) = 9.205 \text{ dscf}$$

$$C_{DG} = \frac{9.704}{9.205} = \boxed{1.054}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 4 Calibrator: Greg Dee

Date: 5 August 1988

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

Run No.: 1 @ 3.00 P_b: 29.92 "Hg

Control Module Vacuum 54 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1127.25	10.000 cf	71 °F	-3.6 "H_2O	486.878 cf	113 °F	95 °F	3.00 "H_2O
Start	1117	0.000 cf	71 °F	-3.6 "H_2O	476.953 cf	110 °F	94 °F	3.00 "H_2O
	10.25	10.000 cf	71 °F	-3.6 "H_2O	9.925 cf	112 °F	95 °F	3.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.000 \left(\frac{29.92 + \frac{-3.60}{13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.999} = 9.681 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.925 \left(\frac{29.92 + \frac{3.00}{13.6}}{103 + 460} \right) = 9.223 \text{ dscf}$$

$$C_{DG} = \frac{9.681}{9.223} = \boxed{1.050}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 4 Calibrator: Greg Ova

Date: 5 August 1988

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

Run No.: 1 @ 4.00 P_b: 29.92 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1200.5	10.005 cf	71 °F	-4.05 "H_2O	510.681 cf	114 °F	94 °F	4.00 "H_2O
Start	1152 / 85	0.000 cf	71 °F	-4.05 "H_2O	500.789 cf	109 °F	93 °F	4.00 "H_2O
		10.005 cf	71 °F	-4.05 "H_2O	9.892 cf	112 °F	94 °F	4.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.005 \left(\frac{29.92 \; + \frac{-4.05}{13.6}}{71 \; + \; 460} \right) \times \underset{(C_f)}{0.999} = 9.675 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.892 \left(\frac{29.92 \; + \frac{4.00}{13.6}}{103 \; + \; 460} \right) = 9.215 \text{ dscf}$$

$$C_{DG} = \frac{9.675}{9.215} = \boxed{1.050}$$

METCO

DRY GAS METER CALIBRATION

Meter Number: 4 Calibrator: Greg Derr

Date: 5 August 1988

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

Run No.: 1 @ 2 l/m P_b: 29.90 "Hg

Control Module Vacuum 20 "Hg

	WET TEST METER (No. 1)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1430.9	1.977 cf	73 °F	-0.30 "H_2O	514.385 cf	96 °F	94 °F	0.00 "H_2O
Start	1401	0.000 cf	73 °F	-0.30 "H_2O	512.450 cf	86 °F	82 °F	0.00 "H_2O
	29.9	1.977	73	-0.30 "H_2O	1.935	91	88	0.00 "H_2O

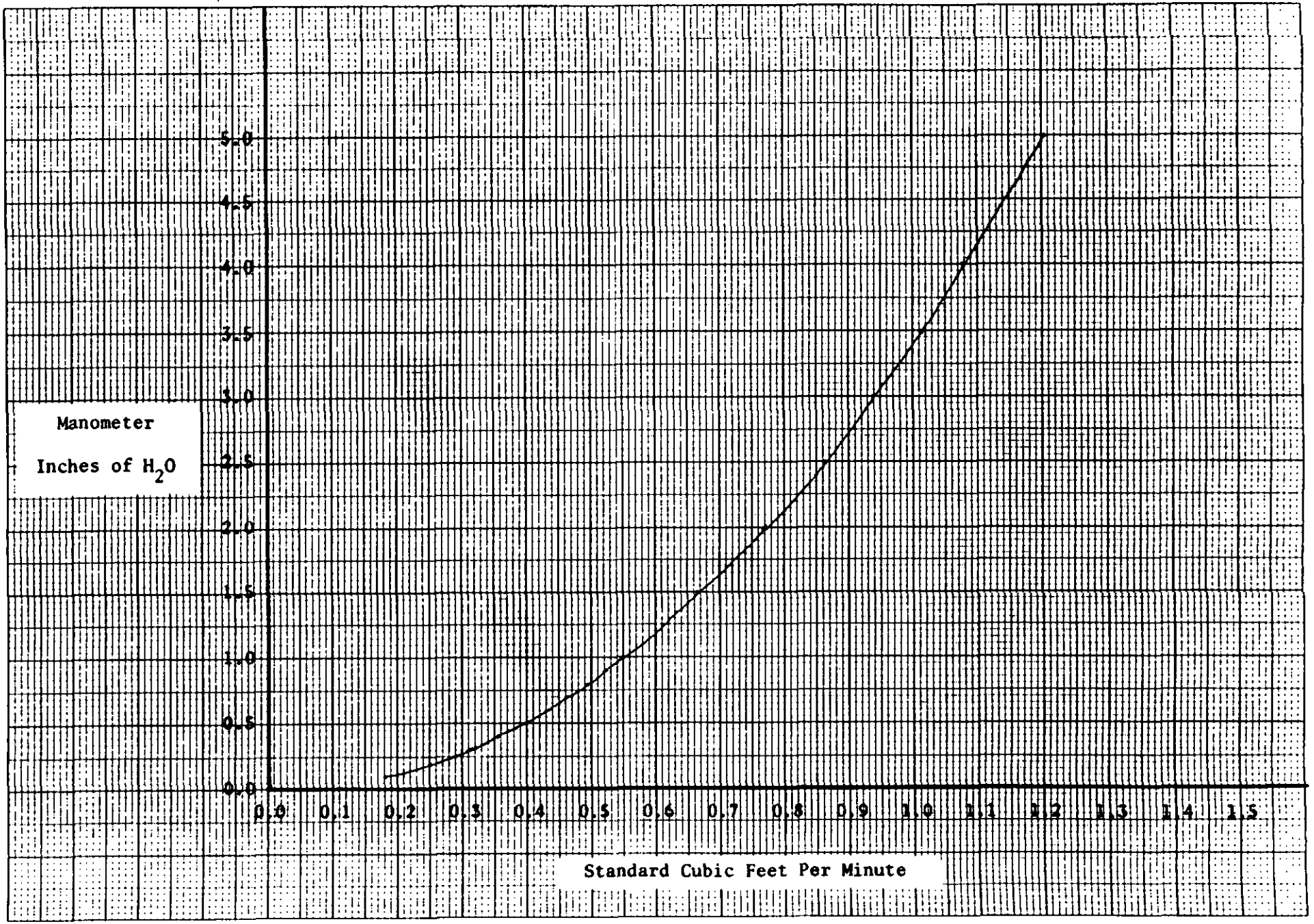
$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 1.977 \left(\frac{29.90 + \frac{-0.30}{13.6}}{73 + 460} \right) \times \underset{(C_f)}{1.007} = 1.937 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 1.935 \left(\frac{29.90 + \frac{20}{13.6}}{90 + 460} \right) = 1.826 \text{ dscf}$$

$$C_{DG} = \frac{1.937}{1.826} = \boxed{1.061}$$

CM #4

MKH
8-8-88



METCO

DIGITAL TEMPERATURE INDICATOR NO. 4

CALIBRATION DATA

Date: 5 August 1988

Media	Time	Mercury Thermometer (°F)	DTI (°F)
Ice Bath	1010	34	37
Ambient Air	1633	78	75
Boiling Water	1040	210	214
Oven	1109	129	130
Oven	1121	268	270
Oven	1153	354	359
Oven	1203	405	402

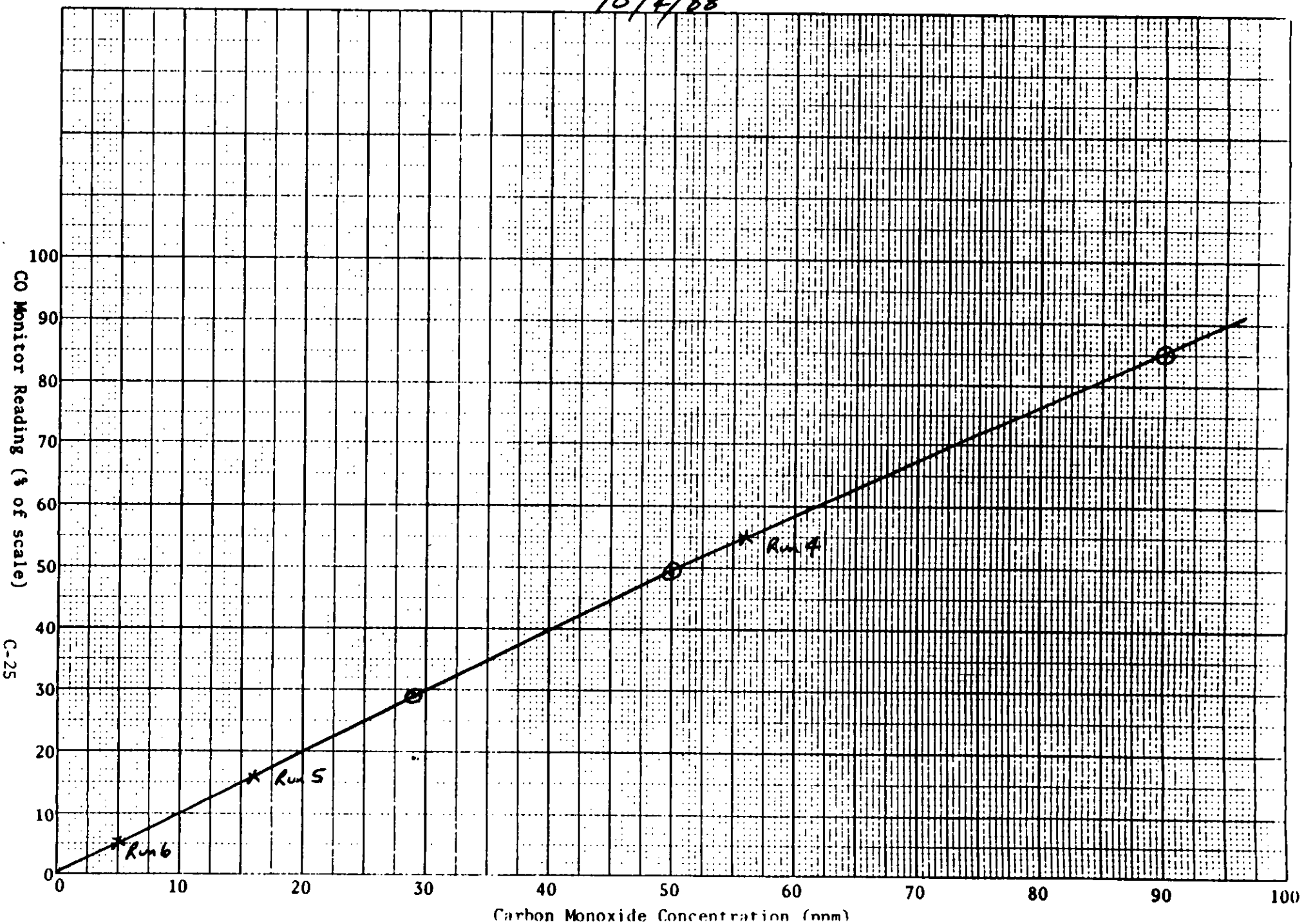
Meter Adjusted? Yes _____ No ✓

Greg Dow
Signature of Calibrator

46 1240

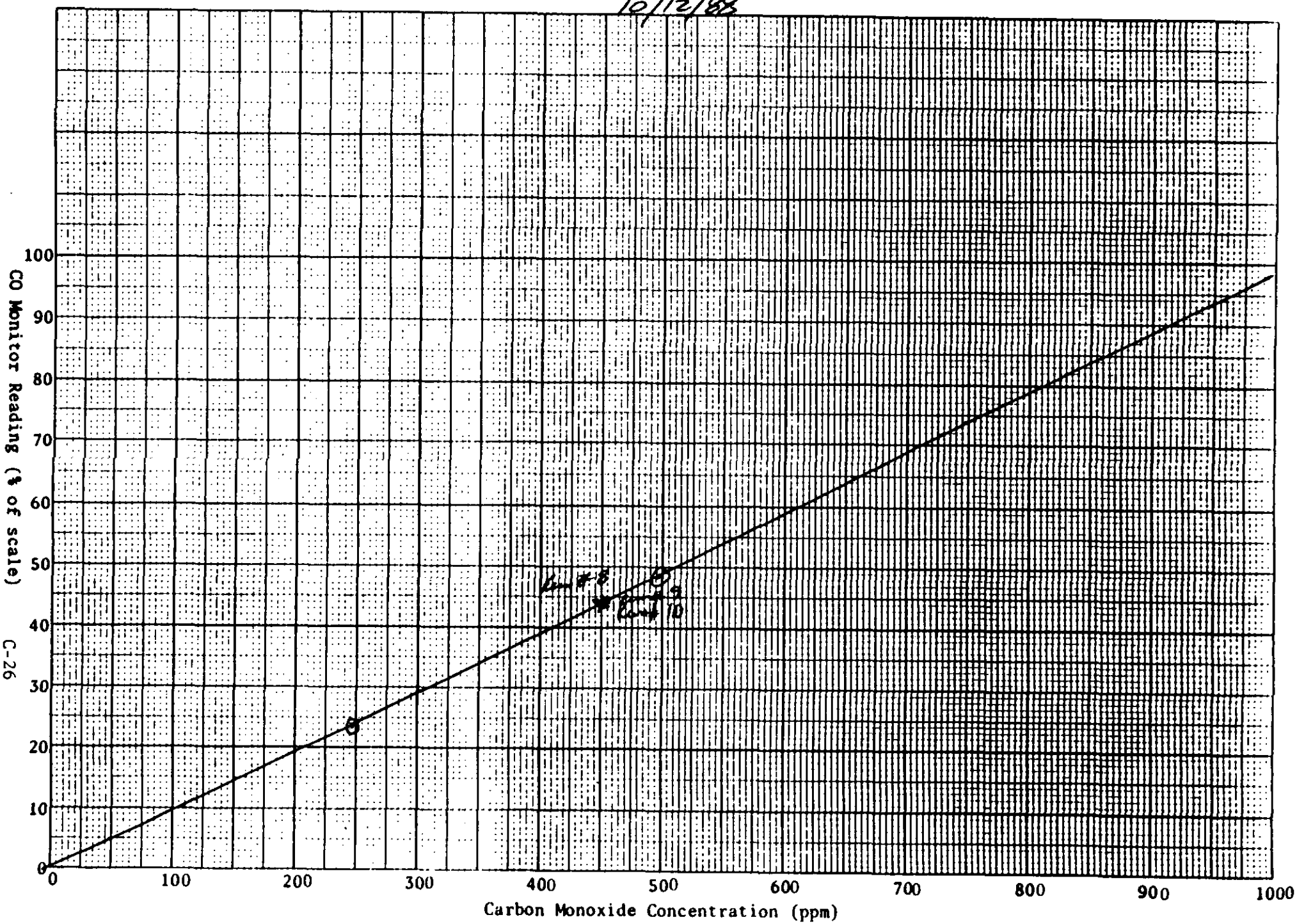
Carbon Monoxide Monitor Calibration Curve

10/4/88



Carbon Monoxide Monitor Calibration Curve

10/12/88



SCOTT SPECIALTY GASES Scott Environmental Technology, Inc.

1290 COMPERMERE TROY, MICHIGAN 48083 TELEPHONE # (313) 589-2950 FAX: (313) 589-2134

Date Shipped :
Our Project # : 928383
Your P.O. # : 435
Page ____ of ____
Expiration Date : 11-31-89

Customer :
MULLINS ENVIRONMENTAL
P.O. BOX 598
ADDISON, TEXAS 75001

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES

Certified Per Traceability Protocol # 1 Procedure # G1 (CIRCLE)

File # P01317

Cylinder Number CAL-5048

Cylinder Pressure 2000 psig

Certified Accuracy ± 2 NBS Traceable

ORIGINAL CERTIFICATION SHEETS IN MAIL

COMPONENT	CERTIFIED CONC.	REFERENCE STD SRM # (CRM #)	REFERENCE STD CYLINDER NUMBER	REFERENCE STD CONC.	GAS ANALYZER MAKE/MODEL/SERIAL #	GAS ANALYZER LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	50.38 PPM	1679	CAL-5168	97.10 PPM	HORIBA	4-28-88	NON-DISPERSIVE INFRARED
		GMIS#	AAL-4463	100.0 PPM			

DILUENT GAS : NITROGEN

C-27

FIRST ANALYSIS DATE : 5-19-88

ZERO GAS (mV)	TEST GAS (mV)	TEST RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	REFERENCE RESULTS PPM
0.00	22.59	50.16	97.1 PPM	44.00	97.10
0.00	23.00	50.38		44.00	97.10
0.00	23.00	50.38		44.00	97.10
CALCULATED RESULTS		50.16			
		50.38			
		50.38			
AVERAGE :		50.31 PPM			

SECOND ANALYSIS DATE : 5-31-88

ZERO GAS (mV)	TEST GAS (mV)	TEST RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	REFERENCE RESULTS PPM
0.09	23.00	50.38	97.1 PPM	44.00	97.10
0.00	23.00	50.38		43.90	96.88
0.00	23.00	50.38		43.90	96.88
CALCULATED RESULTS		50.38			
		50.50			
		50.50			
AVERAGE :		50.46 PPM			

CALIBRATION CURVE 3 rd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
	100.0	100	45.00	99.25	-0.75
1679	97.10	97	44.00	97.10	.00
	50.00	50	22.70	49.71	-0.58
	24.93	25	11.60	24.89	-0.15
	9.900	10	4.70	9.887	-0.13
	0.0000	0	0.00	0.0000	0.00
		0		0.00	0.00
1677	9.900	LOW	4.70	9.887	-0.13
N/A	100.0	GMIS#	45.00	99.25	-0.75

* = NIST GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Steve Hayes

Approved By : J. Shapiro

SCOTT SPECIALTY GASES a division of Scott Environmental Technology, Inc.

1290 COMBERMERE TROY, MICHIGAN 48083 TELEPHONE # (313) 589-2950 FAX: (313) 589-2134

Shipped From : Scott Troy
Date Shipped : ____
Our Project # : 928382
Your P.O. # : 435
Page ___ of ___
Expiration Date : 11-31-89

Customer :
MULLINS ENVIRONMENTAL
P.O. BOX 598
ADDISON, TEXAS 75001

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES

Certified For Traceability Protocol # 1

Procedure # (61) (CIRCLE)

File # PO1318

Certified Accuracy 1 % NBS traceable

Cylinder Number CAL-1264

Cylinder Pressure 2000 psig

COMPONENT	CERTIFIED CONC.	REFERENCE STD SRM # (CRM #)	REFERENCE STD CYLINDER NUMBER	REFERENCE STD CONC.	GAS ANALYZER MAKE/MODEL/SERIAL #	GAS ANALYZER LAST CALIBRATION DATE	GAS ANALYZER ANALYTICAL PRINCIPLE
CARBON MONOXIDE	29.90 PPM	1679	CAL-5168	97.10 PPM	HORIBA	4-28-88	NON-DISPERSIVE INFRARED
		GMIS#	AAL-4463	100.0 PPM	----------		

BALANCE GAS : NITROGEN

FIRST ANALYSIS DATE : 5-19-88

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	REFERENCE RESULTS PPM
0.00	13.80	29.76	97.1 PPM	44.00	97.10
0.00	13.80	29.76		44.00	97.10
0.00	13.80	29.76		44.00	97.10
CALCULATED RESULTS		29.76			
		29.76			
		29.76			
AVERAGE :		29.76 PPM			

SECOND ANALYSIS DATE : 5-31-88

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	REFERENCE RESULTS PPM
0.00	13.90	29.98	97.1 PPM	44.00	97.10
0.00	13.90	29.98		43.90	96.88
0.00	13.90	29.98		43.90	96.88
CALCULATED RESULTS		29.98			
		30.05			
		30.05			
AVERAGE :		30.03 PPM			

CALIBRATION CURVE 3 rd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
	100.0	100	45.00	99.25	-0.75
1679	97.10	97	44.00	97.10	.00
	50.00	50	22.70	49.71	-0.58
	24.93	25	11.60	24.89	-0.15
	9.900	10	4.70	9.887	-0.13
	0.0000	0	0.00	0.000	0.00
		0		0.00	0.00
1677	9.900	LOW	4.70	9.887	-0.13
N/A	100.0	GMIS#	45.00	99.25	-0.75

GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : [signature]

Approved By : S. Shapiro

S C O T T S P E C I A L T Y G A S E S a division of Scott Environmental Technology, Inc.
1290 COMBERMERE TROY, MICHIGAN 48083 TELEPHONE # (313) 589-2950 FAX: (313) 589-2134

Shipped From : Scott Troy
Date Shipped : _____
Our Project # : 929490
Your P.O. # : 479
Page ____ of ____
Expiration Date : 2-2-90

Customer :
METCO ENVIRONMENTAL
BOX 598
ADDISON, TEXAS 75001

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES

Certified Per Traceability Protocol # 1
Procedure # G1
File # P01554
Certified Accuracy 1 % NBS Traceable
Cylinder Number CLM-1084
Cylinder Pressure 2000 psig

		REFERENCE STD			GAS ANALYZER		
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	MAKE/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	248.5 PPM		AAL-7813	500.1 PPM	BECKMAN	6-15-88	NON-DISPERSED INFRARED
		1679	FF-19978	95.40 PPM	_____		
		1680	FF-19741	470.0 PPM	_____		

BALANCE GAS : NITROGEN

C-29

FIRST ANALYSIS — DATE : 7-26-88

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	56.40	250.8	470.0 PPM	95.90	474.6
0.00	56.40	250.8		95.80	474.0
0.00	56.50	251.4		95.80	474.0
CALCULATED RESULTS		248.4			
		248.7			
		249.2			
AVERAGE :		248.8 PPM			

SECOND ANALYSIS — DATE : 8-2-88

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	56.30	250.3	470.0	95.90	474.6
0.00	56.40	250.8		95.80	474.0
0.00	56.30	250.3		95.90	474.6
CALCULATED RESULTS		247.9			
		248.7			
		247.9			
AVERAGE :		248.2 PPM			

CALIBRATION CURVE — 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
	500.1	100	99.97	499.9	-0.04
	400.1	80	83.75	401.5	0.36
	300.1	60	65.84	300.7	0.21
	200.0	40	46.29	200.0	-0.03
	100.0	20	24.54	99.40	-0.62
	0.0000	0	0.00	0.0000	0.00
	0.00			0.00	0.00
1678	45.60	LOW	11.66	45.54	-0.13
1679	95.40		23.70	95.76	0.38

GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Greg Rogers

Approved By : J. Shapiro

S C O T T S P E C I A L T Y G A S E S a division of Scott Environmental Technology, Inc.

1290 COMBERMERE TROY, MICHIGAN 48083 TELEPHONE # (313) 589-2930 FAX: (313) 589-2134

Shipped From : Scott Troy
Date Shipped : _____
Our Project # : 927707
Your P.O. # : 413
Page ___ of ___
Expiration Date : 10-19-89

Customer :
MULLINS ENVIRONMENTAL
P.O. BOX 598
ADDISON TEXAS 75001

****** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ******

Certified Per Traceability Protocol # 1 — Procedure # G2 (CIRCLE) — Cylinder Number CAL-12640

File # P01221 — Cylinder Pressure 2000 psig

Certified Accuracy 1 % NBS Traceable

	REFERENCE STD				GAS ANALYZER		
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	MAKE/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	497.7 PPM	1681	FF-20019	959.0 PPM	BECKMAN	4-12-88	NON-DISPERSIVE INFRARED
		GMIS*	AAL-7813	500.1 PPM			

BALANCE GAS : NITROGEN

FIRST ANALYSIS — DATE : 4-12-88

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	INTERNAL STANDARD (GMIS*)	REFERENCE GAS (mV)	RESULTS PPM
0.00	63.20	497.0	500.1 PPM	63.50	500.1
0.00	63.20	497.0		63.40	499.1
0.00	63.20	497.0		63.40	499.1
CALCULATED RESULTS		497.0 498.0 498.0			
AVERAGE :		497.7 PPM			

SECOND ANALYSIS — DATE : 4-19-88

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	INTERNAL STANDARD (GMIS*)	REFERENCE GAS (mV)	RESULTS PPM
0.00	63.20	497.0	500.1 PPM	63.50	500.1
0.00	63.20	497.0		63.40	499.1
0.00	63.20	497.0		63.40	499.1
CALCULATED RESULTS		497.0 498.0 498.0			
AVERAGE :		497.7 PPM			

CALIBRATION CURVE — 3 rd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1681	959.0	100	100.00	959.0	.00
	767.2	80	86.50	769.2	0.26
	575.4	60	70.50	575.4	0.01
	383.6	40	51.50	382.7	-0.23
	191.8	20	28.60	192.9	0.57
	0.0000	0	0.00	0.0000	0.00
	0.00			0.00	0.00
1679	97.10	LOW	15.20	97.86	0.78
N/A	500.1 GMIS*		63.50	500.1	.00

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : _____ Approved By : _____

SCOTT SPECIALTY GASES a division of Scott Environmental Technology, Inc.

1290 COMBERMERE TROY, MICHIGAN 48083 TELEPHONE # (313) 589-2950 FAX: (313) 589-2134

Shipped From : Scott Troy
Date Shipped : _____
Our Project # : 929490
Your P.O. # : 479
Page ____ of ____
Expiration Date : 2-2-90

Customer :
METCO ENVIRONMENTAL
BOX 598
ADDISON, TEXAS 75001

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES

Certified Per Traceability Protocol # 1
Procedure # 81
File # P01552
Certified Accuracy 1 % NBS Traceable

Cylinder Number CLM-1070
Cylinder Pressure 2000 psig

	REFERENCE STD				GAS ANALYZER		
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	MAKE/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	90.68 PPM		AAL-7813	500.1 PPM	BECKMAN	6-15-88	NON-DISPERSED INFRARED
		1679	FF-19978	95.40 PPM	_____		
					_____		

BALANCE GAS : NITROGEN

C-31

FIRST ANALYSIS — DATE : 7-26-88

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	22.50	90.39	95.40 PPM	23.70	95.76
0.00	22.60	91.02		23.70	95.76
0.00	22.60	91.02		23.70	95.76
CALCULATED RESULTS		90.25 90.68 90.68			
AVERAGE :		90.53 PPM			

SECOND ANALYSIS — DATE : 8-2-88

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	22.60	91.02	95.40 PPM	23.70	95.76
0.00	22.70	91.45		23.70	95.76
0.00	22.60	91.02		23.70	95.76
CALCULATED RESULTS		90.68 91.10 90.68			
AVERAGE :		90.82 PPM			

CALIBRATION CURVE — 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
	500.1	100	99.97	499.9	-0.04
	400.1	80	83.75	401.5	0.36
	300.1	60	65.84	300.7	0.21
	200.0	40	46.29	200.0	-0.03
	100.0	20	24.54	99.40	-0.62
	0.0000	0	0.00	0.0000	0.00
	0.00			0.00	0.00
1678	45.60	LOW	11.66	45.54	-0.13
1679	95.40		23.70	95.76	0.38

GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Lee J. Hogue

Approved By : J. Shapiro

APPENDIX D

Field Testing Data

MULLINS ENVIRONMENTAL TESTING CO., INC.

Job No. 88-141 — Sulfur Dioxide FIELD DATA

Job Name Quemetco

Run No. 1

Location Electric Arc Furnace Duct

Date 4 Oct 1988

Operator Orr, Mullins

Sample Box No. 2 Meter Box No. 4

Read and record at the start of each test point.

Purge to: 202.791

Purge time: 0928 - 0943

Ambient Temp. °F 56

Assumed Moisture % 2

Probe Length 3'

C Factor — 10.0 to reference

Initial Leak @ 19.0 "Hg = 0.000 cfm

Final Leak @ 8.0 "Hg = 0.000 cfm

			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	
A-12	0850	166.350	1.70	1.70	1.70	5.0	146	235	257	49	56	54	
11	0853	168.52	1.90	1.90	1.90	5.0	196	246	258	49	56	54	
10	0856	170.84	2.00	2.00	2.00	5.5	147	236	265	48	58	54	
9	0859	173.12	2.00	2.00	2.00	6.0	148	249	264	49	55	54	
8	0902	175.78	1.90	1.90	1.90	6.0	145	271	263	52	61	55	
7	0905	177.75	1.80	1.80	1.80	6.0	144	255	264	55	62	55	
6	0908	180.00	1.60	1.60	1.60	6.0	144	248	263	58	65	56	
5	0911	182.30	1.65	1.65	1.65	6.0	143	246	263	58	5966	5556	
4	0914	184.65	1.55	1.55	1.55	6.5	142	249	245	60	6666	56	
3	0917	185.96	1.60	1.60	1.60	6.5	142	242	264	61	67	57	
2	0920	188.94	1.30	1.30	1.30	5.0	142	242	264	63	68	57	GRAB
1	0923	190.91	1.05	1.05	1.05	4.5	139	242	264	65	68	57	ORSAT
END	0926	192.736	—	—	—	—	—	—	—	—	—	—	
A-1			1.20				136						
B-1			1.20				139						
10			1.20				139						
9			1.10				140						
8			1.20				140						

Pitot Tube Calibration Factor C_p 0.803

Volume Collected V_m 27.600 ft^3 Baro. Press. P_b 29.31 "Hg

Water Collected V_w 14.4 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 36 min. % CO_2 0.0 % CO 0.0

Stack Pressure P_s -10.2 "H_2O % O_2 20.8 % N_2 79.2

Area Stack A_s 969 in^2

Pitot Tube No. 1 Barometer No. —

Probe Tip No. II-11

V_m = Dry Gas Meter Calibration Factor 1.046 X 26.386

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

M_F = _____ M_T = _____

Impinger Box No. 2

Impinger 1	Final Weight	598.6
	Initial Weight	653.2
	Increase	-54.6
Impinger 2	Final Weight	703.0
	Initial Weight	668.7
	Increase	34.3
Impinger 3	Final Weight	709.0
	Initial Weight	688.5
	Increase	20.5
Impinger 4	Final Weight	486.1
	Initial Weight	485.1
	Increase	1.0
Impinger 5	Final Weight	811.0
	Initial Weight	794.8
	Increase	16.2
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # _____ Final Weight _____ Initial Weight _____ Increase _____

Water Weight Gain

V_w =

g SO_2 = -_____

V_w =

Impinger 1	-526
Impinger 2	34.3
Impinger 3	20.5
Impinger 4	1.0
Impinger 5	16.2
Impinger 6	—
Total	14.4 = V_w

P_b	29.31	$\%CO_2$	0.0
V_m	27600	$\%O_2$	20.8
V_w	14.4	%CO	0.0
P_m	1.671	$\%N_2$	79.2
Avg ΔP	1.525	A_s	969
Avg $\sqrt{\Delta P}$	1.229	D_n	0.190
C_p	0.803	T_t	36
P_s	-10.2 "H_2O	28.56	"Hg
T_m	59 °F	519	°R
T_s	141 °F	601	°R

Moisture Content: %M = 2.40 M_d = 0.9760 MW_d = 28.832 MW = 28.57

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 27600 \left(\frac{29.31 + \frac{1.671}{13.6}}{59 + 460}\right) = 27626 \text{ sft}^3$$

6.767 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 14.4 = 0.680 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.680}{27.600 + 0.680} \times 100 = 2.40\ \%$$

$$V_s = 5123.8 \times 0.803 \sqrt{\frac{601}{28.57 \times 28.56}} \times 1.229 = 4340 \text{ fpm}$$

ACFM: 29,203

SCFM: 23,991

%EA: —

$$\%I = \frac{1039 \times 27.626 \times 601}{0.9760 \times 28.56 \times 4340 \times 36 \times (0.190)^2} = 109.7\ \%$$

Run No. 1

Location Electric Arc Furnace

Date 4 OCT 1988

PARTICULATE FIELD DATA

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	P_m Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	T_s Probe Temp. °F	T_s Oven Temp. °F	T_s Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	T_m Dry Gas Temp. °F Outlet	Remarks
7			1.50				141						
6			1.70				141						
5			1.70				140						
4			1.60				139						
3			1.65				137						
2			1.40				133						
1			1.10				~~128~~ 135						
END			—				—						
All													

MU[illegible]S F[illegible]RON[illegible]AL [illegible]INC[illegible].,

Job No. 88-141

Job Name Demetco

Run No. 2

Location Electric Arc Furnace

Date 4 OCT 1988

Operator DRR, Mullins

Sample Box No. 3 Meter Box No. 4

Sulfur Dioxide FIELD DATA

Read and record at the start of each test point.

Purge to: 237.119

Purge time: 1056 - 1111

Ambient Temp. °F 64

Assumed Moisture % 2

Probe Length 3'

C Factor 10.0 — to reference

Initial Leak @ 17.0 "Hg = 0.000 cfm

Final Leak @ 10.0 "Hg = 0.000 cfm

			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	
B-12	1018	203.049	1.20	1.20	1.20	6.5	134	248	232	65	69	62	
11	1021	209.82	1.30	1.30	1.30	7.0	136	242	236	56	67	63	
10	1024	206.77	1.25	1.25	1.25	7.0	133	241	232	55	68	63	
9	1027	208.81	1.15	1.15	1.15	7.0	132	240	230	54	69	63	
8	1030	210.54	1.20	1.20	1.20	7.0	131	238	230	54	70	63	
7	1033	212.51	1.40	1.40	1.40	7.0	130	248	261	53	72	63	GRAB
6	1036	214.50	1.70	1.70	1.70	9.0	131	256	262	52	73	64	ORSAT
5	1039	216.61	1.70	1.70	1.70	9.0	129	251	270	53	75	65	
4	1042	218.74	1.60	1.60	1.60	9.0	128	245	267	53	76	65	
3	1045	220.97	1.50	1.50	1.50	9.0	126	242	271	53	76	66	
2	1048	223.01	1.50	1.50	1.50	8.8	129	237	256	54	77	66	
1	1051	225.20	1.90	1.90	1.90	7.5	125	245	259	54	77	66	
END	1054	227.376	—	—	—	—	—	—	—	—	—	—	
A-12			1.45				125						
11			1.55				125						
10			1.60				127						
9			1.60				127						
8			1.60				128						

D-5

Pitot Tube Calibration Factor C_p 0.803

Volume Collected V_m 25.446 ft^3 Baro. Press. P_b 29.31 "Hg

Water Collected V_w 6.5 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 36 min. % CO_2 0.4 % CO 0.0

Stack Pressure P_s -1.45 "H_2O % O_2 20.6 % N_2 79.0

Area Stack A_s 969 in^2

Pitot Tube No. 1 Barometer No. —

Probe Tip No. II-11

V_m = Dry Gas Meter Calibration Factor 1.046 X 24.327

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

M_F = ____ M_T = ____

Impinger Box No. 3

			Water Weight Gain	
Impinger 1	Final Weight	650.2		Impinger 1 -29.8
	Initial Weight	680.0		
	Increase	-29.8		Impinger 2 25.2
Impinger 2	Final Weight	752.8		Impinger 3 5.3
	Initial Weight	727.6		
	Increase	25.2		Impinger 4 0
Impinger 3	Final Weight	687.6	V_w =	Impinger 5 5.8
	Initial Weight	682.3	g SO_2 = -	
	Increase	5.3	V_w =	Impinger 6 —
Impinger 4	Final Weight	473.4		Total 6.5 = V_w
	Initial Weight	473.4		
	Increase	0	P_b = 29.31	$\%CO_2$ = 0.0
Impinger 5	Final Weight	863.2	V_m = 25.996	$\%O_2$ = 20.6
	Initial Weight	857.4	V_w = 6.5	%CO = 0.0
	Increase	5.8	P_m = 1.408	$\%N_2$ = 79.0
Impinger 6	Final Weight		Avg ΔP = 1.408	A_s = 969
	Initial Weight		Avg $\sqrt{\Delta P}$ = 1.185	D_n = 0.190
	Increase		C_p = ~~10.~~ 0.803	T_t = 36
Filter # —	Final Weight		P_s = -10.5 "H_2O	28.54 "Hg
	Initial Weight		T_m = 68 °F	528 °R
	Increase		T_s = 128 °F	588 °R

Moisture Content: %M = 1.21 M_d = 0.9879 MW_d = 28.888 MW = 28.76

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 25.446 \left(\frac{29.31 + \frac{1.408}{13.6}}{68 + 460} \right) = 25.019 \text{ sft}^3$$

$$0.695 \text{ scfm}$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 6.5 = 0.307 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.307}{25.019 + 0.307} \times 100 = 1.21\ \%$$

$$V_s = 5123.8 \times 0.803 \sqrt{\frac{588}{28.54 \times 28.76}} \times 1.185 = 4127 \text{ fpm}$$

ACFM: 27,769

SCFM: 23,586

$$\%I = \frac{1039 \times 25.019 \times 588}{0.9879 \times 28.54 \times 4127 \times 36 \times (0.190)^2} = 101.1\ \%$$

%EA: —

Run No. 2

PARTICULATE FIELD DATA

Location Electric Arc Furnace

Date 4 OCT, 1988

			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	
7			1.45				128						
6			1.35				129						
5			1.30				128						
4			1.25				129						
3			1.30				129						
2			1.25				126						
1			1.20				126						
End			—				—						
ALL													

MUI S E ONM AL ING ..., I...

Job No. 88-141 — Sulfur Dioxide FIELD DATA

Job Name Ouemahoo

Run No. 3

Location Electric Arc Furnace

Date 4 OCT 1988

Operator ORL, Mullins

Sample Box No. 2 Meter Box No. 4

Read and record at the start of each test point.

Purge to: 272-320

Purge time: 1209-1224

Ambient Temp. °F 66

Assumed Moisture % 2.0

Probe Length 3'

C Factor — 10 to reference

Initial Leak @ 16.0 "Hg = 0.000 cfm

Final Leak @ 6.0 "Hg = 0.000 cfm

			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
A-12	1132	237.587	1.50	1.50	1.50	4.0	129	274	244	63	72	65	
11	1135	240.01	1.70	1.70	1.70	4.5	130	246	245	56	74	70	
10	1138	241.82	1.70	1.70	1.70	4.6	131	239	245	55	76	70	
9	1141	244.12	1.70	1.70	1.70	5.0	132	234	245	54	77	70	
8	1144	246.42	1.60	1.60	1.60	5.0	131	232	245	55	78	70	
7	1147	248.62	1.50	1.50	1.50	4.5	132	233	247	56	79	70	GRABS OK SAT
6	1150	250.74	1.50	1.50	1.50	4.5	132	247	248	56	80	72	
5	1153	252.83	1.40	1.40	1.40	4.5	132	256	249	57	80	71	
4	1156	254.93	1.45	1.45	1.45	4.5	131	259	250	58	80	71	
3	1159	257.10	1.40	1.40	1.40	4.5	131	262	250	58	81	71	
2	1202	259.08	1.40	1.40	1.40	4.5	129	259	255	60	81	72	
1	1205	261.11	1.15	1.15	1.15	4.0	129	260	255	60	81	72	
END	1208	263.000	—	—	—	—	—	—	—	—	—	—	
B-12			1.05				133						
11			1.05				133						
10			1.05				134						
9			0.96				135						
8			1.00				136						

D-8

Pitot Tube Calibration Factor C_p 0.803

Volume Collected V_m 26.582 ft^3 Baro. Press. P_b 29.31 "Hg

Water Collected V_w 5.0 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 36 min. % CO_2 0.4 % CO 0.0

Stack Pressure P_s -11.3 "H_2O % O_2 20.4 % N_2 79.2

Area Stack A_s 969 in^2

Pitot Tube No. 1 Barometer No. —

Probe Tip No. T-11

V_m = Dry Gas Meter Calibration Factor 1.096 X 25.413

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

M_F = ____ M_T = ____

Impinger Box No. 2

			Water Weight Gain	
Impinger 1	Final Weight	618.0		Impinger 1 -29.0
	Initial Weight	647.0		
	Increase	-29.0		Impinger 2 29.7
Impinger 2	Final Weight	692.3		Impinger 3 3.5
	Initial Weight	667.6		
	Increase	24.7		Impinger 4 0.0
			V_w =	
Impinger 3	Final Weight	694.7	g SO_2 = -	Impinger 5 5.8
	Initial Weight	691.2	V_w =	
	Increase	3.5		Impinger 6 ---
Impinger 4	Final Weight	486.5		Total 5.0 = V_w
	Initial Weight	486.5		
	Increase	0.0		
Impinger 5	Final Weight	~~811.0~~ 816.8		
	Initial Weight	~~816.8~~ 811.0		
	Increase	5.8		
Impinger 6	Final Weight			
	Initial Weight			
	Increase			

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b =	29.31	$\%CO_2$ =	0.9	
V_m =	26.582	$\%O_2$ =	20.4	
V_w =	5.0	%CO =	0.0	
P_m =	1.500	$\%N_2$ =	79.2	
Avg ΔP =	1.384	A_s =	969	
Avg $\sqrt{\Delta P}$ =	1.172	D_n =	0.190	
C_p =	0.803	T_t =	36	
P_s =	-11.3 "H_2O	28.48	"Hg	
T_m =	74 °F	534	°R	
T_s =	132 °F	592	°R	

Moisture Content: %M = 0.90 M_d = 0.9910 MW_d = 28.880 MW = 28.78

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 26.582 \left(\frac{29.31 + \frac{1.500}{13.6}}{74 + 460}\right) = 25.849\ sft^3$$

$$0.718\ scfm$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 5.0 = 0.236\ sft^3$$

$$\%\ Moisture = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.236}{25.849 + 0.236} \times 100 = 0.90\ \%$$

$$V_s = 5123.8 \times 0.803 \sqrt{\frac{592}{28.48 \times 28.78}} \times 1.172 = 4098\ fpm$$

ACFM: 27,577

SCFM: 23,286

$$\%I = \frac{1039 \times 25.849 \times 592}{0.9910 \times 28.48 \times 4098 \times 36 \times (0.190)^2} = 105.8\ \%$$

%EA: ---

Run No. 3

Location Electric Arc Furnace

Date 4 Oct 1988.

PARTICULATE FIELD DATA

			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	
7			1.30				137						
6			1.60				137						
5			1.50				136						
4			1.50				136						
3			1.55				135						
2			1.30				129						
1			1.35				129						
End			—				—						
Air													

MUI S E ONM AL ING , I

Job No. 88-141 Particulate, Vb FIELD DATA

Job Name Quemetco

Run No. 4

Location Electric Arc Furnace Duct

Date 4 Oct 1988

Operator Orr, Mullins

Sample Box No. 3 Meter Box No. 4

Read and record at the start of each test point.

Purge to: —

Purge time: —

Ambient Temp. °F 66

Assumed Moisture % 2

Probe Length 3'

C Factor — 10.0 to reference

Initial Leak @ 16.0 "Hg = 0.000 cfm

Final Leak @ 9.8 "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 (T_m)	Oven Temp. °F (T_m)	Effluent Temp. °F (T_m)	Dry Gas Temp. °F (T_m)		Remarks
				Desired	Actual						Inlet	Outlet	
B-12	1351	272.555	1.20	1.20	1.20	6.5	139	235	252	61	72	72	
11	1354	274.42	1.20	1.20	1.20	6.5	140	234	250	57	73	72	
10	1357	276.23	1.10	1.10	1.10	6.5	140	228	253	55	74	72	
9	1400	278.36	1.05	1.05	1.05	6.0	140	227	241	55	75	72	Inlet
8	1403	280.14	1.05	1.05	1.05	6.0	141	244	247	56	75	73	ORSAT
7	1406	281.72	1.05	1.05	1.05	6.0	140	252	253	56	76	73	
6	1409	283.44	1.45	1.45	1.45	7.5	140	257	257	56	77	73	
5	1412	285.40	1.40	1.40	1.40	7.5	140	260	262	55	78	73	
4	1415	287.52	1.30	1.30	1.30	7.5	140	262	270	55	79	73	
3	1418	289.43	1.30	1.30	1.30	7.2	139	268	257	55	79	73	
2	1421	291.53	1.15	1.15	1.15	7.0	137	250	240	57	80	73	
1	1424	293.41	1.05	1.05	1.05	6.5	137	244	253	57	80	74	
End	1427	295.255	—	—	—	—	—	—	—	—	—	—	
A-12	1430	295.255	1.45	1.45	1.45	7.0	143	251	243	62	78	74	
11	1433	297.24	1.55	1.55	1.55	7.0	143	250	247	57	79	74	
10	1436	298.96	1.60	1.60	1.60	7.3	143	252	245	58	80	74	
9	1439	301.63	1.50	1.50	1.50	7.4	145	251	245	59	80	74	
8	1442	303.83	1.50	1.50	1.50	7.7	145	251	246	60	81	74	

Pitot Tube Calibration Factor C_p 0.803

Volume Collected V_m 48.850 ft^3

Water Collected V_w 10.8 ml

Time of Test T_t 72 min.

Stack Pressure P_s -11.2 "H_2O

Baro. Press. P_b 29.31 "Hg

Probe Tip Dia. D_n 0.190 in.

% CO_2 0.5 % CO 0.0

% O_2 20.4 % N_2 79.1

Area Stack A_s 969 in^2

Pitot Tube No. 1 Barometer No. —

Probe Tip No. II-11

V_m = Dry Gas Meter Calibration Factor 1.046 X 46.702 / 47.015

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

M_F = ____ M_T = ____

Impinger Box No. 3

Impinger 1	Final Weight	608.6
	Initial Weight	610.2
	Increase	-1.6
Impinger 2	Final Weight	626.7
	Initial Weight	623.7
	Increase	3.0
Impinger 3	Final Weight	685.3
	Initial Weight	684.1
	Increase	1.2
Impinger 4	Final Weight	474.6
	Initial Weight	474.3
	Increase	0.3
Impinger 5	Final Weight	870.7
	Initial Weight	862.8
	Increase	7.9
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # _____ Final Weight _____ Initial Weight _____ Increase _____

Water Weight Gain

V_w =

g SO_2 = -_____

V_w =

Impinger 1	-1.6
Impinger 2	3.0
Impinger 3	1.2
Impinger 4	0.3
Impinger 5	7.9
Impinger 6	-
Total	10.8 = V_w

P_b =	29.31	$\%CO_2$ =	0.5
V_m =	48.850	$\%O_2$ =	20.4
V_w =	10.8	%CO =	0.0
P_m =	1.256	$\%N_2$ =	79.1
Avg ΔP =	1.256	A_s =	0.969
Avg $\sqrt{\Delta P}$ =	1.118	D_n =	0.190
C_p =	0.802	T_t =	72
P_s =	-11.2 "H_2O	28.49	"Hg
T_m =	~~142~~ 76 °F	536	°R
T_s =	142 °F	602	°R

Moisture Content: %M = 1.07 M_d = 0.9893 MW_d = 28.896 MW = 28.78

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 48.850 \left(\frac{29.31 + \frac{1.256}{13.6}}{76 + 460} \right) = 47.296 \text{ sft}^3$$

$$0.657 \text{ scfm}$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 10.8 = 0.510 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.510}{47.296 + 0.510} \times 100 = 1.07\ \%$$

$$V_s = 5123.8 \times 0.503 \sqrt{\frac{602}{28.49 \times 28.78}} \times 1.118 = 3941 \text{ fpm}$$

ACFM: 26,523

SCFM: 21,992

$$\%I = \frac{1039 \times 47.296 \times 602}{0.9893 \times 28.49 \times 3941 \times 72 \times (0.190)^2} = 102.5\ \%$$

%EA: —

Run No. 4

PARTICULATE FIELD DATA

Location Electric Arc Furnace Duct

Date 4 Oct, 1988

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	P_m Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	T_s Probe Temp. °F	T_s Oven Temp. °F	T_s Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	T_m Dry Gas Temp. °F Outlet	Remarks
7	1445	305.85	1.45	1.45	1.45	8.2	145	251	248	60	81	74	
6	1448	307.96	1.30	1.30	1.30	7.5	144	252	246	61	81	74	
5	1451	309.92	1.30	1.30	1.30	7.3	144	254	252	61	81	74	
4	1454	311.93	1.05	1.05	1.05	6.5	142	253	251	63	81	75	
3	1457	313.82	1.10	1.10	1.10	6.5	145	259	254	64	81	74	
2	1500	315.66	1.05	1.05	1.05	6.5	145	262	255	65	81	74	
1	1503	317.96	1.00	1.00	1.00	6.2	139	262	254	66	80	74	
END	1506	319.257	—	—	—	—	—	—	—	—	—	—	
1&2													

MULTIPLE ENVIRONMENTAL TESTING, INC.

Job No. 88-141 — Particulate/PM5 FIELD DATA

Job Name Questa

Run No. 5

Location Electric Arc Furnace Duct

Date 4 OCT 1988

Operator DRR, Mullins

Sample Box No. #2 Meter Box No. 4

Read and record at the start of each test point.

Purge to: —

Purge time: —

Ambient Temp. °F 76

Assumed Moisture % 20

Probe Length 3'

C Factor — 10.0 to reference

Initial Leak @ 18.0 "Hg = 0.000 cfm

Final Leak @ 6.5 "Hg = 0.004 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 (P_m) Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F (T_m)	Oven Temp. °F (T_m)	Effluent Temp. °F (T_m)	Dry Gas Temp. °F (T_m) Inlet	Dry Gas Temp. °F (T_m) Outlet	Remarks
A-12	1606	319.726	1.50	1.50	1.50	4.0	145	254	265	64	70	71	
11	1609	321.83	1.65	1.65	1.65	4.0	145	232	262	67	70	71	
10	1612	324.25	1.60	1.60	1.60	4.0	146	247	265	64	71	71	Inlet
9	1615	326.28	1.60	1.60	1.60	4.5	146	249	271	62	72	71	OKSAT
8	1618	328.36	1.60	1.60	1.60	4.5	145	251	273	63	73	71	
7	1621	330.52	1.50	1.50	1.50	4.5	146	255	271	64	74	71	
6	1624	332.67	1.40	1.40	1.40	4.5	144	256	265	66	75	71	
5	1627	334.82	1.35	1.35	1.35	4.0	143	256	257	66	76	70	
4	1630	336.74	1.40	1.40	1.40	4.0	141	256	252	67	76	70	
3	1633	338.73	1.40	1.40	1.40	4.5	139	257	249	67	76	70	
2	1636	340.93	1.25	1.25	1.25	4.0	138	254	243	67	77	71	
1	1639	342.14	1.20	1.20	1.20	4.0	137	252	239	67	77	70	
END	1642	344.687	—	—	—	—	—	—	—	—	—	—	
B-12	1644	344.687	1.05	1.05	1.05	4.0	141	264	232	67	75	70	
11	1647	346.61	1.05	1.05	1.05	4.0	142	248	258	66	76	70	
10	1650	348.47	1.15	1.15	1.15	4.0	143	251	265	66	76	70	
9	1653	350.09	1.15	1.15	1.15	4.0	144	245	271	65	76	70	
8	1656	350.05	1.10	1.10	1.10	4.0	145	250	275	65	76	70	

Pitot Tube Calibration Factor C_p 0803

Volume Collected V_m 50.730 ft^3 Baro. Press. P_b 29.34 "Hg

Water Collected V_w 8.6 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 72 min. % CO_2 0.6 % CO 0.0

Stack Pressure P_s -10.8 "H_2O % O_2 20.4 % N_2 79.0

Area Stack A_s 969 in^2

Pitot Tube No. 1 Barometer No. —

Probe Tip No. TT-11

V_m = Dry Gas Meter Calibration Factor 1.046 X 98.999

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

M_F = ____ M_T = ____

Impinger Box No. 2

Impinger 1	Final Weight 575.8	Water Weight Gain	Impinger 1 -3.2
	Initial Weight 579.0		
	Increase -3.2		Impinger 2 1.9
Impinger 2	Final Weight 567.0		Impinger 3 2.2
	Initial Weight 565.1		
	Increase 1.9		Impinger 4 0.0
Impinger 3	Final Weight 684.3	V_w =	Impinger 5 7.7
	Initial Weight 682.1	g SO_2 = -	
	Increase 2.2	V_w =	Impinger 6 -
Impinger 4	Final Weight 486.2		Total 8.6 = V_w
	Initial Weight 486.2		
	Increase 0.0	P_b = 29.34	$\%CO_2$ = 0.6
Impinger 5	Final Weight 824.9	V_m = 50.730	$\%O_2$ = 20.4
	Initial Weight 817.2	V_w = 8.6	%CO = 0.0
	Increase 7.7	P_m = 1.363	$\%N_2$ = 79.0
Impinger 6	Final Weight	Avg ΔP = 1.363	A_s = 969
	Initial Weight	Avg $\sqrt{\Delta P}$ = 1.165	D_n = 0.190
	Increase	C_p = 0.803	T_t = 36 72
Filter #	Final Weight	P_s = -1.8 "H_2O	28.55 "Hg
	Initial Weight	T_m = 73 °F	533 °R
	Increase	T_s = 142 °F	602 °R

Moisture Content: %M = 0.81 M_d = 0.9919 MW_d = 28.912 MW = 28.82

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times \frac{50.730}{29.34} \left(\frac{29.34 + \frac{1.363}{13.6}}{73 + 460}\right) = \frac{49.456}{7} \text{ sft}^3$$

$$\frac{0.687}{} \text{ scfm}$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 8.6 = 0.406 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.406}{49.456 + 0.406} \times 100 = 0.81 \%$$

$$V_s = 5123.8 \times 0.803 \sqrt{\frac{602}{28.55 \times 28.82}} \times 1.165 = 4100 \text{ fpm}$$

ACFM: 27,589

SCFM: 22,987

$$\%I = \frac{1039 \times 49.456 \times 602}{0.9919 \times 28.55 \times 4100 \times 72 \times (0.190)^2} = 102.50 \%$$

%EA: —

Run No. 5

PARTICULATE FIELD DATA

Location Electric Arc Furnace Duct

Date 4 OCT 1988

			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	
7	1659	353.90	1.35	1.35	1.35	4.5	144	255	255	64	77	70	
6	1702	355.85	1.60	1.60	1.60	5.0	144	255	250	64	77	71	
5	1705	357.95	1.50	1.50	1.50	4.8	142	255	238	63	77	70	
4	1708	360.11	1.45	1.45	1.45	5.0	140	251	263	63	78	76	
3	1711	362.40	1.35	1.35	1.35	4.5	140	253	271	62	78	70	
2	1714	364.29	1.30	1.30	1.30	4.5	137	253	266	62	78	70	
1	1717	366.23	1.20	1.20	1.20	4.4	138	251	254	63	77	70	
END ALL	1720	368.225	—	—	—	—	—	—	—	—	—	—	

M[illegible]NS [illegible]ROI[illegible]TAL [illegible]TIN[illegible]., .

Job No. 88-141

Job Name Gwe meteo Furnace Out

Run No. 6

Location Electric Arc

Date 9 OCT 1988

Operator ORR, Mullins

Sample Box No. 13 Meter Box No. 4

Particulate, Pb FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

Ambient Temp. °F 65

Assumed Moisture % 2.0

Probe Length 3'

C Factor _____ 1/8' to reference

Initial Leak @ 17.0 "Hg = 0.000 cfm

Final Leak @ 19.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot ΔP_s in. H_2O	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	Stack Temp. T_s °F	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. T_m °F Inlet	Dry Gas Temp. T_m °F Outlet	Remarks
D-12	1800	368.584	1.20	1.20	1.20	10.0	134	230	248	62	67	68	
11	1804	370.51	1.30	1.30	1.30	10.5	136	239	245	58	68	68	Inlet
10	1807	372.35	1.30	1.30	1.30	10.5	136	242	247	56	68	68	ORSAT
9	1810	374.15	1.20	1.20	1.20	10.0	135	241	248	55	68	67	
8	1813	376.00	1.25	1.25	1.25	10.5	136	242	256	54	69	67	
7	1816	378.21	1.40	1.40	1.40	11.8	134	243	250	54	69	67	
6	1819	379.83	1.65	1.65	1.65	12.4	133	243	249	53	70	68	
5	1822	381.84	1.45	1.45	1.45	11.9	130	240	262	54	71	67	
4	1825	383.89	1.50	1.50	1.50	13.0	129	244	270	54	71	67	
3	1828	386.05	1.50	1.50	1.50	13.0	126	245	271	54	71	67	
2	1831	388.08	1.50	1.50	1.50	13.0	130	245	270	54	72	67	
1	1834	389.67	1.20	1.20	1.20	11.5	128	248	259	54	72	67	
END	1837	391.850		—	—	—	—	—	—	—	—	—	
A-12	1839	391.950	1.50	1.50	1.50	12.0	130	258	266	57	70	67	
11	1842	394.08	1.70	1.70	1.70	14.5	130	260	247	56	70	67	
10	1845	395.91	1.70	1.70	1.70	14.5	131	259	248	56	69	66	
9	1848	398.14	1.65	1.65	1.65	14.0	132	258	242	54	69	64	
8	1851	400.81	1.70	1.70	1.70	15.5	132	261	239	55	71	64	

D-17

Pitot Tube Calibration Factor C_p 0803

Volume Collected V_m 50.753 ft^3

Water Collected V_w 10.3 ml

Time of Test T_t 72 min.

Stack Pressure P_s -10.8 "H_2O

Baro. Press. P_b 29.34 "Hg

Probe Tip Dia. D_n 0.190 in.

% CO_2 0.3 % CO 0.0

% O_2 20.6 % N_2 79.1

Area Stack A_s 969 in^2

Pitot Tube No. 1 Barometer No. —

Probe Tip No. II-11

V_m = Dry Gas Meter Calibration Factor 1.046 X 48.521

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

M_F = _____ M_T = _____

Impinger Box No. 13

			Water Weight Gain	
Impinger 1	Final Weight	585.5		Impinger 1 −3.8
	Initial Weight	589.3		
	Increase	−3.8		Impinger 2 4.1
Impinger 2	Final Weight	604.1		
	Initial Weight	600.0		Impinger 3 0.8
	Increase	4.1		
Impinger 3	Final Weight	683.8	V_w =	Impinger 4 0.0
	Initial Weight	683.0	g SO_2 = -	
	Increase	0.8	V_w =	Impinger 5 9.2
Impinger 4	Final Weight	496.1		Impinger 6 —
	Initial Weight	496.1		
	Increase	0.0		Total 10.3 = V_w
Impinger 5	Final Weight	889.9	P_b = 29.39	$\%CO_2$ = 0.3
	Initial Weight	880.7	V_m = 50.753	$\%O_2$ = 20.6
	Increase	9.2	V_w = 10.3	%CO = 0.0
Impinger 6	Final Weight		P_m = 1.438	$\%N_2$ = 79.1
	Initial Weight		Avg ΔP = 1.438	A_s = 965
	Increase		Avg $\sqrt{\Delta P}$ = 1.196	D_n = 0.190
Filter # —	Final Weight		C_p = 0.803	T_t = 72
	Initial Weight		P_s = −10.8 "H_2O	28.55 "Hg
	Increase		T_m = 68 °F	528 °R
			T_s = 131 °F	591 °R

Moisture Content: %M = 0.96 M_d = 0.9904 MW_d = 28.872 MW = 28.77

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 50.753 \left(\frac{29.34 + \frac{1.438}{13.6}}{68 + 460} \right) = 49.957 \text{ sft}^3$$

$$0.694 \text{ scfm}$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 10.3 = 0.486 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.486}{49.957 + 0.486} \times 100 = 0.96\ \%$$

$$V_s = 5123.8 \times 0.803 \sqrt{\frac{591}{28.55 \times 28.77}} \times 1.196 = 4174 \text{ fpm}$$

ACFM: 28,088

SCFM: 23,802

$$\%I = \frac{1039 \times 49.957 \times 591}{0.9904 \times 28.55 \times 4174 \times 72 \times (0.190)^2} = 100.0\ \%$$

%EA: —

Run No. 6

PARTICULATE FIELD DATA

Location Electric Arc Furnace Duct

Date 4 OCT 1988

			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	
7	1854	402.44	1.60	1.60	1.60	15.0	132	261	238	55	71	66	
6	1857	404.58	1.50	1.50	1.50	14.8	131	262	236	55	71	66	
5	1900	407.06	1.45	1.45	1.45	14.5	130	262	236	56	71	66	
4	1903	408.97	1.50	1.50	1.50	14.8	129	265	235	56	71	66	
3	1906	411.13	1.50	1.50	1.50	14.8	127	264	233	56	71	66	
2	1909	413.22	1.20	1.20	1.20	13.5	128	229	232	56	71	66	
1	1912	415.27	1.05	1.05	1.05	10.7	129	231	237	56	71	66	
END ALL	1915	417.105	—	—	—	—	—	—	—	—	—	—	

MU IS E RONI AL ING ..., ...

Job No. 88-191 — SO_2 FIELD DATA

Job Name Quemetco Inc

Run No. 2

Location Reverb Stack

Date 11ø Oct. 1988

Operator ORe Mullins

Sample Box No. 3 Meter Box No. ~~4~~ 2

Read and record at the start of each test point.

Purge to: 305.298

Purge time: 0810 - 0825

Ambient Temp. °F 45

Assumed Moisture % 8.0

Probe Length 5'

C Factor _____ — _____ to reference

Initial Leak @ 16.5 "Hg = 0.005 cfm

Final Leak @ 6.0 "Hg = 0.002 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O (ΔP_s)	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge (P_m)	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 (T_m) Outlet	Remarks
B-6	~~0736~~ 0735	292.800	0.87	0.22	0.22	3.0	202	261	238	98	98	98	
5	0740	294.09	1.30	0.32	0.32	3.3	209	258	268	66	~~98~~	98	
4	0745	295.52	1.30	0.32	0.32	3.3	209	232	271	68	49	51	
3	0750	297.09	1.10	0.28	0.28	3.0	202	246	252	71	52	55	Clean
2	0755	298.37	1.15	0.29	0.29	3.0	190	247	248	70	55	59	Dust
1	0800	299.82	0.86	0.22	0.22	3.0	186	250	254	75	57	61	
END	0805	301.090	—	—	—	—	—	—	—	—	—	—	
A-6			0.76				192						
5			1.00				198						
4			1.20				301 ~~304~~						
3			1.30										
2			1.20				205						
1			0.88				205						
END			—				—						
ALL													

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 8.481 ft^3 Baro. Press. P_b 29.09 "Hg

Water Collected V_w 11.7 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 30 min. % CO_2 2.4 % CO 0.0

Stack Pressure P_s + 0.84 "H_2O % O_2 19.1 % N_2 78.5

Area Stack A_s 2430 in^2

Pitot Tube No. 5 Barometer No. —

Probe Tip No. TT-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 8.290

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

M_F = _____ M_T = _____

Impinger Box No. 3

Impinger 1	Final Weight	681.7
	Initial Weight	683.9
	Increase	-2.2
Impinger 2	Final Weight	742.7
	Initial Weight	733.2
	Increase	9.5
Impinger 3	Final Weight	686.3
	Initial Weight	684.3
	Increase	2.0
Impinger 4	Final Weight	473.7
	Initial Weight	473.6
	Increase	0.1
Impinger 5	Final Weight	785.3
	Initial Weight	782.5
	Increase	2.8
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # _____ Final Weight _____ Initial Weight _____ Increase _____

Water Weight Gain

V_w = 12.0 (2)

g SO_2 = -0.5

V_w = 11.7

Impinger 1	-2.2
Impinger 2	9.5
Impinger 3	2.0
Impinger 4	0.1
Impinger 5	2.8
Impinger 6	~~3.8~~ -
Total	~~43~~ 12.2 = V_w

P_b	= 29.09	$\%CO_2$	= 2.9
V_m	= 8.981	$\%O_2$	= 19.1
V_w	= 11.7	%CO	= 0.0
P_m	= 0.275	$\%N_2$	= 78.5
Avg ΔP	= 1.077	A_s	= 2430
Avg $\sqrt{\Delta P}$	= 1.034	D_n	= 0.190
C_p	= ~~0.~~805	T_t	= 30
P_s	= 30.24 "H_2O	29.15	"Hg
T_m	= 53 °F	513	°R
T_s	= 199 °F	659	°R

Moisture Content: %M = 6.35 (10) M_d = 0.9365 (90) MW_d = 29.148 MW = ~~28.44~~ (7)

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 8.981 \left(\frac{29.09 + \frac{0.275}{13.6}}{53 + 460}\right) = 8.494\ \text{sft}^3$$

0.283 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times \frac{11.7}{12} = \frac{0.552}{0.576}\ \text{sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.552}{8.494 + 0.552} \times 100 = 6.35\ (10)\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{659}{29.15 \times 28.44}} \times 1.034 = 3802\ (0)\ \text{fpm}$$

(7)

ACFM: 64,167 (33)

SCFM: 47,074 (175)

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

%EA: 1121.9

Job No. 88-141 — SO2 FIELD DATA

Job Name Quametco, Inc.

Run No. 3

Location Reverb Stack

Date 11 Oct 1988

Operator Orr, Mullins

Sample Box No. 2 Meter Box No. ~~4~~ 2

Read and record at the start of each test point.

Purge to: 319520

Purge time: 0919 - 0929

MULLINS ENVIRONMENTAL TESTING

Ambient Temp. °F 63

Assumed Moisture % 8.0

Probe Length 5'

C Factor — to reference

Initial Leak @ 17.0 "Hg = 0.008 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 Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge (P_m)	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F Inlet (T_m)	Dry Gas Temp. °F Outlet (T_m)	Remarks
A-6	0843	306.218	0.78	0.18	0.18	2.5	196	244	259	57	63	69	
5	0848	307.65	1.10	0.28	0.28	2.8	190	241	265	59	63	68	
4	0853	309.02	1.25	0.31	0.31	28.	188	239	261	63	65	69	Grab
3	0858	310.51	1.30	0.33	0.33	2.8	195	248	271	63	64.7	69	ORSAT
2	0903	312.07	1.25	0.32	0.32	2.5	193	249	253	64	68	73	
1	0908	313.59	0.85	0.21	0.21	2.0	198	261	247	63	70	74	
End	0913	314.795	—	—	—	—	—	—	—	—	—	—	
B-6			0.94				193						
5			1.35				193						
4			1.40				196						
3			1.30				198						
2			1.25				198						
1			0.88				199						
End			—	—	—	—	—	—	—	—	—	—	
All													

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 8.774 ft^3 Baro. Press. P_b 29.09 "Hg

Water Collected V_w 9.4 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 30 min. % CO_2 26 % CO 0.0

Stack Pressure P_s -0.85 "H_2O % O_2 19.4 % N_2 78.0

Area Stack A_s 2430 in^2

Pitot Tube No. 5 Barometer No. —

Probe Tip No. II-11

V_m = Dry Gas Meter Calibration Factor 1.046 (23) X 8.577

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

M_F = ____ M_T = ____

Impinger Box No. 2

			Water Weight Gain	
Impinger 1	Final Weight	648.4		Impinger 1 −3.9
	Initial Weight	652.3		
	Increase	−3.9		Impinger 2 51.6
Impinger 2	Final Weight	724.9		Impinger 3 −40.9
	Initial Weight	673.3		
	Increase	51.6		Impinger 4 0.3
Impinger 3	Final Weight	649.3	V_w = 9.7	Impinger 5 2.6
	Initial Weight	690.2	g SO_2 = −0.3	
	Increase	−40.9	V_w = 9.4	Impinger 6 —
Impinger 4	Final Weight	485.4		Total 9.7 = V_w
	Initial Weight	485.1		
	Increase	0.3	P_b = 29.09	$\%CO_2$ = 2.6
Impinger 5	Final Weight	807.4	V_m = 8.774	$\%O_2$ = 19.4
	Initial Weight	804.8	V_w = 9.4	%CO = 0.0
	Increase	2.6	P_m = 0.271	$\%N_2$ = 78.0
Impinger 6	Final Weight		Avg ΔP = 1.138	A_s = 2430
	Initial Weight		Avg $\sqrt{\Delta P}$ = 1.062	D_n = 0.190
	Increase		C_p = 0.805	T_t = 30
Filter #	Final Weight		P_s = +0.45 "H_2O	29.15 "Hg
	Initial Weight		T_m = 68 °F	528 °R
	Increase		T_s = 195 °F	655 °R

Moisture Content: %M = 5.09 (4.94) M_d = 0.9491 (0.9506) MW_d = 29.192 MW = 28.62 (4.)

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 8.774 \left(\frac{29.09 + \frac{0.272}{13.6}}{68 + 460}\right) = 0.538\ \text{sft}^3$$

0.285 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 9.7\ (9.4) = 0.458\ (44)\ \text{sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.458\ (44)}{8.538 + 0.458\ (44)} \times 100 = 5.09\ (4.94)\ \%$$

$$I_s = 5123.8 \times 0.805 \sqrt{\frac{655}{29.15 \times 28.62}} \times 1.062 = 3886\ (0)\ \text{fpm}$$

ACFM: 65,497 (74) / 49061

SCFM: 48,996

%EA: 152.6

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

1.25 ΔH
1.14 ΔP

MU IS E RON AL 'ING

Job No. 88-141 — S_{02} FIELD DATA

Job Name Quemetco

Run No. 4

Location Reheat Stack

Date 11 OCT. 1988

Operator OER, Mullins

Sample Box No. 3 Meter Box No. 2

Read and record at the start of each test point.

Purge to: 332.757

Purge time: 1016 - 1031

Ambient Temp. °F 65

Assumed Moisture % 8.0

Probe Length 5'

C Factor ____ - ____ to reference

Initial Leak @ 15.0 "Hg = 0.000 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 Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge (P_m)	Stack Temp. °F (T_s)	Probe Temp. °F	Oven Temp. °F	Effluent Temp. °F	Dry Gas Temp. °F Inlet (T_m)	Dry Gas Temp. °F Outlet	Remarks
B 6	0944	319.56	0.90	0.23	0.23	2.0	211	241	237	61	70	76	
5	0949	320.95	1.30	0.32	0.32	2.5	214	258	241	64	70	75	
4	0954	322.52	1.25	0.31	0.31	2.6	215	252	246	68	71	76	
3	0959	324.02	1.25	0.31	0.31	3.0	217	241	255	71	72	77	Glass
2	1004	325.60	1.10	0.27	0.27	2.8	215	240	273	79	74	79	overt
1	1009	327.09	0.76	0.18	0.18	2.0	214	241	251	81	75	81	
END	1014	328.541	—	—	—	—	—	—	—	—	—		
A-6			0.85				181						
5			1.05				184						
4			1.30				185						
3			1.40				186						
2			1.40				186						
1			0.96				186						
END			—				—						
AM													

Pitot Tube Calibration Factor C_p 0.305

Volume Collected V_m 8.987 ft^3 Baro. Press. P_b 29.09 "Hg

Water Collected V_w 10.1 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 30 min. % CO_2 2.5 % CO 0.0

Stack Pressure P_s +0.82 "H_2O % O_2 19.4 % N_2 78.1

Area Stack A_s 2430 in^2

Pitot Tube No. 5 Barometer No. ____

Probe Tip No. II-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 8.785

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

M_F = ____ M_T = ____

Impinger Box No. 3

Impinger 1	Final Weight	679.9
	Initial Weight	682.7
	Increase	-2.8
Impinger 2	Final Weight	740.1
	Initial Weight	731.1
	Increase	9.0
Impinger 3	Final Weight	684.8
	Initial Weight	683.0
	Increase	1.8
Impinger 4	Final Weight	474.5
	Initial Weight	474.1
	Increase	0.4
Impinger 5	Final Weight	787.1
	Initial Weight	785.3
	Increase	1.8
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

V_w = 10.2
g SO_2 = -0.1
V_w = 10.1

Impinger 1	-2.8
Impinger 2	9.0
Impinger 3	1.8
Impinger 4	0.4
Impinger 5	1.8
Impinger 6	-
Total	10.2 = V_w

P_b =	29.09	$\%CO_2$ =	2.5
V_m =	8.987	$\%O_2$ =	19.4
V_w =	10.1	%CO =	0.0
P_m =	0.270	$\%N_2$ =	78.1
Avg ΔP =	1.127	A_s =	2430
Avg $\sqrt{\Delta P}$ =	1.057	D_n =	0.190
C_p =	0.805	T_t =	30
P_s =	+0.83 "H_2O	29.15	"Hg
T_m =	75 °F	535	°R
T_s =	200 °F	660	°R

Moisture Content: %M = 5.28 M_d = 0.9472 MW_d = 29.176 MW = 28.59

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 8.987 \left(\frac{29.09 + \frac{0.270}{13.6}}{75 + 460} \right) = 8.631 \text{ sft}^3$$

0.288 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 10.8 = 0.481 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.481}{8.631 + 0.481} \times 100 = 5.28\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{660}{29.15 \times 29.59}} \times 1.057 = 3880 \text{ fpm}$$

ACFM: 65,472

SCFM: 48,545

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

%EA: 1496.3

Job No. 88-141

Job Name Quemetco Inc

Run No. 8

Location Reverb STACKS

Date 12 OCT 1988

Operator Orr, Mullins

Sample Box No. 13 Meter Box No. 2

Method 5 Train Pb FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

MULLINS ENVIRONMENTAL INC.,

Ambient Temp. °F 51

Assumed Moisture % 50

Probe Length 5'

C Factor — 10' to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 10.5 "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 (P_m) Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F (T_s)	Oven Temp. °F (T_s)	Effluent Temp. °F (T_s)	Dry Gas Temp. °F (T_m) Inlet	Dry Gas Temp. °F (T_m) Outlet	Remarks
B-6	1149	432.050	0.82	0.82	0.82	5.0	229	242	231	54	63	65	
5	1154	435.19	1.20	1.20	1.20	5.5	229	237	236	57	64	66	
4	1159	437.61	1.25	1.25	1.25	7.0	230	238	244	55	65	66	
3	1204	440.59	1.10	1.10	1.10	8.5	229	236	268	60	67	68	
2	1209	443.56	1.05	1.05	1.05	8.0	228	241	276	62	69	69	
1	1214	446.58	0.75	0.75	0.75	5.5	227	241	266	67	71	71	
END	1219	448.775	—	—	—	—	—	—	—	—	—	—	
A-6	1221	448.775	0.75	0.75	0.75	5.5	228	243	261	59	71	71	DRSAT
5	1226	451.11	0.96	0.96	0.96	6.5	227	247	265	60	72	72	
4	1231	453.69	1.10	1.10	1.10	7.0	228	243	271	57	72	73	
3	1236	456.91	1.15	1.20	1.20	7.5	229	241	261	57	73	75	CHANGE
2	1241	459.28	1.10	1.15	1.15	8.0	229	236	251	57	74	75	P.F
1	1246	462.20	0.84	0.88	0.88	6.0	228	233	258	61	75	75	
END	1251	464.715	—	—	—	—	—	—	—	—	—		
ALL													

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 32.598 ft^3 Baro. Press. P_b 29.39 "Hg

Water Collected V_w 51.4 ml Probe Tip Dia. D_n 0.160 in.

Time of Test T_t 60 min. % CO_2 2.9 % CO 0.0

Stack Pressure P_s +0.76 "H_2O % O_2 19.0 % N_2 78.1

Area Stack A_s 2430 in^2

Pitot Tube No. 5 Barometer No. —

Probe Tip No. 11-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 31.865

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

M_F = ____ M_T = ____

Impinger Box No. 13

			Water Weight Gain	
Impinger 1	Final Weight	634.0		Impinger 1 47.1
	Initial Weight	586.9		Impinger 2 157.2
	Increase	47.1		Impinger 3 -159.2
Impinger 2	Final Weight	754.9		Impinger 4 1.3
	Initial Weight	597.7		Impinger 5 5.0
	Increase	157.2		Impinger 6 -
Impinger 3	Final Weight	524.1	V_w =	
	Initial Weight	683.3	g SO_2 = -	Total 58.4 = V_w
	Increase	-159.2	V_w =	
Impinger 4	Final Weight	510.7		
	Initial Weight	509.4		
	Increase	1.3		
Impinger 5	Final Weight	902.4		
	Initial Weight	897.4		
	Increase	5.0		
Impinger 6	Final Weight			
	Initial Weight			
	Increase			

Filter # _____ Final Weight _____ Initial Weight _____ Increase _____

P_b =	29.39	$\%CO_2$ =	2.9	
V_m =	30.598	$\%O_2$ =	19.0	
V_w =	51.4	%CO =	0.0	
P_m =	1.018	$\%N_2$ =	78.1	
Avg ΔP =	1.006	A_s =	2430	
Avg $\sqrt{\Delta P}$ =	0.999 / 1.000	D_n =	0.190	
C_p =	0.805	T_t =	60	
P_s =	+0.76 "H_2O	29.45	"Hg	
T_m =	70 °F	530	°R	
T_s =	228 °F	688	°R	

Moisture Content: %M = 7.05 / 2.43 M_d = 0.9295 / 0.9757 MW_d = 29.224 MW = 28.43

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times \frac{32.598}{29.39} \left(\frac{29.39 + \frac{1.018}{13.6}}{530 / 70 + 460} \right) = 31.986\ \text{sft}^3$$

0.533 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 51.4 = 2.43\ \text{sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{2.43}{31.986 + 2.43} \times 100 = 7.06\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{688}{29.43 \times 29.45}} \times \frac{0.999}{1.000} = 3738\ \text{fpm}$$

ACFM: 6303 / 6317

SCFM: 4460

$$\%I = \frac{1039 \times 31.986 \times 688}{0.9295 \times 29.45 \times 60 \times 3738 \times (0.190)^2} = 103.2\ \%$$

%EA: 1120.0

Job No. 88-141
Job Name Queretaro
Run No. 9
Location Reheat Stack
Date 12 OCT 1988
Operator ORR Mullins
Sample Box No. 2 Meter Box No. 2

PAC Tiralabe PD FIELD DATA

Read and record at the start of each test point.

Purge to: —
Purge time:

MU IS E RON AL INC

Ambient Temp. °F 62
Assumed Moisture % 6.0
Probe Length 5
C Factor — 10.5 to reference
Initial Leak @17.0 "Hg = 0.004 cfm
Final Leak @9.1 "Hg = 0.000 cfm

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
A-6	1334	465.170	0.73	0.77	0.77	4.5	226	251	237	66	67	69	
5	1339	467.52	0.98	1.06	1.05	6.0	229	245	271	63	66	68	
4	1344	470.26	1.20	1.25	1.25	7.5	229	243	245	63	67	69	
3	1349	473.22	1.30	1.40	1.40	7.8	230	234	238	65	70	71	
2	1354	476.37	1.20	1.25	1.25	7.0	230	243	241	67	72	73	
1	1359	479.32	0.80	0.85	0.85	5.0	228	241	256	69	74	75	
End	1404	481.840	—	—	—	—	—	—	—	—	—		
B-6	1405	481.840	0.82	0.90	0.90	5.5	227	238	237	71	75	76	ORSAT
5	1410	484.37	1.10	1.15	1.15	6.0	229	263	262	70	75	77	
4	1415	487.17	1.15	1.20	1.20	6.5	230	264	271	68	76	78	
3	1420	490.21	1.10	1.15	1.15	6.5	231	261	259	65	77	79	
2	1425	492.29	1.05	1.10	1.10	6.0	231	268	247	67	74	80	
End	1430	495.78	0.80	0.84	0.84	5.0	223	255	298	69	78	80	
All	1435	498.223	—	—	—	—	—	—	—	—	—	—	

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 33.813 ft^3 Baro. Press. P_b 29.93 "Hg

Water Collected V_w 49.3 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 60 min. % CO_2 2.3 % CO 0.0

Stack Pressure P_s -0.84 "H_2O % O_2 19.5 % N_2 78.2

Area Stack A_s 2430 in^2

Pitot Tube No. 5 Barometer No. —

Probe Tip No. T-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 33.053

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

M_F = ____ M_T = ____

Impinger Box No. 2

			Water Weight Gain	
Impinger 1	Final Weight	605.6		Impinger 1 27.9 ✓
	Initial Weight	577.7		Impinger 2 4.5 ✓
	Increase	27.9 ✓		Impinger 3 10.4 ✓
Impinger 2	Final Weight	570.0		Impinger 4 0.6 ✓
	Initial Weight	565.5	V_w = C	Impinger 5 5.9 ✓
	Increase	4.5 ✓	g SO_2 = -	
Impinger 3	Final Weight	718.3	V_w =	Impinger 6 -
	Initial Weight	707.9		
	Increase	10.4 ✓		Total 49.3 ✓ = V_w
Impinger 4	Final Weight	486.5		
	Initial Weight	485.9	P_b = 29.93 ✓	$\%CO_2$ = 2.3 ✓
	Increase	0.6 ✓	V_m = 33.83 ✓	$\%O_2$ = 18.5 ✓
Impinger 5	Final Weight	820.9	V_w = 49.3 ✓	%CO = 0.0 ✓
	Initial Weight	815.0	P_m = 1.076 ✓	$\%N_2$ = 78.2 ✓
	Increase	5.9 ✓	Avg ΔP = 1.019 ✓	A_s = 2430 ✓
Impinger 6	Final Weight		Avg $\sqrt{\Delta P}$ = 1.005 ✓	D_n = 0.190 ✓
	Initial Weight		C_p = 0.805 ✓	T_t = 60 ✓
	Increase		P_s = +0.84 ✓ "H_2O	29.99 ✓ "Hg
Filter #	Final Weight		T_m = 74 ✓ °F	534 ✓ °R
	Initial Weight		T_s = 229 ✓ °F	689 ✓ °R
	Increase			

Moisture Content: %M = 6.59 ✓ M_d = 0.9341 ✓ MW_d = 29.148 ✓ MW = 28.41 ✓

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 33.813 \left(\frac{29.43 + \frac{1.076}{13.6}}{74 + 460} \right) = 32.979 \text{ sft}^3$$

0.549 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 49.3 = 2.327 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{2.327}{32.979 + 2.327} \times 100 = 6.59\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{689}{28.41 \times 29.99}} \times 1.005 = 3759 \text{ fpm}$$

ACFM: 6343C ✓

SCFM: 4991 9 ✓

$$\%I = \frac{1039 \times 32.979 \times 689}{0.9341 \times 29.99 \times 3759 \times 60 \times (0.190)^2} = 105.3\ \%$$

%EA: 1594.4 ✓

Job No. 88-141 — PART 1/Pb — FIELD DATA

Job Name Quemetco

Run No. 10

Location Reverb Stack

Date 12 OCT 1988

Operator ORR, Mullins

Sample Box No. 3 Meter Box No. 2

Read and record at the start of each test point.

Purge to: —

Purge time: —

MULLINS ENVIRONMENTAL TESTING CO., INC.

Ambient Temp. °F 61

Assumed Moisture % 50

Probe Length 5'

C Factor — 10.5 to reference

Initial Leak @ 17.2 "Hg = 0.000 cfm

Final Leak @ 9.0 "Hg = 0.000 cfm

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
B-6	1517	498.650	0.83	0.84	0.88	3.0	217	247	270	71	67	69	
5	1522	501.13	1.15	1.20	1.20	6.5	221	253	269	59	67	69	
4	1527	503.99	1.15	1.20	1.20	6.5	228	258	258	59	67	70	
3	1532	507.00	1.20	1.25	1.25	7.0	228	260	254	60	69	71	
2	1537	509.90	1.10	1.15	1.15	7.0	229	256	256	63	71	73	
1	1542	512.81	0.76	0.80	0.80	5.0	228	250	261	63	72	74	
END	1547	515.244	—	—	—	—	—	—	—	—	—	—	
A-6	1548	515.244	0.71	0.78	0.78	5.0	225	245	263	69	72	75	ORSAT
5	1553	517.71	0.93	0.98	0.98	5.2	227	253	267	69	73	76	
4	1558	520.31	1.15	1.20	1.20	6.5	230	253	270	63	74	76	
3	1603	523.17	1.20	1.25	1.25	7.0	233	250	261	61	75	77	
2	1608	526.13	1.20	1.25	1.25	7.0	232	248	262	60	75	77	
1	1613	529.18	0.76	0.80	0.80	5.0	232	239	271	57	75	78	
END	1618	531.619	—	—	—	—	—	—	—	—	—	—	
ALL													

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 33.722 ft^3 Baro. Press. P_b 27.39 "Hg

Water Collected V_w 44.7 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 60 min. % CO_2 2.5 % CO 0.0

Stack Pressure P_s 10.92 "H_2O % O_2 19.9 % N_2 78.1

Area Stack A_s 2430 in^2

Pitot Tube No. 5 Barometer No. —

Probe Tip No. T1-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 32.964

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

M_F = ____ M_T = ____

Impinger Box No. 3

Impinger 1	Final Weight	634.3
	Initial Weight	609.8
	Increase	24.5
Impinger 2	Final Weight	628.1
	Initial Weight	623.2
	Increase	4.9
Impinger 3	Final Weight	697.4
	Initial Weight	687.7
	Increase	9.7
Impinger 4	Final Weight	479.9
	Initial Weight	479.8
	Increase	0.1
Impinger 5	Final Weight	800.2
	Initial Weight	794.7
	Increase	5.5
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # _____ Final Weight _____ Initial Weight _____ Increase _____

Water Weight Gain

V_w =

g SO_2 = -_____

V_w =

Impinger 1	24.5
Impinger 2	4.9
Impinger 3	9.7
Impinger 4	0.1
Impinger 5	5.5
Impinger 6	
Total	44.7 = V_w

P_b	= 29.43	$\%CO_2$	= 2.5
V_m	= 33.722	$\%O_2$	= 19.4
V_w	= 44.7	%CO	= 0.0
P_m	= ~~1.026~~ 1.062	$\%N_2$	= 78.1
Avg ΔP	= 1.012	A_s	= 2430
Avg $\sqrt{\Delta P}$	= 1.001	D_n	= 0.190
C_p	= 0.805	T_t	= 60
P_s	= +0.92 "H_2O	29.50	"Hg
T_m	= 73 °F	533	°R
T_s	= 225 °F	685	°R

Moisture Content: %M = 6.02 M_d = 0.9398 MW_d = 29.176 MW = 28.50

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 33.722 \left(\frac{29.43 + \frac{1.062}{13.6}}{73 + 460}\right) = \frac{32.948}{51} = 0.549 \text{ sft}^3 \text{ scfm}$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 44.7 = 2.110 \text{ sft}^3$$

$$\%\text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{2.110}{32.948 + 2.110} \times 100 = 6.02\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{685}{28.50 \times 29.50}} \times 1.001 = 3727 \text{ fpm}$$

ACFM: 62889

SCFM: 45086

$$\%I = \frac{1039 \times 32.948 \times 685}{0.9398 \times 29.50 \times 3727 \times 60 \times (0.190)^2} = 104.8\ \%$$

%EA: 1496.3

Job No. 88-141 Particulate, Pb FIELD DATA

Job Name Qualimetrics, Inc.

Run No. 1

Location 039 Baghouse Stack

Date 13 Oct 1988

Operator Orr, Mullins

Sample Box No. 2 Meter Box No. 2

Read and record at the start of each test point.

Purge to: —

Purge time: —

MU S E ONM AL ING , I

Ambient Temp. °F 53

Assumed Moisture % 2

Probe Length 5'

C Factor — 13.5 to reference

Initial Leak @ 15.5 "Hg = 0.004 cfm

Final Leak @ 11.0 "Hg = 0.000 cfm

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
E-6	0904	532.500	1.05	1.95	1.95	7.5	91	248	268	62	53	57	
5	0906	533.61	0.90	1.20	1.20	7.5	92	236	270	53	55	58	
4	0908	534.83	0.66	0.90	0.90	6.5	91	236	272	51	55	59	
3	0910	535.87	0.63	0.85	0.85	5.0	92	247	269	51	56	59	
2	0912	536.79	0.89	1.20	1.20	6.5	92	254	266	52	56	57	
1	0914	537.63	0.76	1.05	1.05	6.0	95	259	254	53	56	58	
END	0916	538.041	—	—	—	—	—	—	—	—	—	—	
D-6	0917	538.041	1.05	1.90	1.90	7.0	91	257	266	53	57	58	
5	0919	540.19	0.87	1.20	1.20	7.2	92	258	271	51	58	59	
4	0921	541.33	0.68	0.92	0.92	6.0	93	257	251	51	59	61	
3	0923	542.39	0.70	0.95	0.95	6.0	93	255	258	52	59	60	
2	0925	543.43	0.88	1.20	1.20	6.5	91	254	226	54	59	59	
1	0927	544.56	0.96	1.30	1.30	7.0	91	257	262	54	59	58	
END	0929	545.740	—	—	—	—	—	—	—	—	—	—	
C-6	0930	545.740	1.05	1.90	1.90	7.2	91	262	271	56	60	60	
5	0932	546.90	0.76	1.05	[illegible]	7.0	92	261	268	53	60	61	
4	0934	548.63	0.69	0.9[illegible]	[illegible]	6.0	92	262	271	54	61	61	
3	0936	549.10	0.67	[illegible]	[illegible]92	5.5	93	263	270	59	62	62	ORSAT

Pitot Tube Calibration Factor C_p 0.[illegible]

Volume Collected V_m 34.409 ft^3 Barom. Press. P_b 29.60 "Hg

Water Collected V_w 5.7 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 60 min. % CO_2 [illegible]3 % CO 0.0

Stack Pressure P_s [illegible]0.25 "H_2O % O_2 19.7 % N_2 80.0

Area Stack A_s 1068 in^2

Pitot Tube No. 5 Barometer No. —

Probe Tip No. II-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 33.635

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

M_F = ____ M_T = ____

Impinger Box No. 2

			Water Weight Gain	
Impinger 1	Final Weight	585.2		Impinger 1 −1.3
	Initial Weight	586.5		Impinger 2 1.4
	Increase	−1.3		Impinger 3 0.5
Impinger 2	Final Weight	566.8		Impinger 4 5.1
	Initial Weight	565.4	V_w =	Impinger 5 ____
	Increase	1.4	g SO_2 = - ____	Impinger 6 ____
Impinger 3	Final Weight	487.7	V_w =	Total 5.7 = V_w
	Initial Weight	487.2		
	Increase	0.5		
Impinger 4	Final Weight	825.8		
	Initial Weight	820.7		
	Increase	5.1		
Impinger 5	Final Weight	____		
	Initial Weight	____		
	Increase			
Impinger 6	Final Weight	____		
	Initial Weight	____		
	Increase			
Filter # ____	Final Weight	____		
	Initial Weight	____		
	Increase	____		

P_b =	29.60	$\%CO_2$ =	0.3	
V_m =	34.409	$\%O_2$ =	19.7	
V_w =	5.7	%CO =	0.0	
P_m =	1.162	$\%N_2$ =	80.0	
Avg ΔP =	0.857	A_s =	1068	
Avg $\sqrt{\Delta P}$ =	0.922	D_n =	0.190	
C_p =	0.805	T_t =	60	
P_s =	+0.25 "H_2O	29.62	"Hg	
T_m =	62 °F	522	°R	
T_s =	93 °F	553	°R	

Moisture Content: %M = 0.77 M_d = 0.9923 MW_d = 28.836 MW = 28.75

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 34.409 \left(\frac{29.60 + \frac{1.162}{13.6}}{62 + 460}\right) = \frac{34.578}{0.579}\ \text{sft}^3 / \text{scfm}$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 5.7 = 0.269\ \text{sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.269}{34.578 + 0.269} \times 100 = 0.77\ \%$$

$$V_s = 5123.8 \times \frac{0.805}{\sqrt{29.62 \times 28.75}} \times \sqrt{\frac{553}{}} \times 0.922 = 3065\ \text{fpm}$$

ACFM: 22,729

SCFM: 21,400

$$\%I = \frac{1039 \times 34.578 \times 553}{0.9923 \times 29.62 \times 3065 \times 60 \times (0.190)^2} = 101.9\ \%$$

%EA: 1313.3

28.62
3072
102.9

Run No. 1

Location 039 Baghouse Stack

Date 13 Oct 1988

PARTICULATE FIELD DATA

			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	
2	0932	550.13	0.90	1.20	1.20	6.5	92	263	271	55	63	65	
1	0940	551.20	0.90	1.20	1.20	6.5	92	263	276	54	63	68	
END	0942	552.386	-	-	-	-	-	-	-	-	-	-	
B-6	0943	552.386	0.84	1.15	1.15	6.5	92	261	255	56	65	65	
5	0945	553.51	0.70	0.96	0.96	5.5	92	265	261	56	65	65	
4	0947	554.54	0.70	0.96	0.96	5.5	92	271	270	56	66	66	
3	0949	555.59	0.88	1.20	1.20	6.5	93	261	29	55	67	66	
2	0951	556.63	1.00	1.35	1.35	7.0	97	260	267	54	69	66	
1	0953	557.89	0.81	1.10	1.10	~~6.0~~ 7.0	93	259	258	53	69	67	
END	0955	558.733	-	-	-	-	-	-	-	-	-	-	
A-6	0956	558.933	0.97	1.30	1.30	6.8	93	251	257	56	69	68	
5	0958	560.10	0.82	1.10	1.10	7.0	93	246	232	54	69	69	
4	1000	561.28	0.84	1.15	1.15	7.0	94	235	242	54	69	68	
3	1002	562.36	1.20	1.60	1.60	8.5	93	239	235	54	69	67	
2	1004	563.69	1.15	1.55	1.55	8.8	94	240	242	53	69	67	
1	1006	564.95	0.80	1.10	1.10	7.5	94	240	245	53	69	66	
END	1008	~~566.135~~	-	-	-	-	-	-	-	-	-	-	
ALL		566.135											

Job No. 88-141

Job Name Quemetco, Inc

Run No. 2

Location Baghouse 039 Stack

Date 13 Oct. 1988

Operator ORR, Mullins

Sample Box No. 3 Meter Box No. 2

PART/Pb FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

MULLINS IRON TAL INC.,

Ambient Temp. °F 50

Assumed Moisture % 2.0

Probe Length 5'

C Factor — 13.5 to reference

Initial Leak @ 18.0 "Hg = 0.000 cfm

Final Leak @ 10.0 "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 (T_m)	Oven Temp. °F (T_m)	Effluent Temp. °F (T_m)	Dry Gas Temp. °F (T_m)		Remarks
				Desired	Actual						Inlet	Outlet	
A-6	1100	566.981	1.05	1.45	1.45	7.5	97	261	271	56	63	64	
5	1102	567.63	0.80	1.10	1.10	7.0	97	248	270	52	63	64	
4	1104	568.79	0.80	1.10	1.10	7.0	97	232	273	51	63	64	
3	1106	569.91	0.99	1.20	1.20	7.0	97	230	261	51	64	64	
2	1108	571.08	1.10	1.50	1.50	8.0	97	236	266	50	64	64	
1	1110	572.34	0.86	1.15	1.15	7.2	98	237	271	50	64	64	
END	1112	573.565	—	—	—	—	—	—	—	—	—	—	
B-6	1113	573.565	0.78	1.05	1.05	6.2	100	242	260	53	65	66	
5	1115	574.65	0.68	0.90	0.90	5.5	100	246	271	52	65	67	
4	1117	575.69	0.67	0.89	0.89	5.5	100	251	270	52	66	67	
3	1119	576.74	0.84	1.15	1.15	6.5	101	254	267	52	67	69	
2	1121	577.77	0.97	1.30	1.30	7.5	101	256	258	51	68	69	
1	1123	578.92	0.75	1.00	1.00	6.5	105	252	251	51	69	70	
END	1125	580.640	—	—	—	—	—	—	—	—	—	—	
C-6	1126	580.040	0.90	1.20	1.20	7.0	105	256	244	54	69	71	
5	1128	581.19	0.72	0.98	0.98	6.0	103	254	248	53	69	71	
4	1130	582.27	0.62	0.84	0.84	5.1	107	253	245	52	69	71	
3	1132	583.26	0.67	0.92	0.92	5.0	109	258	250	53	69	71	CRSAT

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 33.988 ft^3

Water Collected V_w 16.5 ml

Time of Test T_t 60 min.

Stack Pressure P_s +0.21 "H_2O

Baro. Press. P_b 29.60 "Hg

Probe Tip Dia. D_n 0.190 in.

% CO_2 0.0 % CO 0.0

% O_2 20.8 % N_2 79.2

Area Stack A_s 1068 in^2

Pitot Tube No. 5 Barometer No. —

Probe Tip No. 11-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 33.224

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

M_F = ____ M_T = ____

Impinger Box No. 3

			Water Weight Gain		
Impinger 1	Final Weight	580.0		Impinger 1	8.4
	Initial Weight	571.6			
	Increase	8.4		Impinger 2	2.7
Impinger 2	Final Weight	623.7		Impinger 3	0.0
	Initial Weight	621.0			
	Increase	2.7		Impinger 4	5.4
Impinger 3	Final Weight	480.8	V_w =	Impinger 5	
	Initial Weight	480.8	g SO_2 = -		
	Increase	0.0	V_w =	Impinger 6	-
Impinger 4	Final Weight	805.8		Total	16.5 = V_w
	Initial Weight	800.4			
	Increase	5.4			
Impinger 5	Final Weight				
	Initial Weight				
	Increase				
Impinger 6	Final Weight				
	Initial Weight				
	Increase				

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b =	29.60	$\%CO_2$ =	0.0	
V_m =	33.988	$\%O_2$ =	20.8	
V_w =	16.5	%CO =	0.0	
P_m =	1.097	$\%N_2$ =	79.2	
Avg ΔP =	0.812	A_s =	1068	
Avg $\sqrt{\Delta P}$ =	0.898	D_n =	0.190	
C_p =	0.805	T_t =	60	
P_s =	-0.21 "H_2O		29.62 "Hg	
T_m =	70 °F		530 °R	
T_s =	102 °F		562 °R	

Moisture Content: %M = 2.27 M_d = 0.9773 MW_d = 28.832 MW = 28.59

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 33.988 \left(\frac{29.60 + \frac{1.097}{13.6}}{70 + 460} \right) = 33.594\ sft^3$$

$$0.560\ scfm$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 16.5 = 0.779\ sft^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.779}{33.594 + 0.779} \times 100 = 2.27\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{562}{29.62 \times 28.59}} \times 0.898 = 3017\ fpm$$

ACFM: 22,379

SCFM: 20,414

$$\%I = \frac{1039 \times 33.594 \times 562}{0.9773 \times 29.62 \times 3017 \times 60 \times (0.190)^2} = 103.7\ \%$$

%EA: —

Run No. 2

Location Bag House 039 Stack

Date 13 OCT 1988

PARTICULATE FIELD DATA

			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	
2	1134	584.27	0.80	1.10	1.10	6.5	113	253	241	52	70	72	
1	1136	585.38	0.89	1.20	1.20	7.0	113	250	236	52	69	71	
END	1138	586.481	-	-	-	-	-	-	-	-	-	-	
D-6	1139	586.481	0.94	1.30	1.30	7.5	105	257	257	53	70	72	
5	1141	587.70	0.79	1.05	1.05	6.9	96	259	253	51	70	73	
4	1143	588.84	0.65	0.89	0.89	5.5	98	260	257	51	71	73	
3	1145	589.87	0.65	0.89	0.89	5.5	103	262	260	52	72	74	
2	1147	590.86	0.80	1.10	1.10	6.5	107	263	255	52	73	75	
1	1149	591.97	0.93	1.25	1.25	7.0	106	263	251	52	73	75	
END	1151	593.125	-	-	-	-	-	-	-	-	-	-	
E-6	1152	593.125	0.85	1.15	1.15	7.5	108	261	256	53	73	76	
5	1154	594.29	0.80	1.10	1.10	7.0	107	255	254	62	73	76	
4	1156	595.37	0.65	0.90	0.90	6.0	97	250	253	51	72	76	
3	1158	596.44	0.70	0.95	0.95	5.9	97	249	252	50	72	76	
2	1200	597.47	0.81	1.10	1.10	6.2	96	248	251	50	73	76	
1	1202	598.51	0.89	1.20	1.20	7.0	99	249	249	49	72	76	
END	1204	599.705	-	-	-	-	-	-	-	-	-	-	
ALL													

Job No. 88-141 Part/Pb FIELD DATA

Job Name Quemetco Inc

Run No. 3

Location Bag House 039 STACK

Date 13 OCT 1988

Operator Orr, Mullins

Sample Box No. 13 Meter Box No. 2

Read and record at the start of each test point.

Purge to: —

Purge time: —

MI NS RON CAL ...TIN ..., ...

Ambient Temp. °F 69

Assumed Moisture % 2.0

Probe Length 5'

C Factor — 13.5 to reference

Initial Leak @ 15.6 "Hg = 0.000 cfm

Final Leak @ 9.1 "Hg = 0.022 cfm

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
E-6	1240	600.100	1.05	1.40	1.40	7.8	97	241	251	52	68	69	
5	1242	601.21	0.82	1.10	1.10	8.0	97	240	260	52	69	71	
4	1244	602.40	0.62	0.84	0.84	6.0	99	240	261	50	71	73	
3	1246	603.42	0.62	0.84	0.84	6.0	100	243	269	50	71	74	
2	1248	604.41	0.76	1.05	1.05	7.0	102	240	271	50	72	76	
1	1250	605.49	0.88	1.20	1.20	7.5	103	240	269	50	73	76	
END	1252	606.642	—	—	—	—	—	—	—	—	—	—	
D-6	1253	606.642	0.96	1.30	1.30	8.0	103	243	261	51	73	77	
5	1255	607.86	0.77	1.05	1.05	7.5	101	239	263	49	73	78	
4	1257	608.08	0.62	0.84	0.84	6.0	99	242	250	50	75	79	
3	1259	610.01	0.66	0.90	0.90	6.0	98	241	246	51	75	80	
2	1301	610.91	0.79	1.10	1.10	7.0	102	242	260	50	76	80	
1	1303	612.12	0.99	1.35	1.35	8.0	100	242	249	50	76	80	
END	1305	613.330	—	—	—	—	—	—	—	—	—	—	
E-6	1306	613.330	0.95	1.30	1.30	8.5	96	238	241	54	77	81	
5	1308	614.57	0.76	1.05	1.05	7.2	97	235	233	53	77	82	
4	1310	615.77	0.67	0.91	0.91	6.8	99	237	238	55	77	82	OFFSET
3	1312	616.82	0.76	1.00	1.00	7.0	107	231	237	58	77	82	

Pitot Tube Calibration Factor C_p 0.865

Volume Collected V_m 34682 ft^3

Water Collected V_w 13.0 ml

Time of Test T_t 60 min.

Stack Pressure P_s +0.31 "H_2O

Baro. Press. P_b 29.60 "Hg

Probe Tip Dia. D_n 0.190 in.

% CO_2 0.0 % CO 0.0

% O_2 21.0 % N_2 79.0

Area Stack A_s 1068 in^2

Pitot Tube No. 5 Barometer No. —

Probe Tip No. 11-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 33.902

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

M_F = ____ M_T = ____

Impinger Box No. 13

Impinger 1	Final Weight	647.3
	Initial Weight	588.2
	Increase	59.1
Impinger 2	Final Weight	544.9
	Initial Weight	596.5
	Increase	−51.6
Impinger 3	Final Weight	483.5
	Initial Weight	483.9
	Increase	−0.4
Impinger 4	Final Weight	908.0
	Initial Weight	902.1
	Increase	5.9
Impinger 5	Final Weight	
	Initial Weight	
	Increase	
Impinger 6	Final Weight	
	Initial Weight	
	Increase	

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

Water Weight Gain

Impinger 1	59.1
Impinger 2	−51.6
Impinger 3	−0.4
Impinger 4	5.9
Impinger 5	
Impinger 6	
Total	13.0 = V_w

V_w = ____
g SO_2 = ____
V_w = ____

P_b = 29.60 $\%CO_2$ = 0.0
V_m = 34.682 $\%O_2$ = 21.0
V_w = 13.0 $\%CO$ = 0.0
P_m = 1.122 $\%N_2$ = 79.0
Avg ΔP = 0.826 A_s = 1068
Avg $\sqrt{\Delta P}$ = 0.906 D_n = 0.190
C_p = 0.805 T_t = 60
P_s = +0.31 "H_2O 29.62 "Hg
T_m = 78 °F 538 °R
T_s = 103 °F 563 °R

Moisture Content: %M = 1.78 M_d = 0.9822 MW_d = 28.840 MW = 28.65

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right) = 17.65 \times 34.682 \left(\frac{29.60 + \frac{1.122}{13.6}}{78 + 460}\right) = 33.773\ \text{sft}^3$$

0.563 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 13.0 = 0.614\ \text{sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.614}{33.773 + 0.614} \times 100 = 1.78\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{563}{29.62 \times 28.65}} \times 0.906 = 3044\ \text{fpm}$$

ACFM: 22,575
SCFM: 20,663

$$\%I = \frac{1039 \times 33.773 \times 563}{0.9822 \times 29.62 \times 3044 \times 60 \times (0.190)^2} = 103.0\ \%$$

%EA: —

Run No. 3

Location Bag House 039 STACK

Date 13 OCT 1988

PARTICULATE FIELD DATA

Point	Clock Time	Dry Gas Meter, CF	ΔP_s Pitot in. H_2O	P_m Orifice ΔH in. H_2O Desired	P_m Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge	T_s Stack Temp. °F	T_s Probe Temp. °F	T_s Oven Temp. °F	T_s Effluent Temp. °F	T_m Dry Gas Temp. °F Inlet	T_m Dry Gas Temp. °F Outlet	Remarks
2	1314	618.10	0.88	1.20	1.20	7.5	106	235	264	57	78	83	
1	1316	619.00	0.92	1.25	1.25	8.0	107	236	266	57	78	83	
END	1318	620.140	—	—	—	—	—	—	—	—	—	—	
B-6	1319	620.140	0.84	1.15	1.15	8.0	105	245	270	57	77	82	
5	1321	621.20	0.73	1.00	1.00	7.5	104	246	271	58	77	81	
4	1323	622.32	0.60	0.82	0.82	6.0	114	249	261	58	77	81	
3	1325	623.30	0.75	1.00	1.00	7.0	113	254	261	56	77	81	
2	1327	624.35	0.94	1.25	1.25	8.0	111	256	260	56	77	81	
1	1329	625.52	0.80	1.10	1.10	8.0	112	258	257	55	77	82	
END	1331	626.705	—	—	—	—	—	—	—	—	—	—	
A-6	1332	626.705	0.97	1.30	1.30	8.1	99	260	242	55	77	82	
5	1334	627.83	0.84	1.15	1.15	8.5	99	258	244	55	78	82	
4	1336	629.04	0.79	1.10	1.10	8.0	102	250	244	55	77	82	
3	1338	630.21	1.05	1.40	1.40	8.5	103	261	249	54	78	82	
2	1340	631.51	1.10	1.50	1.50	9.5	105	256	255	59	79	84	
1	1342	632.76	0.88	1.20	1.20	9.0	106	252	257	54	80	85	
END	1344	634.002	—	—	—	—	—	—	—	—	—	—	
ALL													

Job No. 88-141 Particulate, Pb FIELD DATA

Job Name Quemetco, Inc.

Run No. 1

Location Baghouse 040 Stack

Date 13 OCT 1988

Operator Orr, Mullins

Sample Box No. 2 Meter Box No. 2

Read and record at the start of each test point.

Purge to: —

Purge time: —

MULLINS IRONMENTAL TESTING CO., INC.

Ambient Temp. °F 61

Assumed Moisture % 3%

Probe Length 5'

C Factor — 1.29 to reference

Initial Leak @ 15.0 "Hg = 0.002 cfm

Final Leak @ 16.5 "Hg = 0.004 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 (P_m) Actual	Pump Vacuum In. Hg Gauge	Stack Temp. °F (T_s)	Probe Temp. °F (T_s)	Oven Temp. °F (T_s)	Effluent Temp. °F (T_s)	Dry Gas Temp. °F (T_m) Inlet	Dry Gas Temp. °F (T_m) Outlet	Remarks
E-6	1644	634.900	1.70	2.20	2.20	11.0	117	241	230	66	72	74	
5	1646	635.85	1.70	2.20	2.20	12.0	118	239	232	53	70	73	
4	1648	637.43	1.60	2.05	2.05	12.0	118	243	252	51	69	73	
3	1650	639.02	2.00	2.50	2.50	14.0	119	246	271	51	69	73	
2	1652	640.181	2.10	2.70	2.70	15.5	118	237	257	51	68	73	
1	1654	642.42	1.65	2.10	2.10	10.0	118	232	268	51	68	73	
End	1656	644.050	—	—	—	—	—	—	—	—	—	—	
D-6	1657	644.050	1.60	~~1.25~~ 2.00	2.00	7.5	119	237	235	55	69	74	
5	1659	645.32	1.60	2.00	2.00	8.0	119	238	239	53	69	#	
4	1701	646.77	1.90	1.60	1.80	8.0	120	235	253	51	69	74	
3	1703	648.23	1.70	2.20	2.20	9.5	119	242	238	51	69	74	
2	1705	649.81	1.50	1.90	1.90	9.0	119	246	265	51	70	74	
1	1707	651.31	1.90	2.40	2.40	9.5	119	249	262	50	71	75	
End	1709	653.085	—	—	—	—	—	—	—	—	—	—	
C-6	1710	653.085	1.70	2.20	2.20	9.0	120	257	272	52	72	76	
5	1712	654.41	1.20	1.50	1.50	7.5	120	256	268	51	72	76	
4	1714	655.78	1.30	1.65	1.65	7.9	121	256	271	51	72	76	
3	1716	657.20	1.20	1.50	1.50	7.0	121	259	255	51	72	76	OPSMT

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 44.885 ft^3 Baro. Press. P_b 29.51 "Hg

Water Collected V_w 9.3 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 60 min. % CO_2 0.3 % CO 0.0

Stack Pressure P_s +0.55 "H_2O % O_2 20.6 % N_2 79.1

Area Stack A_s 647 in^2

Pitot Tube No. 5 Barometer No. —

Probe Tip No. II-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 43.876

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

M_F = ____ M_T = ____

Impinger Box No. 2

			Water Weight Gain	
Impinger 1	Final Weight	581.4		Impinger 1 -1.5
	Initial Weight	582.9		Impinger 2 2.9
	Increase	-1.5		Impinger 3 0.6
Impinger 2	Final Weight	565.1		Impinger 4 7.3
	Initial Weight	562.2	V_w =	
	Increase	2.9	g SO_2 = -	Impinger 5
Impinger 3	Final Weight	488.2	V_w =	Impinger 6
	Initial Weight	487.6		
	Increase	0.6		Total 13 = V_w
Impinger 4	Final Weight	833.2		
	Initial Weight	825.9		
	Increase	7.3		
Impinger 5	Final Weight			
	Initial Weight			
	Increase			
Impinger 6	Final Weight			
	Initial Weight			
	Increase			

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b =	29.51	$\%CO_2$ =	0.3	
V_m =	44885	$\%O_2$ =	20.6	
V_w =	9.3	%CO =	0.0	
P_m =	1.878	$\%N_2$ =	79.1	
Avg ΔP =	1.473	A_s =	642	
Avg $\sqrt{\Delta P}$ =	1.208	D_n =	0.190	
C_p =	0.805	T_t =	60	
P_s =	40.55 "H_2O	29.55	"Hg	
T_m =	73 °F	533	°R	
T_s =	120 °F	580	°R	

Moisture Content: %M = 0.99 M_d = 0.9901 MW_d = 28.872 MW = 28.76

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 44.885 \left(\frac{29.51 + \frac{1.878}{13.6}}{73 + 460} \right) = \frac{44.067}{0.734} \text{ sft}^3 \text{ scfm}$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 9.3 = 0.439 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.439}{44.067 + 0.439} \times 100 = 0.99\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{580}{28.76 \times 29.55}} \times 1.208 = 411.6 \text{ fpm}$$

ACFM: 18351

$$\%I = \frac{1039 \times 44.067 \times 580}{0.9901 \times 29.55 \times 411.6 \times 60 \times (0.190)^2} = 101.8\ \%$$

SCFM: 16395

%EA: —

44 216 216
28.55
4124

Run No. 1

PARTICULATE FIELD DATA

Location Baghouse 090 Stack

Date 13 OCT 1988

			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	
2	1718	658.52	1.90	2.40	2.40	10.0	121	255	261	51	72	76	
1	1720	660.11	1.50	1.90	1.90	10.0	121	251	270	50	73	77	
END	1722	661.735	—	—	—	—	—	—	—	—	—	—	
B-6	1723	661.735	1.60	2.05	2.05	9.5	121	254	249	53	73	77	
5	1725	663.24	1.30	1.65	1.65	8.0	121	256	251	52	73	77	
4	1727	664.71	1.10	1.40	1.40	7.5	121	257	251	52	73	77	
3	1729	666.09	1.05	1.35	1.35	6.5	121	251	249	52	73	77	
2	1731	667.32	1.40	1.80	1.80	7.5	122	251	246	52	73	77	
1	1733	668.72	1.10	1.40	1.40	7.0	121	251	248	52	73	76	
END	1735	670.051	—	—	—	—	—	—	—	—	—	—	—
A-6	1736	670.051	1.40	1.80	1.80	7.5	120	261	249	54	72	77	
5	1738	671.57	1.40	1.80	1.80	8.0	121	262	249	52	72	76	
4	1740	672.92	1.10	1.40	1.40	7.0	120	262	249	51	72	76	
3	1742	674.29	1.45	1.85	1.85	8.0	120	260	249	52	72	76	
2	1744	675.67	1.00	1.30	1.30	6.5	120	256	237	52	72	76	
1	1746	676.98	1.05	1.35	1.35	6.4	119	255	235	53	72	76	
END	1748	678.276	—	—	—	—	—	—	—	—	—	—	—
ALL													

Job No. 88-191

Job Name Quemetco Inc

Run No. 2

Location Baghouse 690 Stack

Date 13 OCT 1988

Operator Orr, Mullins

Sample Box No. 3 Meter Box No. 2

Pb FIELD DATA

Read and record at the start of each test point.

Purge to: —

Purge time: —

MULLINS ENVIRONMENTAL TESTING

Ambient Temp. °F 56

Assumed Moisture % 3%

Probe Length 5'

C Factor — 127 to reference

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 17.1 "Hg = 0.000 cfm

			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
A-6	1825	678.650	1.35	1.70	1.70	8.0	118	265	235	48	60	62	
5	1831	679.91	1.40	1.80	1.80	10.0	116	267	236	45	60	62	
4	1833	681.42	1.20	1.50	1.50	10.0	117	268	259	44	59	62	
3	1835	683.18	1.05	1.35	1.35	7.0	116	260	271	45	59	62	
2	1837	684.99	1.05	1.35	1.35	7.0	117	247	270	45	59	62	
1	1839	685.77	1.00	1.30	1.30	7.0	116	233	267	46	60	62	
END	1841	687.152	—	—	—	—	—	—	—	—	—	—	
B-6	1842	687.152	1.50	1.90	1.90	8.3	120	246	270	48	59	61	
5	1844	688.52	1.30	1.65	1.65	8.0	120	256	265	47	60	60	
4	1846	689.88	1.05	1.35	1.35	7.0	119	258	271	47	60	60	
3	1848	691.27	1.10	1.40	1.40	7.4	120	253	261	48	60	59	
2	1850	692.51	1.00	1.30	1.30	7.5	120	248	253	48	60	59	
1	1852	693.69	1.40	1.80	1.80	8.2	118	245	234	49	61	59	
END	1854	695.096	—	—	—	—	—	—	—	—	—	—	
C-6	1855	695.096	1.50	1.90	1.90	8.0	119	246	239	52	61	59	
5	1857	696.47	1.30	1.65	1.65	8.0	120	243	243	50	62	59	
4	1859	698.00	1.25	1.60	1.60	8.0	118	239	252	50	62	59	
3	1901	699.28	1.25	1.60	1.60	8.0	119	239	259	50	63	59	ORSAT

D-44

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 44.054 ft^3

Water Collected V_w 10.1 ml

Time of Test T_t 60 min.

Stack Pressure P_s 0.55 "H_2O

Baro. Press. P_b 29.51 "Hg

Probe Tip Dia. D_n 0.190 in.

% CO_2 0.3 % CO 0.0

% O_2 20.7 % N_2 79.0

Area Stack A_s 642 in^2

Pitot Tube No. S Barometer No. —

Probe Tip No. T-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 43.054

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

M_F = ____ M_T = ____

Impinger Box No. 3

			Water Weight Gain	
Impinger 1	Final Weight	569.7		Impinger 1 -1.7
	Initial Weight	571.4		Impinger 2 2.9
	Increase	-1.7		Impinger 3 1.2
Impinger 2	Final Weight	624.5		Impinger 4 7.7
	Initial Weight	621.6	V_w =	Impinger 5 ____
	Increase	2.9	g SO_2 = - ____	Impinger 6 ____
Impinger 3	Final Weight	482.0	V_w =	Total 10.1 = V_w
	Initial Weight	480.8		
	Increase	1.2		
Impinger 4	Final Weight	813.6		
	Initial Weight	805.9		
	Increase	7.7		
Impinger 5	Final Weight	____		
	Initial Weight	____		
	Increase			
Impinger 6	Final Weight	____		
	Initial Weight	____		
	Increase			

Filter # ____ Final Weight ____ Initial Weight ____ Increase ____

P_b =	29.51	$\%CO_2$ =	0.3	
V_m =	44.854	$\%O_2$ =	20.7	
V_w =	10.1	%CO =	0.0	
P_m =	~~1.800~~ 1.843	$\%N_2$ =	79.0	
Avg ΔP =	1.447	A_s =	642	
Avg $\sqrt{\Delta P}$ =	1.197	D_n =	0.190	
C_p =	0.805	T_t =	60	
P_s =	-0.55 "H_2O		29.55 "Hg	
T_m =	61 °F		521 °R	
T_s =	118 °F		578 °R	

Moisture Content: %M = 1.05 M_d = 0.9895 MW_d = 28.876 MW = 28.76

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 44.854 \left(\frac{29.51 + \frac{1.843}{13.6}}{61 + 460} \right) = 45.042\ \text{sft}^3$$

0.751 scfm

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 10.1 = 0.477\ \text{sft}^3$$

$$\%\ \text{Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.477}{45.042 + 0.477} \times 100 = 1.04\ \%$$

$$V_s = 5123.8 \times 0.805 \sqrt{\frac{578}{28.76 \times 29.55}} \times \frac{1.197}{1.44} = 4672\ \text{fpm}$$

ACFM: 18153

SCFM: 16266

$$\%I = \frac{1039 \times 45.042 \times 578}{0.9895 \times 29.55 \times 4672 \times 60 \times (0.190)^2} = 104.9\ \%$$

%EA: ____

Run No. 2

Location Baghouse, Old Stack

Date 13 Oct 1988

PARTICULATE FIELD DATA

			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	
2	1903	700.65	1.70	2.20	2.20	10.0	117	239	264	50	63	59	
1	1905	702.21	1.50	1.90	1.90	9.5	116	240	268	50	64	58	
END	1907	703.755	—	—	—	—	—	—	—	—	—	—	
D-6	1908	703.755	1.90	2.40	2.40	11.3	115	240	266	49	64	59	
5	1910	705.41	1.50	1.90	1.90	10.0	119	241	267	49	64	60	
4	1912	706.92	1.50	1.90	1.90	10.0	120	239	265	50	64	59	
3	1914	708.47	1.50	1.90	1.90	9.5	119	242	270	49	65	59	
2	1916	709.97	1.90	2.40	2.40	10.5	118	242	262	50	65	59	
1	1918	711.53	1.70	2.20	2.20	10.3	113	242	241	49	65	59	
END	1920	713.096	—	—	—	—	—	—	—	—	—	—	
E-6	1921	713.696	1.60	2.00	2.00	9.5	116	245	242	53	65	59	
5	1923	714.51	1.80	2.30	2.30	10.0	119	242	238	50	64	59	
4	1925	716.19	1.80	2.30	2.30	10.5	121	241	239	50	64	59	
3	1927	717.73	1.50	1.90	1.90	9.5	120	241	232	50	64	59	
2	1929	719.31	2.10	2.65	2.65	11.2	121	239	235	50	64	59	
1	1931	720.95	1.70	2.20	2.20	11.0	118	240	240	50	65	59 59	
END	1933	722.494	—	—	—	—	—	—	—	—	—	—	
ALL													

MU[illegible]S E[illegible]RON[illegible]AL [illegible]INC.,

Job No. 88-141 — Particulate, Pb FIELD DATA

Job Name Quemetco Inc

Run No. 3

Location Baghouse 040 STACK

Date 18 Oct 1988

Operator Orr, Mullins

Sample Box No. 13 Meter Box No. 2

Read and record at the start of each test point.

Purge to: —

Purge time: —

Ambient Temp. °F 50

Assumed Moisture % 3.0

Probe Length 5'

C Factor — 1.29 to reference

Initial Leak @ 12.0 "Hg = 0.000 cfm

Final Leak @ 16.2 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	Pitot ΔP_s in. H_2O	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Pump Vacuum In. Hg Gauge (P_m)	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 (T_m) Outlet	Remarks
E-6	2024	723.000	1.50	1.80	1.80	9.5	122	259	270	51	52	51	
5	2026	724.27	1.90	2.40	2.40	14.0	121	266	261	44	48	50	
4	2028	725.83	1.90	2.40	2.40	14.0	121	262	238	49	48	50	
3	2030	727.43	2.20	2.80	2.80	15.1	120	269	234	43	48	49	
2	2032	729.11	2.20	2.80	2.80	15.2	120	262	241	44	50	48	
1	2034	730.82	1.70	2.20	2.20	15.0	119	263	240	45	51	47	
END	2036	732.440	—	—	—	—	—	—	—	—	—	—	
E-6	2037	732.940	1.90	1.80	1.80	12.0	119	261	250	49	51	47	
5	2039	733.97	1.90	1.80	1.80	13.5	119	239	249	48	51	48	
4	2041	735.61	1.60	2.00	2.00	13.0	118	235	261	48	52	49	
3	2043	737.12	1.70	2.20	2.20	14.1	115	224	260	49	53	49	
2	2045	738.71	2.10	2.70	2.70	14.2	118	239	249	49	53	49	
1	2047	740.48	1.50	1.90	1.90	14.0	120	233	249	50	54	49	
END	2049	742.951	—	—	—	—	—	—	—	—	—	—	
C-6	2050	742.781	1.40	1.80	1.80	9.140	133	239	237	53	54	50	
5	2052	743.51	1.20	1.50	1.50	9.5	136	239	249	52	55	50	
4	2054	744.11	1.05	1.35	1.35	9.4	138	236	253	51	54	50	
3	2056	745.92	1.30	1.65	1.65	9.8	136	237	254	52	54	50	ORSAT

D-47

Pitot Tube Calibration Factor C_p 0.805

Volume Collected V_m 43.676 ft^3 Baro. Press. P_b 29.51 "Hg

Water Collected V_w 11.9 ml Probe Tip Dia. D_n 0.190 in.

Time of Test T_t 60 min. % CO_2 0.9 % CO 0.0

Stack Pressure P_s +0.41 "H_2O % O_2 20.6 % N_2 79.0

Area Stack A_s 6.42 in^2

Pitot Tube No. 5 Barometer No. —

Probe Tip No. 11-11

V_m = Dry Gas Meter Calibration Factor 1.023 X 42.694

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

M_F = ____ M_T = ____

Impinger Box No. 13

			Water Weight Gain	
Impinger 1	Final Weight	586.7		Impinger 1 -1.0
	Initial Weight	587.7		Impinger 2 3.9
	Increase	-1.0		Impinger 3 1.0
Impinger 2	Final Weight	600.6		Impinger 4 8.0
	Initial Weight	596.7	V_w =	Impinger 5 ____
	Increase	3.9	g SO_2 = - ____	Impinger 6 ____
Impinger 3	Final Weight	482.3	V_w =	Total 11.9 = V_w
	Initial Weight	481.3		
	Increase	1.0		
Impinger 4	Final Weight	916.0		
	Initial Weight	908.0		
	Increase	8.0		
Impinger 5	Final Weight	____		
	Initial Weight	____		
	Increase			
Impinger 6	Final Weight	____		
	Initial Weight	____		
	Increase			
Filter # ____	Final Weight	____		
	Initial Weight	____		
	Increase	____		

P_b =	29.51	$\%CO_2$ =	6.4
V_m =	43.676	$\%O_2$ =	20.6
V_w =	11.9	%CO =	0.0
P_m =	1.830	$\%N_2$ =	79.0
Avg ΔP =	~~1.595~~ 1.938	A_s =	642
Avg $\sqrt{\Delta P}$ =	1.191	D_n =	0.190
C_p =	0.845	T_t =	60
P_s =	-0.41 "H_2O	29.54	"Hg
T_m =	~~53~~ 52 °F	~~513~~ 512	°R
T_s =	178 °F	588	°R

Moisture Content: %M = 1.28 M_d = 0.9875 MW_d = 28.888 MW = 28.75

$$V_{m_{std}} = 17.65\ V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = 17.65 \times 43.676 \left(\frac{29.51 + \frac{1.830}{13.6}}{\frac{52}{53} + 460} \right) = 44.547 \text{ sft}^3$$

$$6.742 \text{ scfm}$$

$$V_{w_{gas}} = 0.0472 \times V_w = 0.0472 \times 11.9 = 0.562 \text{ sft}^3$$

$$\% \text{ Moisture} = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \frac{0.562}{44.547 + 0.562} \times 100 = 1.25\ \%$$

$$V_s = 5123.8 \times 0.845 \sqrt{\frac{588}{28.75 \times 29.54}} \times 1.191 = 4688 \text{ fpm}$$

ACFM: 18229

SCFM: 16016

$$\%I = \frac{1039 \times 44.547 \times 588}{0.9875 \times 29.54 \times 4688 \times 60 \times (0.190)^2} = 165\ \%$$

%EA: —

Run No. 3

PARTICULATE FIELD DATA

Location Baghouse 040 STACK

Date 13 OCT 1988

			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	
2	2058	747.52	1.50	1.90	1.90	10.5	136	239	254	52	55	51	
1	2100	748.61	1.70	2.30	2.20	12.5	131	236	237	51	56	51	
END	2102	750.210	—	—	—	—	—	—	—	—	—	—	
B-6	2103	750.210	1.50	1.90	1.90	9.5	132	242	254	55	56	51	
5	2105	751.65	1.20	1.50	1.50	8.6	134	242	257	52	56	52	
4	2107	753.03	1.00	1.30	1.30	9.0	132	241	250	53	56	52	
3	2109	754.29	1.40	1.90	1.40	8.1	130	238	238	53	56	52	
2	2111	755.69	1.10	1.40	1.40	8.3	130	242	245	53	57	53	
1	2113	756.86	1.30	1.65	1.65	10.1	127	245	245	53	57	53	
END	2115	758.100	—	—	—	—	—	—	—	—	—	—	
A-6	2116	758.100	1.20	1.50	1.50	8.5	130	251	248	57	57	53	
5	2118	759.32	1.20	1.50	1.50	8.6	135	252	250	54	57	54	
4	2120	760.67	1.25	1.60	1.60	9.0	131	250	253	54	57	54	
3	2122	761.94	1.00	1.30	1.30	8.0	131	249	245	54	57	54	
2	2124	763.25	1.00	1.30	1.30	8.2	131	249	251	55	58	54	
1	2126	764.59	1.05	1.35	1.35	8.3	135	250	262	55	57	54	
END	2128	765.694	—	—	—	—	—	—	—	—	—	—	
ALL													

APPENDIX E

Analytical Data

SO_2 EMISSION DATA

Job Number 88-141 Location Indianapolis, IN.

Job Name Quemetco Unit Tested Electric Arc Furnace

Run Number	1	2	3		
N - normality of $Ba(ClO_4)_2$	0.0099	0.0099	0.0099		
ML_I - ml in impinger #2	340	327	296		
ML_I - ml in impinger #3	345	285	340		
ML_A - ml in aliquot #2	1	1	1		
ML_A - ml in aliquot #3	10	10	10		
ML_B - ml of $Ba(ClO_4)_2$ to titrate #2	0.40	0.35	0.50		
	0.45	0.35	0.50		
	0.40	0.35	0.50		
Average ML_B - ml of $Ba(ClO_4)_2$	0.42 ✓	0.35 ✓	0.50 ✓		
ML_B - ml of $Ba(ClO_4)_2$ to titrate #3	0.20	0.25	0.15		
	0.20	0.20	0.20		
	0.25	0.25	0.20		
Average ML_B - ml of $Ba(ClO_4)_2$	0.22 ✓	0.23 ✓	0.18 ✓		
ML_{BB} - ml of $Ba(ClO_4)_2$ to titrate blank	0.25	0.05	0.05		
T_m - average gas meter temp., °F	59	68	74		
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$	27.600	25.446	26.582		
P_b - barometric pressure, "Hg Abs.	29.31	29.31	29.31		
Q_s - stack gas volume dry @ standard conditions, *SCFM	23 991	23,586	23,284		
C_I - SO_2 in impinger #2, mgs	39.9	31.1	42.2		
C_I - SO_2 in impinger #3, mgs	1.9	1.6	1.4		
C_T - total SO_2 in impingers, mgs	41.7 ✓	32.7 ✓	43.6 ✓		
ppm SO_2	20.1	17.4	22.5		
C_{SO_2} - emission rate of SO_2, lbs/day	115.4	98.1	125.0		
C_{SO_2} - emission rate of SO_2, lbs/hr	4.81	4.09	5.21		
C_s - emission rate of S, lbs/day					

• 29.92 "Hg, 68°F (760 mm Hg, 20°C)

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

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

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

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

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

METCO

SULFUR TRIOXIDE EMISSION DATA

Job Number 88-141 Location Indianapolis, IN.

Job Name Quemetco Unit Tested Electric Arc Furnace

Run Number	1	2	3	
Date	10/11/88	10/11/88	10/11/88	
Time	1500	1527	1534	
$\underline{N}$ - normality of $Ba(ClO_4)_2$	0.0099	0.0099	0.0099	
ML_I - ml in impinger	190	225	235	
ML_A - ml in aliquot	10.0	10.0	10.0	
ML_B - ml of $Ba(ClO_4)_2$ to titrate	0.40	0.50	0.50	
	0.35	0.50	0.50	
	0.35	0.50	0.45	
Average ML_B - ml of $Ba(ClO_4)_2$ to titrate	0.37	0.50	0.48	
ML_{BB} - ml of $Ba(ClO_4)_2$ to titrate blank	0.05	0.05	0.05	
T_m - average gas meter temp., °F				
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$				
P_b - barometric pressure, "Hg Abs.				
Q_s - stack gas volume dry @ standard conditions, *SCFM				
C_I - SO_3 in impinger, mgs	2.4	4.0	4.0	
ppm SO_3				
C_{SO_3} - emission rate of SO_3, lbs/day				
C_S - emission rate of S, lbs/day				

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

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

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

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

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

METCO Environmental

Particulate Analysis Summary

Job Number 88-141

Job Name Quemetco

Location Indianapolis, IN.

Date Analysis Completed 10/23/88

Unit Tested Electric Arc Furnace Duct

	✓	/	/		
Run No.	4	5	6		
Particulate on Filter (mg)	2.6	0.6	0.5		
Particulate in Front Wash (mg)*	4.8	4.6	5.9		
MF (mg)	7.4	5.2	6.4		
Particulate in Impinger #1 (mg)**	—	—	—		
MT (mg)	7.4	5.2	6.4		

John P. McGuire

Analyst

* Less Acetone Residue

** Less Ammonium Sulfate

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Stack Filters

Job Number 88-141 Location Indianapolis, IN.

Job Name Quemetco Unit Tested Electric Arc Furnace Duct

Desiccator Time In	1100 10-7	1635 10-10			
Desiccator Time Out	1630 10-10	1450 10-11			

Run No. 4	Filter No. D-35				
Filter & Particulate + Tare Weight (g)	2.3864	2.3861			
Tare Weight (g)	1.7338	1.7337	✓		
Filter & Particulate (g)	0.6526	0.6524			

Filter & Particulate Average (g) 0.0525

Initial Filter Weight (g) 0.6499

Total Particulate (mg) 2.6 ✓

Run No. 5	Filter No. F-63				
Filter & Particulate + Tare Weight (g)	2.3560	2.3553			
Tare Weight (g)	1.7338	1.7335	✓		
Filter & Particulate (g)	0.6222	0.6218			

Filter & Particulate Average (g) 0.6220

Initial Filter Weight (g) 0.6214

Total Particulate (mg) 0.6 ✓

Run No. 6	Filter No. F-60				
Filter & Particulate + Tare Weight (g)	2.3618	2.3615			
Tare Weight (g)	1.7340	1.7334	✓		
Filter & Particulate (g)	0.6278	0.6281			

Filter & Particulate Average (g) 0.6280

Initial Filter Weight (g) 0.6275

Total Particulate (mg) 2.5 ✓

John Pellegrini

Analyst

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Front Wash

Job Number 88-141 Location Indianapolis, IN.

Job Name Quemetco Unit Tested Electric Arc Furnace Duct

Desiccator Time In	0830 10-11	1130 10-13	0950 10-14		
Desiccator Time Out	1120 10-13	0940 10-14	1610 10-14		

Run No. 4	Volume (ml) 245				
Final Weight (g)	138.6209	138.6207			
Initial Weight (g)	138.6145	138.6145	✓		
Particulate Weight (g)	0.0064	0.0062			

Particulate Average (mg) 6.3
Less Acetone Blank (mg) 1.5 −
Total Particulate (mg) 4.8 ✓

Run No. 5	Volume (ml) 205				
Final Weight (g)	140.6257	140.6263			
Initial Weight (g)	140.6203	140.6203	✓		
Particulate Weight (g)	0.0056	0.0060			

Particulate Average (mg) 5.8
Less Acetone Blank (mg) 1.2 −
Total Particulate (mg) 4.6 ✓

Run No. 6	Volume (ml) 285				
Final Weight (g)	143.0596	143.0601			
Initial Weight (g)	143.0523	143.0523	✓		
Particulate Weight (g)	0.0073	0.0078			

Particulate Average (mg) 7.6
Less Acetone Blank (mg) 1.7 −
Total Particulate (mg) 5.7 ✓

Acetone Blank	Volume (ml) 383				
Final Weight (g)	142.6191	142.6199	142.6197		
Initial Weight (g)	142.6175	142.6175	142.6175	✓	
Difference (g)	0.0016	0.0024	0.0022		

Average (mg) 2.3 ✓
* mg/l 6.0 ✓

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

John Pellegrini
Analyst

SO_2 EMISSION DATA

Job Number 88-14 Location Indianapolis, IN.

Job Name Chemetco Unit Tested Reverb STACK

Run Number	2	3	4		
N - normality of $Ba(ClO_4)_2$	0.0099	0.0099	0.0099		
ML_I - ml in impinger #2	273	352	248		
ML_I - ml in impinger #3	295	260	285		
ML_A - ml in aliquot #2	1	1	1		
ML_A - ml in aliquot #3	15	15	15		
ML_B - ml of $Ba(ClO_4)_2$ to titrate #2	6.20	2.95	0.75		
	6.20	2.95	0.75		
	6.25	3.00	0.75		
Average ML_B - ml of $Ba(ClO_4)_2$	6.22 ✓	2.97 ✓	0.75 ✓		
ML_B - ml of $Ba(ClO_4)_2$ to titrate #3	1.20	0.60	0.25		
	1.15	0.55	0.25		
	1.20	0.55	0.30		
Average ML_B - ml of $Ba(ClO_4)_2$	1.18 ✓	0.57 ✓	0.27 ✓		
ML_{BB} - ml of $Ba(ClO_4)_2$ to titrate blank	0.05	0.05	0.05		
T_m - average gas meter temp., °F	53	68	75		
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$	8.481	8.538	8.987		
P_b - barometric pressure, "Hg Abs.	29.09	29.09	29.09		
Q_s - stack gas volume dry @ standard conditions, *SCFM	47,074	48,991	46,515		
C_I - SO_2 in impinger #2, mgs	533.7	325.6	55.0		
C_I - SO_2 in impinger #3, mgs	7.0	2.9	1.3		
C_T - total SO_2 in impingers, mgs	540.7 ✓	328.5 ✓	56.3 ✓		
ppm SO_2	844.6	524.6	86.6		
C_{SO_2} - emission rate of SO_2, lbs/day					
C_{SO_2} - emission rate of SO_2, lbs/hr	396.3	256.2	41.9		
C_s - emission rate of S, lbs/day					

• 29.92 "Hg, 68°F (760 mm Hg, 20°C)

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

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

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

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

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

METCO

SULFUR TRIOXIDE EMISSION DATA

Job Number 88-141 Location Indianapolis IN.

Job Name Quemetco Unit Tested Reverb STACK

Run Number	2	3	4	
Date				
Time				
$\underline{N}$ - normality of $Ba(ClO_4)_2$	0.0099	0.0099	0.0099	
ML_I - ml in impinger	225	263	224	
ML_A - ml in aliquot	15	15	15	
ML_B - ml of $Ba(ClO_4)_2$ to titrate	0.50	0.45	0.40	
	0.50	0.50	0.45	
	0.50	0.50	0.45	
Average ML_B - ml of $Ba(ClO_4)_2$ to titrate	0.50 ✓	0.48 ✓	0.43 ✓	
ML_{BB} - ml of $Ba(ClO_4)_2$ to titrate blank	0.05	0.05	0.05	
T_m - average gas meter temp., °F				
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$				
P_b - barometric pressure, "Hg Abs.				
Q_s - stack gas volume dry @ standard conditions, *SCFM				
C_I - SO_3 in impinger, mgs	2.7 ✓	3.0 ✓	2.2 ✓	
ppm SO_3				
C_{SO_3} - emission rate of SO_3, lbs/day				
C_S - emission rate of S, lbs/day				

• 29.92 "Hg, 68°F (760 mm Hg, 20°C)

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

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

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

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

Mullins Environmental Testing Co., Inc.

Particulate Analysis Summary

Job Number 88-141

Job Name Quemetco

Location Indianapolis, IN.

Date Analysis Completed 10-3-88

Unit Tested Reverb Stack

Run No.	8	9	10		
Particulate on Filter (mg)	3.5	1.2	1.8		
Particulate in Front Wash (mg)*	10 7	9.3	8.3		
MF (mg)	14.2	10.5	10.1		
Particulate in Impinger #1 (mg)**					
MT (mg)					

Analyst

* Less Acetone Residue

** Less Ammonium Sulfate

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Stack Filters

Job Number 88-141 Location Indianapolis, IN.

Job Name Quemetco Unit Tested Reverb STACK

Desiccator Time In	0930 10-17	0915 10-19			
Desiccator Time Out	0900 10-19	1600 10-19			

Run No. 8	Filter No. F-67				
Filter & Particulate + Tare Weight (g)	2.3212	2.3207			
Tare Weight (g)	1.6930	1.6924	✓		
Filter & Particulate (g)	0.6282	0.6283			

Filter & Particulate Average (g) 0.6283

Initial Filter Weight (g) 0.6248

Total Particulate (mg) 3.5 ✓

Run No. 9	Filter No. F-68				
Filter & Particulate + Tare Weight (g)	2.3165	2.3165			
Tare Weight (g)	1.6924	1.6924	✓		
Filter & Particulate (g)	0.6241	0.6241			

Filter & Particulate Average (g) 0.6241

Initial Filter Weight (g) 0.6229

Total Particulate (mg) 1.2 ✓

Run No. 10	Filter No. F-69				
Filter & Particulate + Tare Weight (g)	2.3202	2.3201			
Tare Weight (g)	1.6923	1.6924	✓		
Filter & Particulate (g)	0.6279	0.6277			

Filter & Particulate Average (g) 0.6278

Initial Filter Weight (g) 0.6266

Total Particulate (mg) 1.8 ✓

John Pellegrino

Analyst

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Front Wash

Job Number 88-141 Location Indianapolis, IN.

Job Name Quemetco Unit Tested Reverb STACK

Desiccator Time In	0800 10-20	0900 10-21			
Desiccator Time Out	0850 10-21	2045 10-21			

Run No. 8	Volume (ml) 270				
Final Weight (g)	143.9946	143.9949			
Initial Weight (g)	143.9820	143.9820	✓		
Particulate Weight (g)	0.0126	0.129			

Particulate Average (mg) 12.8
Less Acetone Blank (mg) 2.1
Total Particulate (mg) 10.7 ✓

Run No. 9	Volume (ml) 253				
Final Weight (g)	178.3285	178.3285			
Initial Weight (g)	178.3172	178.3172	✓		
Particulate Weight (g)	0.0113	0.0113			

Particulate Average (mg) 11.3
Less Acetone Blank (mg) 2.0
Total Particulate (mg) 9.3 ✓

Run No. 10	Volume (ml) 231				
Final Weight (g)	156.3639	156.3644			
Initial Weight (g)	156.3541	156.3541	✓		
Particulate Weight (g)	0.0098	0.0103			

Particulate Average (mg) 10.1
Less Acetone Blank (mg) 1.8
Total Particulate (mg) 8.3 ✓

Run No. Acetone Blank	Volume (ml) 450				
Final Weight (g)	156.8766	156.8770			
Initial Weight (g)	156.8719	156.8719	✓		
Particulate Weight (g)	0.0047	0.0051			

Particulate Average (mg) 4.9
~~Less~~ Acetone Blank (mg) 12.9 ✓
Total Particulate (mg)

use 7.9 mg/l for Ace. Blk

John Pellegrini
Analyst

METCO Environmental

Particulate Analysis Summary

Job Number 84-141
Job Name Quemetco
Location Indianapolis, IN

Date Analysis Completed 10/23/84
Unit Tested Baghouse 039 Stack

Run No.	1 ✓	2 ✓	3 ✓		
Particulate on Filter (mg)	0.0	0.1	1.0		
Particulate in Front Wash (mg)*	7.0	5.7	4.4		
MF (mg)	7.0	5.8	5.4		
Particulate in Impinger #1 (mg)**					
MT (mg)					

J R Manfredi
Analyst

* Less Acetone Residue

** Less Ammonium Sulfate

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Stack Filters

Job Number 88-141 Location Indianapolis, IN.

Job Name Quemetco Unit Tested Baghouse 039 STACK

Desiccator Time In	0930 10-17	0945 10-19			
Desiccator Time Out	0930 10-19	1345 10-19			

Run No. 1	Filter No. F-71				
Filter & Particulate + Tare Weight (g)	2.3149	2.3149			
Tare Weight (g)	1.6923	1.6927	✓		
Filter & Particulate (g)	0.6226	0.6221			

Filter & Particulate Average (g) 0.6224

Initial Filter Weight (g) 0.6242

Total Particulate (mg) -2- ✓

Run No. 2	Filter No. F-72				
Filter & Particulate + Tare Weight (g)	2.3219	2.3219			
Tare Weight (g)	1.6923	1.6927	✓		
Filter & Particulate (g)	0.6296	0.6292			

Filter & Particulate Average (g) 0.6294

Initial Filter Weight (g) 0.6293

Total Particulate (mg) 0.1 ✓

Run No. 3	Filter No. F-70				
Filter & Particulate + Tare Weight (g)	2.3174	2.3179			
Tare Weight (g)	1.6923	1.6927	✓		
Filter & Particulate (g)	0.6251	0.6252			

Filter & Particulate Average (g) 0.6252

Initial Filter Weight (g) 0.6242

Total Particulate (mg) 1.0 ✓

JRM

Analyst

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Front Wash

Job Number 88-141 Location Indianapolis, IN

Job Name Quemetco Unit Tested Baghouse 039 STACK

Desiccator Time In	0830 10-21	0940 10-22	0955 10-23		
Desiccator Time Out	0930 10-22	0945 10-23	1600 10-23		

Run No. 1	Volume (ml) 253				
Final Weight (g)	155.6115	155.6115			
Initial Weight (g)	155.6028	155.6028	✓		
Particulate Weight (g)	0.0087	0.0087			

Particulate Average (mg) 8.7
Less Acetone Blank (mg) 1.7
Total Particulate (mg) 7.0 ✓

Run No. 2	Volume (ml) 216				
Final Weight (g)	149.8719	149.8728	149.8725	✓	
Initial Weight (g)	149.8655	149.8655	149.8655		
Particulate Weight (g)	0.0064	0.0073	0.0070		

Particulate Average (mg) 7.2
Less Acetone Blank (mg) 1.5
Total Particulate (mg) 5.7 ✓

Run No. 3	Volume (ml) 260				
Final Weight (g)	142.7542	142.7538			
Initial Weight (g)	142.7478	142.7478	✓		
Particulate Weight (g)	0.0064	0.0060			

Particulate Average (mg) 6.2
Less Acetone Blank (mg) 1.8
Total Particulate (mg) 4.4 ✓

Acetone Blank	Volume (ml) 262				
Final Weight (g)	147.9641	147.9641			
Initial Weight (g)	147.9623	147.9623	✓		
Difference (g)	0.0018	0.0018			

Average (mg) 1.8
* mg/l 6.9

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

JRM
Analyst

METCO Environmental

Particulate Analysis Summary

Job Number 87-141

Job Name Ruemelin

Location Indianapolis, IN

Date Analysis Completed 10/22/88

Unit Tested Baghouse 042 Stack

Run No.	1	2	3		
Particulate on Filter (mg)	0.5	0.3	0.6		
Particulate in Front Wash (mg)*	13.0	8.3	10.7		
MF (mg)	13.5	8.6	11.3		
Particulate in Impinger #1 (mg)**					
MT (mg)					

JR Martin

Analyst

* Less Acetone Residue

** Less Ammonium Sulfate

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Stack Filters

Job Number 88-141 Location Indianapolis, IN

Job Name Quemetco Unit Tested Baghouse 040 STACK

Desiccator Time In	0930 10-7	0930 10-9			
Desiccator Time Out	0920 10-19	1605 10-19			

Run No. 1	Filter No. F-73				
Filter & Particulate + Tare Weight (g)	2.3171	2.3169			
Tare Weight (g)	1.6925	1.6923	✓		
Filter & Particulate (g)	0.6246	0.6246			

Filter & Particulate Average (g) 0.6246

Initial Filter Weight (g) 0.6241

Total Particulate (mg) 0.5 ✓

Run No. 2	Filter No. F-74				
Filter & Particulate + Tare Weight (g)	2.3170	2.3176			
Tare Weight (g)	1.6923	1.6927	✓		
Filter & Particulate (g)	0.6247	0.6249			

Filter & Particulate Average (g) 0.6248

Initial Filter Weight (g) 0.6245

Total Particulate (mg) 0.3 ✓

Run No. 3	Filter No. F-75				
Filter & Particulate + Tare Weight (g)	2.3206	2.3207			
Tare Weight (g)	1.6923	1.6926	✓		
Filter & Particulate (g)	0.6283	0.6281			

Filter & Particulate Average (g) 0.6282

Initial Filter Weight (g) 0.6276

Total Particulate (mg) 0.6 ✓

JRM

Analyst

Mullins Environmental Testing Co., Inc.

Particulate Analysis EPA Method 5

Front Wash

Job Number 94-141 Location Indianapolis, IN

Job Name Quemetco Unit Tested Baghouse 040 STACK

Desiccator Time In	0830 10-21	0950 10-22			
Desiccator Time Out	0940 10-22	1650 10-22			

Run No. 1	Volume (ml) 245				
Final Weight (g)	128.8057	128.8058			
Initial Weight (g)	128.7913	128.7913	✓		
Particulate Weight (g)	0.144	0.0145			

Particulate Average (mg) 14.5 -
Less Acetone Blank (mg) 1.5 -
Total Particulate (mg) 13.0 ✓

Run No. 2	Volume (ml) 245				
Final Weight (g)	121.1764	121.1769			
Initial Weight (g)	121.1669	121.1669	✓		
Particulate Weight (g)	0.0095	0.0100			

Particulate Average (mg) 9.9 -
Less Acetone Blank (mg) 1.5 -
Total Particulate (mg) 8.3 ✓

Run No. 3	Volume (ml) 291				
Final Weight (g)	120.0616	120.0618			
Initial Weight (g)	120.0492	120.0492	✓		
Particulate Weight (g)	0.0124	0.0126			

Particulate Average (mg) 12.5 -
Less Acetone Blank (mg) 1.8
Total Particulate (mg) 10.7 ✓

Acetone Blank	Volume (ml) 378				
Final Weight (g)	119.4910	119.4914			
Initial Weight (g)	119.4889	119.4889	✓		
Difference (g)	0.0021	0.0025			

Average (mg) 2.3 -
* mg/l 6.1 -

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

JRM
Analyst

APPENDIX F

Lead Analysis

ANALYTICAL REPORT

Doug Saathoff
METCO ENVIRONMENTAL
P.O. Box 598
Addison Tx 75001

10-27-88

Sample No: SEE BELOW

Sample Description: SEE BELOW
ELECTRIC ARC FURNACE PROJ#88-141

Date Received: 10-25-88 0945

100447	RUN 4 FRONT WASH & FILTER		Taken: 10-25-88
Lead		0.495	Total mg
100448	RUN 5 FRONT WASH & FILTER		Taken: 10-25-88
Lead		0.382	Total mg
100449	RUN 6 FRONT WASH & FILTER		Taken: 10-25-88
Lead		0.382	Total mg
100450	BLANK HNO3 & FILTER		Taken: 10-25-88
Lead		<0.003	Total mg

Edwin R. Wheeler, Laboratory Director

Preliminary Report

ANALYTICAL REPORT

Doug Saathoff
METCO ENVIRONMENTAL
P.O. Box 598
Addison Tx 75001

10-27-88

Sample No: SEE BELOW

Sample Description: SEE BELOW
REVERB STACK PROJ#88-141

Date Received: 10-25-88 0945

100454	RUN 8 IMP 1 & FILTER		Taken: 10-25-88
Lead		2.65	Total mg
100455	RUN 9 IMP 1 & FILTER		Taken: 10-25-88
Lead		2.07	Total mg
100456	RUN 10 IMP 1 & FILTER		Taken: 10-25-88
Lead		1.61	Total mg

Edwin R. Wheeler, Laboratory Director

Preliminary Report

ANALYTICAL REPORT

Doug Saathoff
METCO ENVIRONMENTAL
P.O. Box 598
Addison Tx 75001

10-27-88

Sample No: SEE BELOW

Sample Description: SEE BELOW
BAGHOUSE STACK 039 PROJ# 88-141

Date Received: 10-25-88 0945

100443	RUN 1 IMP 1,2 FRONT WASH & FILT	Taken: 10-25-88	
Lead	0.428		Total mg
100444	RUN 2 IMP 1,2 FRONT WASH & FILT	Taken: 10-25-88	
Lead	0.579		Total mg
100445	RUN 3 IMP 1,2 FRONT WASH & FILT	Taken: 10-25-88	
Lead	0.408		Total mg
100446	BLANK HNO3 & FILTER	Taken: 10-25-88	
Lead	0.009		Total mg

Edwin R. Wheeler, Laboratory Director

Preliminary Report

ANALYTICAL REPORT

Doug Saathoff
METCO ENVIRONMENTAL
P.O. Box 598
Addison Tx 75001

10-27-88

Sample No: SEE BELOW

Sample Description: SEE BELOW
PROJECT #88-141 BAGHOUSE STACK 040

Date Received: 10-25-88 0945

100439	RUN 1 IMP 1,2 FRONT WASH		Taken: 10-25-88
Lead		0.304	Total mg
100440	RUN 2 IMP 1,2 FRONT WASH & FILT		Taken: 10-25-88
Lead		0.353	Total mg
100441	RUN 3 IMP 1,2 FRONT WASH & FILT		Taken: 10-25-88
Lead		0.444	Total mg
100442	BLANK HNO3 & FILTER		Taken: 10-25-88
Lead		0.007	Total mg

Edwin R. Wheeler, Laboratory Director

Preliminary Report

ANALYTICAL REPORT

Doug Saathoff
METCO ENVIRONMENTAL
P.O. Box 598
Addison Tx 75001

10-27-88

Sample No: SEE BELOW

Sample Description: SEE BELOW
REVERB STACK PROJ#88-141

Date Received: 10-25-88 0945

100457	BLANK HNO3 & FILTER		Taken: 10-25-88
Lead		0.008	Total mg

Edwin R. Wheeler, Laboratory Director

Preliminary Report

ANALYTICAL REPORT

Doug Saathoff
METCO ENVIRONMENTAL
P.O. Box 598
Addison Tx 75001

10-27-88

Sample No: 100458

Sample Description: OH PB AUDIT
PROJECT # OH

Date Received: 10-25-88 0945

100458	OH PB AUDIT		Taken: 10-25-88
Lead		1124	mg/L

Edwin R. Wheeler, Laboratory Director

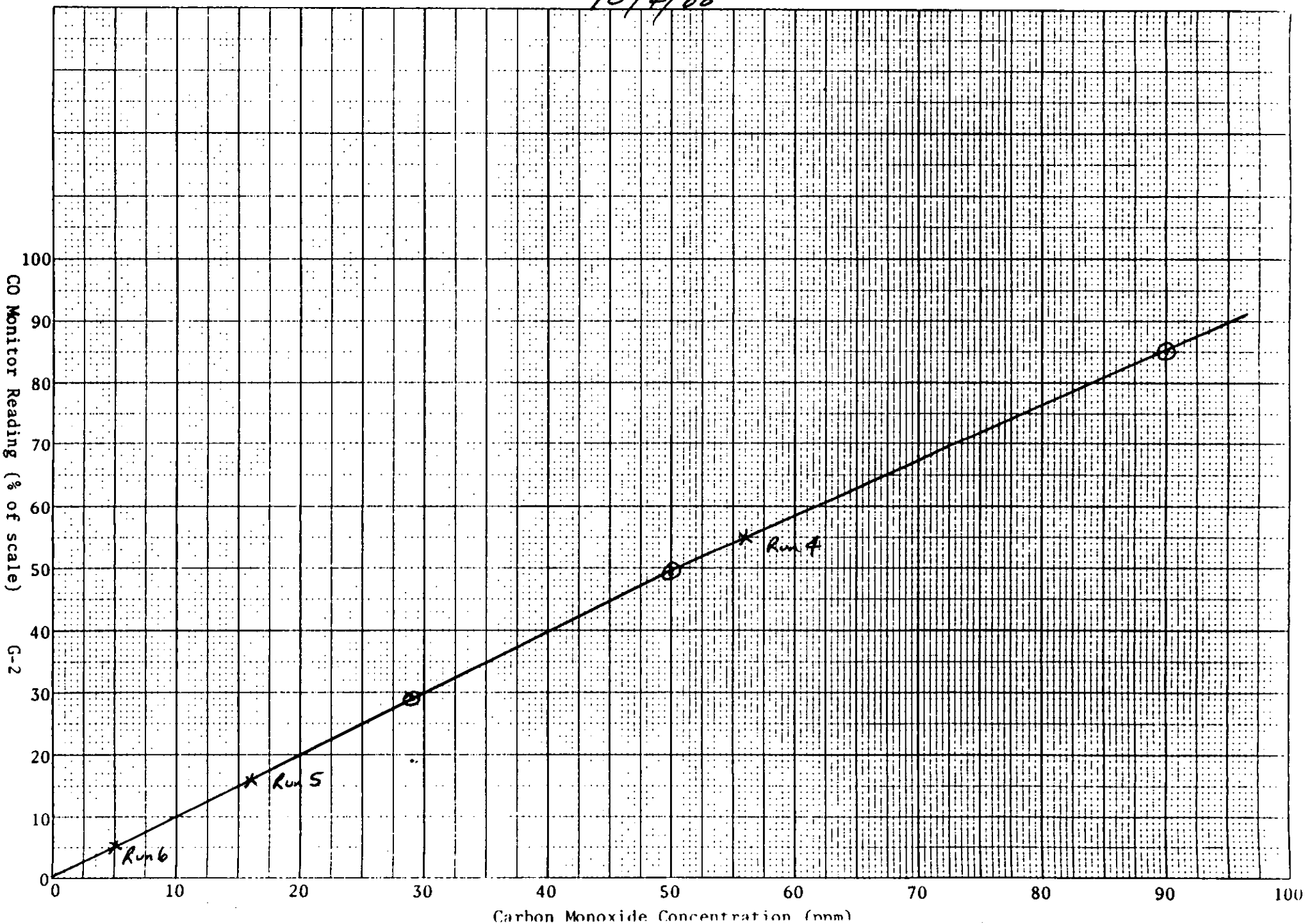
Preliminary Report

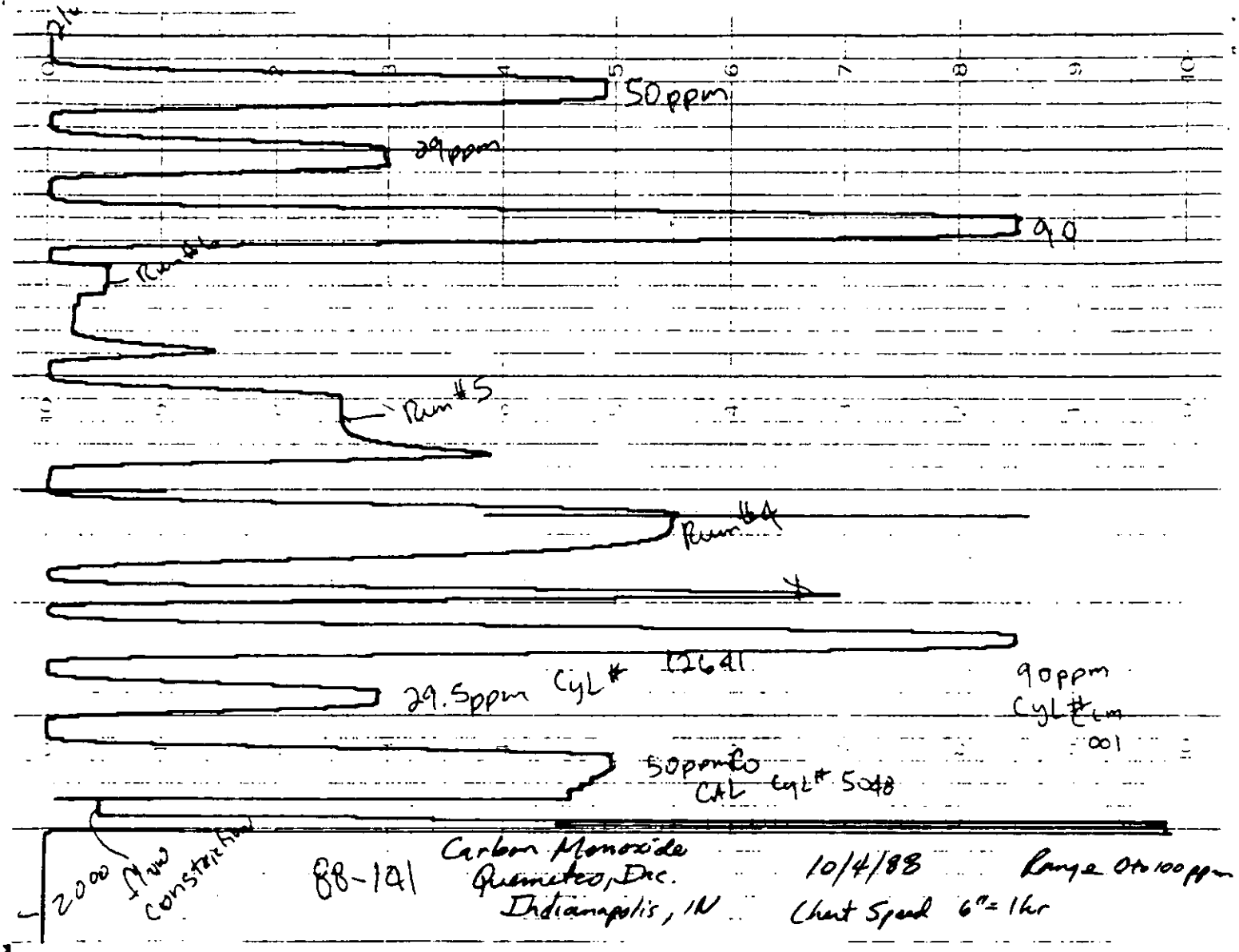
APPENDIX G

Carbon Monoxide Data

Carbon Monoxide Monitor Calibration Curve

10/4/88

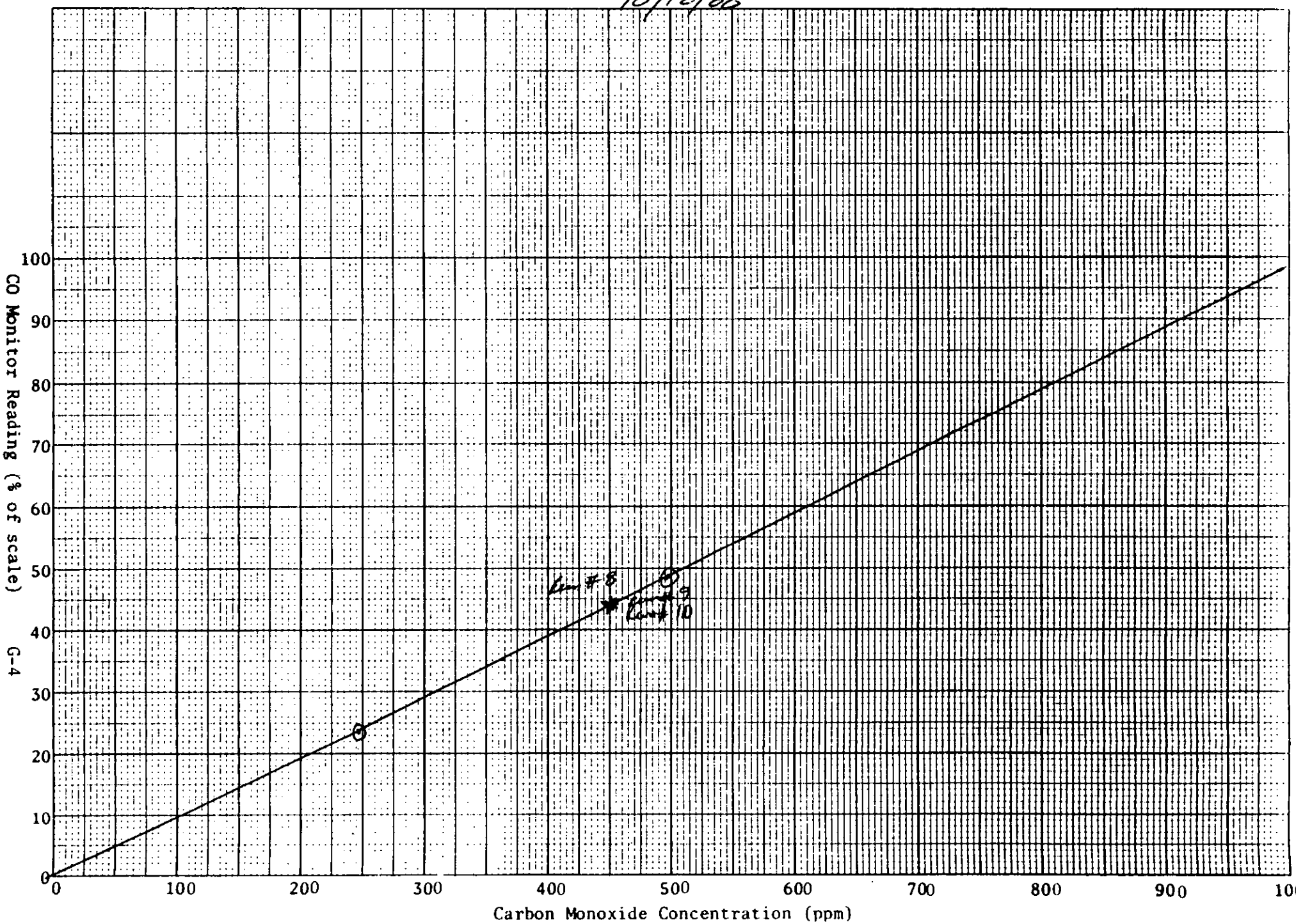



0
1
2
3
4
5
6
7
8
9
10
50ppm
29ppm
90
Run #5
Run #4
29.5ppm Cyl# ID641
90ppm
Cyl# ID
001
50ppm CO
CAL Cyl# 5048
2000 Flow
88-191
Carbon Monoxide
Quametco, Inc.
Indianapolis, IN
10/4/88
Chart Speed 6" = 1hr
Range 0 to 100 ppm

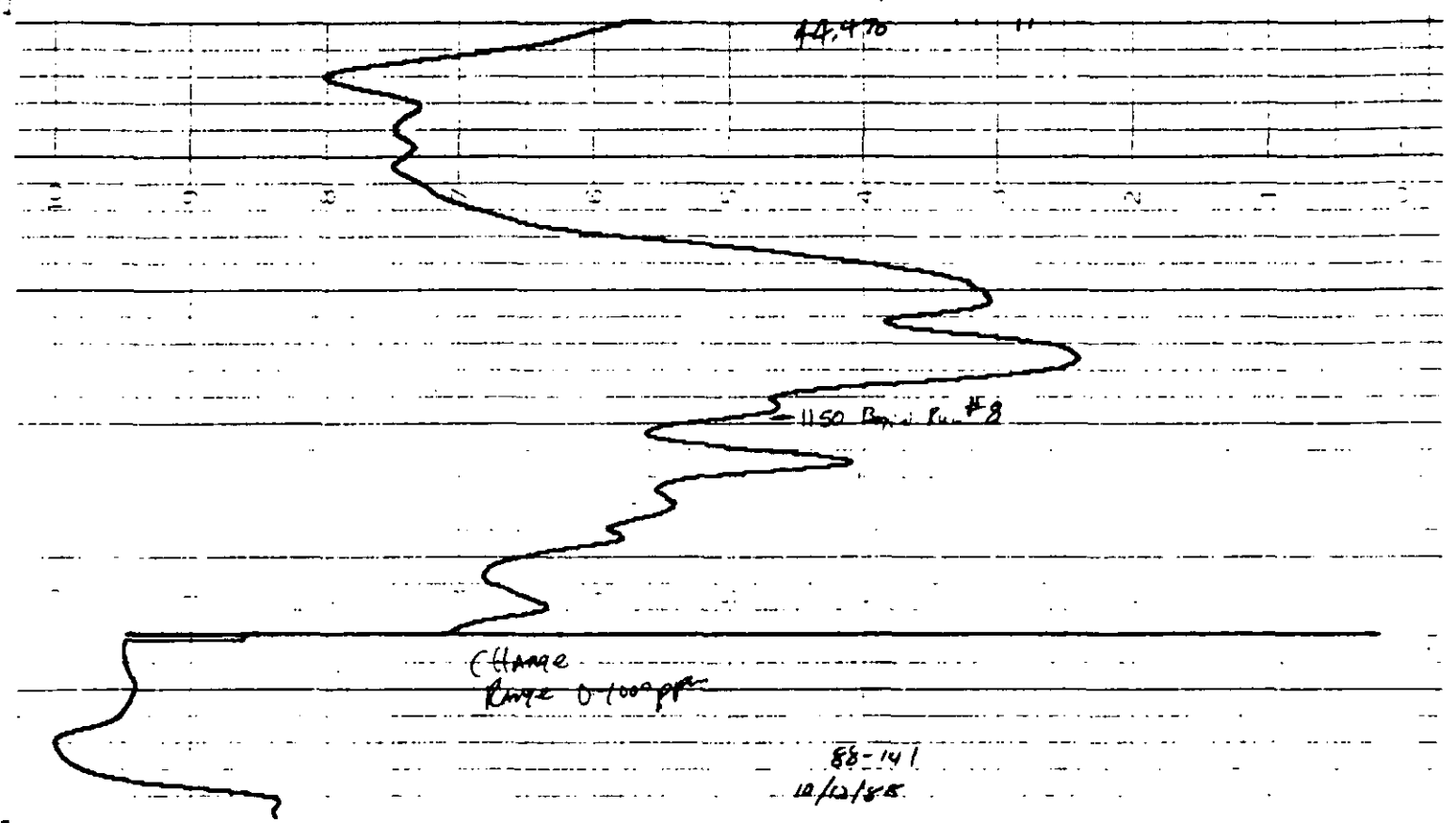
K•Σ

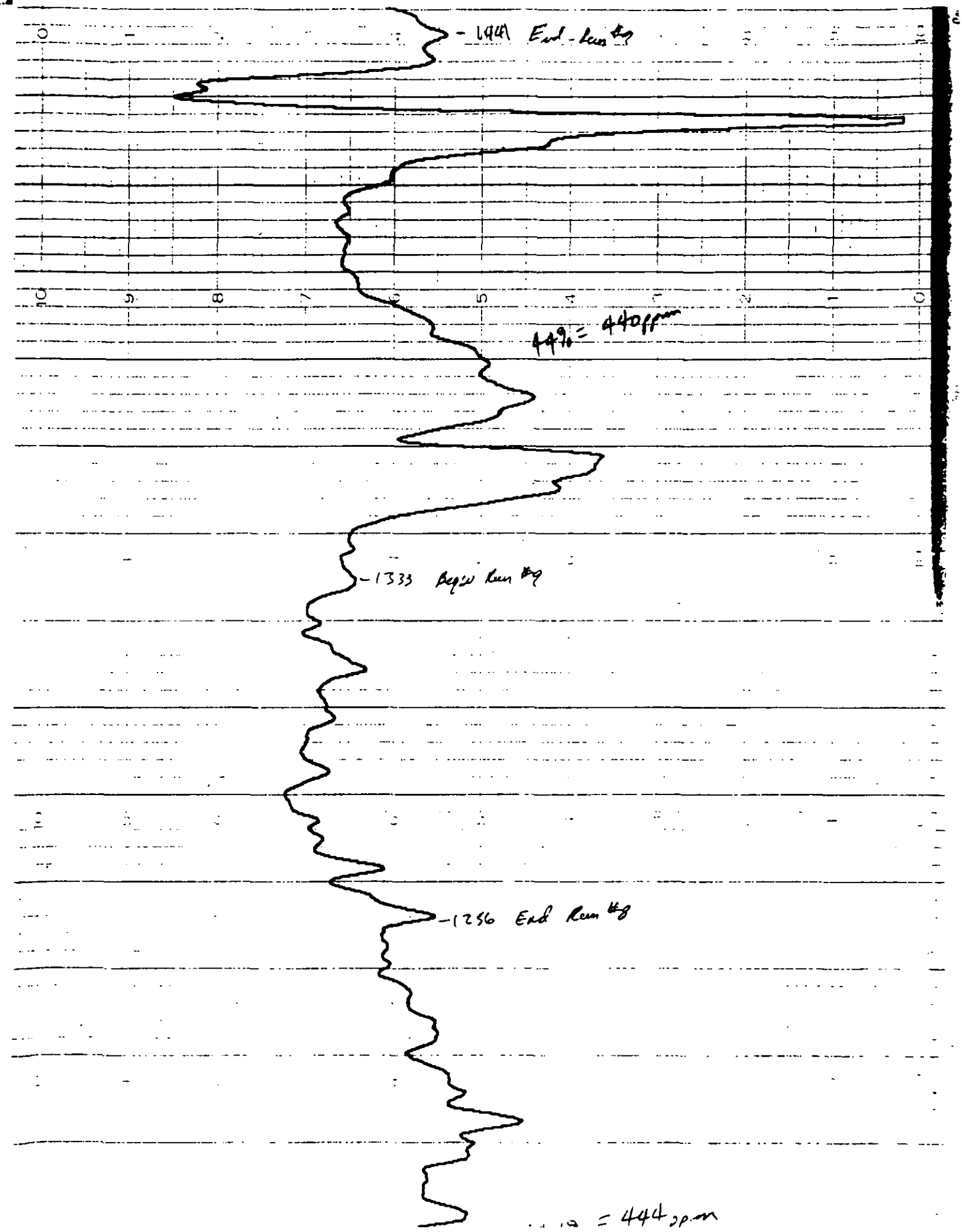
Carbon Monoxide Monitor Calibration Curve

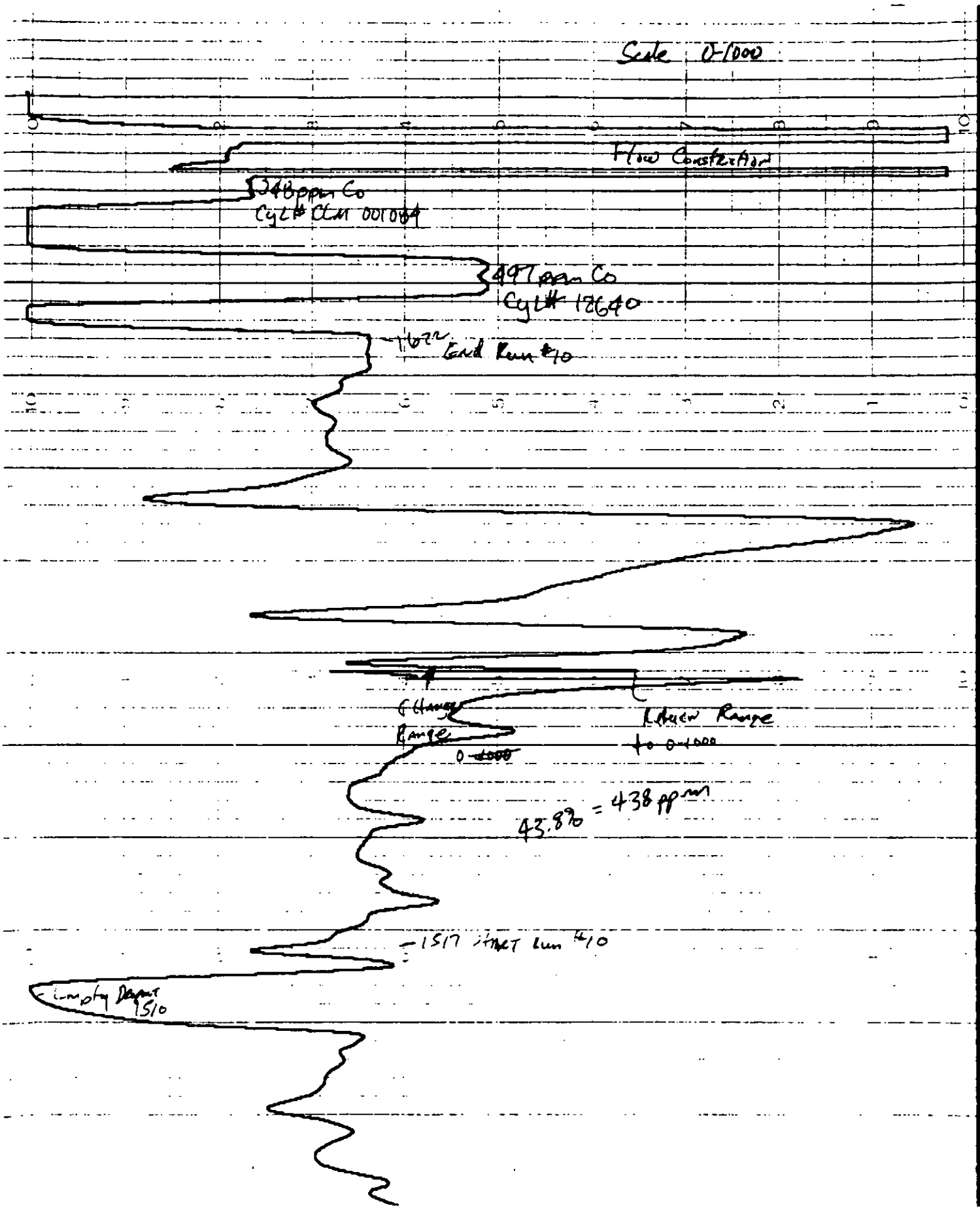
10/12/88



G-4


44,470
1150 Begin Run #8
Change
Range 0-1000 ppm
88-141
10/12/88


-1444 End - Run #9
10 9 8 7 6 5 4 3 2 1 0
44% = 440ppm
-1333 Begin Run #9
-1256 End Run #9
= 444 ppm


Scale 0-1000
Flow Constant Air
348 ppm Co
Cyl# CLM 001084
497 ppm Co
Cyl# 12640
1622 End Run #10
Change Range
0-1000
Leave Range
to 0-1000
43.8% = 438 ppm
1517 start Run #10
Empty Data 1510

METCO ENVIRONMENTAL

APPENDIX H

Chain of Custody

METCO ENVIRONMENTAL

Chain of Custody

Job Number 88-141

Job Name Quemetco, Inc.

Location Indianapolis, IN

Unit Tested Electric Arc Furnace Duct

Date(s) Sampled 10/4/88

Number of Tests 111

Date Results Required 10/10/88

SOURCE SAMPLES

	Number of Containers	Particulate	SO_2	SO_3	H_2S	Cl_2	H_2SO_4	Metals	Other
Filter Container									
Front Wash									
Back Wash									
Impinger No. 1	111			✓					
Impinger No. 2	111		✓						
Impinger No. 3	111		✓						
Impinger No. 4									
Acetone Blank									
NO_x									

Special Instructions

Outside Analysis

Firm: Date Taken:

Analysis for:

Sample No. 1 Recovered by: Greg Dove Date: 10/4/88 Time: 1058 Location: Van

Sample No. 2 Recovered by: Greg Dove Date: 10/4/88 Time: 1210 Location: Van

Sample No. 3 Recovered by: Greg Dove Date: 10/4/88 Time: 1330 Location: Van

Samples Received by: Billy J. Mullins, Jr. for Transport Date: 10/5/88 Time: 1030

Samples Received at Lab by: DR Scantlin Date: 10/7/88 Time: 1000

Samples Analyzed by: John Pellegrini Date: 10/25/88 Time: 1430

METCO ENVIRONMENTAL

Chain of Custody

Job Number 88-141

Job Name Quemetco, Inc

Location Indianapolis, IN

Unit Tested Electric Arc Furnace Duct

Date(s) Sampled 10/4/88

Number of Tests 3

Date Results Required 10/10/88

SOURCE SAMPLES

	Number of Containers	Particulate	SO_2	SO_3	H_2S	Cl_2	H_2SO_4	Metals	Other
Filter Container	III	✓						Pb	
Front Wash	III	✓						Pb	
Back Wash									
Impinger No. 1	III							Pb	
Impinger No. 2									
Impinger No. 3	III								No Analysis
Impinger No. 4									
Acetone Blank	I	✓							
NO_x									
Nitric Acid blank	I							Pb	

Special Instructions

EPA Method 12

Outside Analysis

Firm: NET Date Taken: 10/25/88

Analysis for: M-12 Pb ASAP 10/26.

Sample No. 4 Recovered by: Greg Orr Date: 10/4/88 Time: 1644 Location: Van

Sample No. 5 Recovered by: Greg Orr Date: 10/4/88 Time: 1842 Location: Van

Sample No. 6 Recovered by: Billy J. Mullins Jr. Date: 10/4/88 Time: 2010 Location: Van

Samples Received by: Billy J. Mullins Jr. for Transport Date: 10/5/88 Time: 1030

Samples Received at Lab by: DR Scatliff Date: 10/7/88 Time: 1020

Samples Analyzed by: John Pellegrini Date: 10/25/88 Time: 1430

METCO ENVIRONMENTAL

Chain of Custody

Job Number 88-141

Job Name Quemetco Inc

Location Indy IN

Unit Tested Reverb Stack

Date(s) Sampled 10/11/88

Number of Tests III

Date Results Required 10/21/88

SOURCE SAMPLES

	Number of Containers	Particulate	SO_2	SO_3	H_2S	Cl_2	H_2SO_4	Metals	Other
Filter Container									
Front Wash									
Back Wash									
Impinger No. 1	III			✓					
Impinger No. 2	III		✓						
Impinger No. 3	III		✓						
Impinger No. 4									
Acetone Blank									
NO_x									

Special Instructions

Report

Outside Analysis

Firm: Date Taken:

Analysis for:

Sample No. 12 Recovered by: Greg Orr Date: 10/11/88 Time: 0915 Location: VAN

Sample No. 13 Recovered by: Greg Orr Date: 10/11/88 Time: 1116 Location: VAN

Sample No. 14 Recovered by: Greg Orr Date: 10/11/88 Time: 1145 Location: VAN

Samples Received by: Billy J. Mullins Jr. for Transport Date: 10/14/88 Time: 0900

Samples Received at Lab by: DR Southoff Date: 10/17/88 Time: 0730

Samples Analyzed by: John Pellegrini Date: 10/24/88 Time: 1100

METCO ENVIRONMENTAL

Chain of Custody

Job Number 88-141

Job Name Quemetco Inc

Location Indy IN

Unit Tested Reverb Stack

Date(s) Sampled 10/12/88

Number of Tests III

Date Results Required 10/21/88

SOURCE SAMPLES

	Number of Containers	Particulate	SO_2	SO_3	H_2S	Cl_2	H_2SO_4	Metals	Other
Filter Container	III	✓						Pb	
Acc Front Wash	III	✓						Pb	
Back Wash									
Impinger No. 1	III							Pb	Pb
Impinger No. 2									
Impinger No. 3	III								Hold
Impinger No. 4									
Acetone Blank	I	✓						Pb	
NO_x									

Special Instructions

Lead Analysis by EPA Method 12

Outside Analysis

Firm: NET Date Taken: 10/25/88

Analysis for: M-12 Pb ASAP 10/26 a.m.

Pb

Sample No. 8 Recovered by: Greg Corn Date: 10/12/88 Time: 1500 Location: Van

Sample No. 9 Recovered by: Greg Corn Date: 10/12/88 Time: 1608 Location: Van

Sample No. 10 Recovered by: Greg Corn Date: 10/12/88 Time: 1750 Location: Van

Samples Received by: Billy J. Mullins Jr. for Transport Date: 10/14/88 Time: 0900

Samples Received at Lab by: DR Southhoff Date: 10/17/88 Time: 0745

Samples Analyzed by: John Pellegrini Date: 10/25/88 Time: 1430

METCO ENVIRONMENTAL

Chain of Custody

Job Number 88-141

Job Name Quemetco Inc.

Location Indy In

Unit Tested ~~Lateral~~ Baghouse 035 STACK

Date(s) Sampled 10/13/88

Number of Tests 111

Date Results Required 10/21/88

SOURCE SAMPLES

	Number of Containers	Particulate	SO_2	SO_3	H_2S	Cl_2	H_2SO_4	Metals	Other
Filter Container	111	✓	—	—	—	—	—	Pb	
Acc Front Wash	111	✓	—	—	—	—	—		
Back Wash			—	—	—	—	—		
Impinger No. 1	111		—	—	—	—	—	Pb	
Impinger No. 2			—	—	—	—	—		
Impinger No. 3			—	—	—	—	—		
Impinger No. 4			—	—	—	—	—		
Acetone Blank			—	—	—	—	—		
NO_x			—	—	—	—	—		
			—	—	—	—	—		
			—	—	—	—	—		

Special Instructions

Lead Analysis by EPA Method 12

Outside Analysis

Firm: WET Date Taken: 10/25

Analysis for: M-12 Pb ASAP 10/26

Sample No. 1 Recovered by: Greg Orr Date: 10/13/88 Time: 1515 Location: Van

Sample No. 2 Recovered by: Greg Orr Date: 10/13/88 Time: 1530 Location: Van

Sample No. 3 Recovered by: Billy J. Mullins Jr Date: 10/13/88 Time: 1545 Location: Van

Samples Received by: Billy J. Mullins, Jr for Transport Date: 10/14/88 Time: 0900

Samples Received at Lab by: DR Southall Date: 10/17/88 Time: 0720

Samples Analyzed by: John Pellegrini Date: 10/25/88 Time: 1430

METCO ENVIRONMENTAL

Chain of Custody

Job Number 88-141

Job Name Quemetco, Inc.

Location Indianapolis, IN

Unit Tested Baghouse 040 Stack

Date(s) Sampled 10/13/88

Number of Tests 111

Date Results Required 10/21/88

SOURCE SAMPLES

	Number of Containers	Particulate	SO_2	SO_3	H_2S	Cl_2	H_2SO_4	Metals	Other
Filter Container	111	✓						Pb	
Acetone Front Wash	111	✓							
Back Wash									
Impinger No. 1	111							Pb	
Impinger No. 2									
Impinger No. 3									
Impinger No. 4									
Acetone Blank	1	✓						Pb	
NO_x									
Nitric Acid Blank	1	=						Pb	

Special Instructions

Lead Analysis by EPA Method 12

Outside Analysis

Firm: NET Date Taken: 10/25

Analysis for: M-12 Pb ASAP 10/20

Sample No. 1 Recovered by: Billy J. Mullins, Jr. Date: 10/13/88 Time: 2315 Location: Van

Sample No. 2 Recovered by: Billy J. Mullins, Jr. Date: 10/13/88 Time: 2330 Location: Van

Sample No. 3 Recovered by: Billy J. Mullins, Jr. Date: 10/13/88 Time: 2345 Location: Van

Samples Received by: Billy J. Mullins, Jr. for Transport Date: 10/14/88 Time: 0900

Samples Received at Lab by: DR Scattergood Date: 10/17/88 Time: 0740

Samples Analyzed by: John Pellegrini Date: 10/25/88 Time: 1430

APPENDIX I

Resumes of Test Personnel

METCO ENVIRONMENTAL
P.O. Box 598
Addison, TX 75001
(214) 931-7127

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)
Diplomat in the American Academy of Environmental Engineers
Inductee into the Stack Sampling Hall of Fame

Professional Memberships

Air Pollution Control Association - Past Chairman, Southwest Section; Chairman - Consultants Committee
Source Evaluation Society - Past President
Texas Society of Professional Engineers
National Society of Professional Engineers
American Management Association

MULLINS

Technical Experience

Directed and performed stack sampling on over 1400 sources of which over 200 were sampled simultaneously using more than one sampling train at several points in the flue gas stream. 1972-present.

Directed and performed over 200 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.

MULLINS

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.

METCO ENVIRONMENTAL
P.O. Box 598
Addison, TX 75001
(214) 931-7127

GREGGORY M. ORR, Environmental Field Technician

Education	B.S. 1985, Louisiana Tech University, Ruston, Louisiana, in Geology.
Technical Experience	Participated in the sampling of over 90 sources, including several which were sampled simultaneously using more than one sampling train. Thoroughly trained in all EPA testing procedures. 1986-present.