



MOUNTAINEER CARBON COMPANY

P. O. BOX 577, MOUNDSVILLE, WV 26041

PHONE 304 845-1380

RECEIVED

JAN 9 1985

AIR POLLUTION
CONTROL COMMISSION

*Date / Fanley Review
Please comment 1-11-85
January 7, 1985*

Note: This is a reference cited in AP 42, *Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources*. AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

Mr. Carl Beard, II, Director
West Virginia Air Pollution Control Commission
1558 Washington Street, East
Charleston, West Virginia 25311

Re: Incinerator Compliance Testing
for Graphite Coke

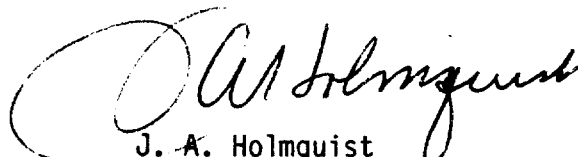
Dear Mr. Beard:

Pursuant to West Virginia TP-4 Compliance Test Procedures for Regulation VII, Mountaineer Carbon Company is hereby submitting the attached compliance testing report for graphite coke (Attachment I). Testing was conducted on both kiln-incinerator trains on December 12 and 13, 1984. Submittal of these results completes the compliance program outlined in the Consent Order.

Graphite coke sales have been less than expected and, therefore, completion of the extensive testing program outlined in the test protocol was not feasible. Emission rates are a function of a large number of process variables. We feel that the results obtained in December do not fully reflect the potential range in emission rates. Therefore, stack testing results obtained during preliminary testing of the incinerators are also provided in Table 3 summarizing actual and allowable emission rates. I will furnish additional information regarding the preliminary testing if needed. Mountaineer Carbon may still elect to perform further stack testing at a future date for its own informational purposes.

If you have any questions, please contact me at (304) 845-1380.

Yours truly,


J. A. Holmquist
Manager-Operations

JAH/GWM/lsm/2278

Attachments

TABLE I

MOUNTAINEER CARBON COMPANY

EMISSION RATE AND PROCESS DATA SUMMARY

Run No.	Kiln Feed (Tons/Hr)	Emission Rate (Lbs/Hr)	Incinerator Temperatures (°F)							Draft Incin. (In H ₂ O)	Draft Stack (In H ₂ O)	Combustion Air (SCFM)	
			Zone 1	Zone 2	Zone 3	Zone 4	Breeching	Stack	Wt'd.Avg. (a)			Bustle	Burner
1	35.9	31.7	2382	2335	2329	2237	2077	1936	2251	-0.76	-2.00	7,851	1407
2	31.6	12.9	2360	2340	2339	2251	2096	1962	2259	-0.73	-2.00	10,636	1512
3	35.7	26.2	2362	2323	2319	2228	2071	1943	2241	-0.77	-2.00	9,329	1522
4	35.4	32.4	2351	2161	2392	2331	2228	1977	2278	-0.53	-1.96	8,804	1398
5	31.3	18.8	2335	2271	2382	2324	2221	1969	2290	-0.58	-1.99	9,322	1429
6 ^(b)	34.6	41.9	2383	2178	2422	2363	2260	1996	2306	-0.33	-2.00	10,326	1386

(a) The weighted average temperature was defined in the testing protocol as a means to conveniently describe several operating temperatures of the new control system. Avg. Temp = 0.14 (Zone 1) + 0.18 (Zone 2) + 0.25 (Zone 3) + 0.25 (Zone 4) + 0.16 (Breeching) + 0.06 (Stack)

(b) To maintain desired incinerator temperatures, natural gas was burned in the incinerator during part of the testing period for this run only.

TABLE 2
MOUNTAINEER CARBON COMPANY
TIMING OF TESTING RUNS

<u>Run No.</u>	<u>Test Date</u>	<u>Hour Start</u>	<u>Hour Stop</u>	<u>Shift Hour Reported</u>	<u>Kiln No.</u>
1	12/12	8:49	10:06	2	1
2	12/12	11:46	13:05	5	1
3	12/12	13:57	15:06	7	1
4	12/13	8:40	9:47	2	2
5	12/13	10:35	11:47	4	2
6	12/13	13:31	14:39	7	2

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TABLE 3
MOUNTAINEER CARBON COMPANY
ACTUAL AND ALLOWANCE EMISSION RATE SUMMARIES

<u>Kiln No.</u>	<u>Date</u>	<u>Three-Run Average Throughput (Tons/Hr)</u>	<u>Three-Run Average Emission Rate (Lb/Hr)</u>	<u>Allowable Emission Rate (Lb/Hr)^(c)</u>
1	12/12	34.4	23.6	181
2	12/13	33.8	31.0	179
2	04/10 ^(d)	30	96.0	165
2	04/11 ^(d)	36	70.3	186
1	02/29 ^(d)	36	184.	186
1	03/01 ^(d)	36	122.	186
1	03/02 ^(d)	36 ^(e)	93.5 ^(e)	186

(c) $E = 16.89 P^{0.67}$

Where E = Allowable Emission Rate (Lb/Hr)

P = Process Weight Rate (Tons/Hr)

E is not to exceed 200 Lb/Hr.

(d) Stack testing was performed during preliminary incinerator testing and was not part of the compliance testing phase. Throughput rates are approximate.

(e) Only two (2) testing runs were completed and their average is reported here.

TABLE 4

PRODUCTION DATA SHEET FOR DECEMBER 12

MOUNTAINEER CARBON COMPANY
NO. 1 UNIT PRODUCTION ANALYSIS (SHIFT)

LEAD OPERATOR: JPB
LINE OPERATOR: JDM
OPERATOR HELPER: RDM
SUPERVISOR: RPY/JLB

DATE: 12-12-84
SHIFT: 2
TIME: 16:23:12
PAGE NO.: 1

		HOUR ONE	HOUR TWO	HOUR THREE	HOUR FOUR	HOUR FIVE	HOUR SIX	HOUR SEVEN	HOUR EIGHT	SHIFT AVERAGE
RAW MATERIALS										
TPH	W52011	.0	.0	.0	.0	.0	.0	.0	1.48	.19
PCT	Y52011	.0	.0	.0	.0	.0	.0	.0	5.51	.69
TPH	W52021	.0	.0	.0	.0	.0	.0	.0	.0	.0
PCT	Y52021	.0	.0	.0	.0	.0	.0	.0	.0	.0
TPH	W52031	.0	.0	.0	.0	.0	.0	.0	.0	.0
PCT	Y52031	.0	.0	.0	.0	.0	.0	.0	.0	.0
TPH	W52041	.0	.0	.0	.0	.0	.0	.0	.0	.0
PCT	Y52041	.0	.0	.0	.0	.0	.0	.0	.0	.0
TPH	W52051	.0	.0	.0	.0	.0	.0	.0	.0	.0
PCT	Y52051	.0	.0	.0	.0	.0	.0	.0	2.95	.37
TPH	W52061	32.81	35.94	35.96	36.11	31.61	33.24	35.75	30.40	33.98
PCT	Y52061	100.00	100.00	100.00	100.00	100.00	100.00	100.00	91.47	98.94
TPH	W5200	33.14	36.00	35.98	35.09	31.48	33.33	35.71	32.17	34.11
TOTAL										
INCINERATOR										
DRAFT INCINERATOR	IN H2O	-2.000*	-2.000*	-2.000*	-1.998*	-1.999*	-1.997	-1.998	-1.998	-1.999
DRAFT STACK	IN H2O	1848	1855	1805	1808	1825	1875	1850	1824	1839
TEMPERATURE SETTLING CHAMBER	DEG F	1912	1905	1862	1861	1870	1917	1899	1875	1888
TEMPERATURE DUCT	DEG F	2356	2382	2416	2387	2360	2294	2362	2379	2367
TEMPERATURE ZONE 1	DEG F	2319	2335	2366	2368	2340	2286	2323	2342	2335
TEMPERATURE ZONE 2	DEG F	2316	2329	2357	2366	2339	2290	2319	2338	2332
TEMPERATURE ZONE 3	DEG F	2225	2237	2260	2274	2251	2205	2228	2247	2241
TEMPERATURE ZONE 4	DEG F	2066	2077	2100	2117	2096	2035	2071	2091	2084
TEMPERATURE BREECHING	DEG F	1926	1936	1952	1975	1962	1938	1943	1957	1949
OXYGEN	PCT O2	10.00*	10.00*	10.00*	10.00*	10.00*	10.00*	10.00*	10.00*	.0
CARBON MONOXIDE	PCT CO	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0
DAMPER POSITION	PCT OP	27.4	27.4	27.4	28.2	28.5	28.5	28.5	28.5	28.0
NATURAL GAS (BUSTLE)	SCFM	.0	.0	.0	.0	.0	.0	.0	.0	.0
COMBUSTION AIR (BUSTLE)	SCFM	8123	7851	8311	10109	10636	10335	9329	9426	9265
NATURAL GAS (START-UP)	SCFM	.0	.0	.0	.0	.0	.0	.0	.0	.0
COMBUSTION AIR (START-UP)	SCFM	1396	1407	1444	1460	1512	1523	1522	1531	1474

PRODUCTION DATA SHEET FOR DECEMBER 13

DATE: 12-13-84
SHIFT: 2
TIME: 16:16:40
PAGE NO.: 1

[illegible]

-501	-532	-505	-579	-670	-377	-328	-488	-497
1955	-1960	-1971	-1977	-1981	-1978	-1989	-1967	-1972
1810	1793	1753	1730	1845	1867	1707	1746	1781
2048	2036	2008	1996	2075	2034	1946	1991	2017
2321	2351	2379	2335	2273	2321	2383	2297	2333
2145	2161	2245	2271	2056	2088	2178	2119	2158
2375	2392	2388	2382	2325	2344	2422	2385	2377
2317	2331	2328	2324	2271	2286	2363	2331	2319
2219	2228	2221	2221	2169	2184	2260	2227	2216
1972	1977	1973	1969	1937	1944	1996	1985	1969
.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0
.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0
26.6	26.4	26.4	26.4	26.4	24.0	23.8	27.3	25.9
.0*	.0*	.0*	.0*	.0*	169	.0	.0	21
8829	8804	10214	9322	6749	8685	10326	12553	9435
.0	.0	.0	.0	.0	.0	.0	.0	.0
1404	1398	1423	1429	1438	1403	1386	1436	1415

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ATTACHMENT I

COMPLIANCE TESTING REPORT

Submitted by:

ENTROPY ENVIRONMENTALISTS, INC.

ENTROPY

ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

STATIONARY SOURCE SAMPLING REPORT

EEI REF. NO. 2711

MOUNTAINEER CARBON COMPANY

MOUNDSVILLE, WEST VIRGINIA

PARTICULATE EMISSIONS COMPLIANCE TESTING

#1 AND 2 INCINERATOR OUTLET STACKS

DECEMBER 12-13, 1984

RECEIVED

JAN 9 1985

AIR POLLUTION
CONTROL COMMISSION

REPORT CERTIFICATION

The sampling and analysis performed for this report was carried out under my direction and supervision.

Date December 28, 1984

Signature Willis S. Nesbit

Willis S. Nesbit

I have reviewed all testing details and results in this test report and hereby certify that the test report is authentic and accurate.

Date December 28, 1984

Signature D. James Grove

D. James Grove, P.E.

ENTROPY

TABLE OF CONTENTS

	<u>PAGE</u>
INTRODUCTION	
1.1 Source	1-1
1.2 Test Program	1-1
1.3 Test Participants	1-1
SUMMARY OF RESULTS 2-1	
2.1 General	2-1
2.2 Discussion	2-1
PROCESS DESCRIPTION AND OPERATION	
3.1 General	3-1
3.2 Source Air Flow	3-1
SAMPLING AND ANALYTICAL PROCEDURES	
4.1 General	4-1
4.2 Sampling Points	4-1
4.3 Flue Gas Velocity and Molecular Weight	4-1
4.4 Particulate Emissions	4-1
4.5 Sampling Equipment	4-1
APPENDICES	
A. Test Results and Example Calculations	
1. Unit #1 Incinerator Stack	
2. Unit #2 Incinerator Stack	
B. Field and Analytical Data	
1. Unit #1 Incinerator Stack	
2. Unit #2 Incinerator Stack	
C. Sampling and Analytical Procedures	
D. Calibration Data	

INTRODUCTION

1.1 Source. Mountaineer Carbon Company (MOCAR) in Moundsville, West Virginia, uses incinerators to combust emissions from the graphite coke production processes; this report covers stationary source sampling performed for compliance purposes on December 12 and 13, 1984, at the stacks exhausting the #1 and #2 incinerators.

1.2 Test Program. Three EPA Method 5 runs were performed on December 12 at the Unit #1 incinerator stack, and on December 13 at the Unit #2 incinerator stack, to determine the particulate emissions.

1.3 Test Participants. Table 1-1 lists the personnel present during the testing program.

TABLE 1-1
TEST PARTICIPANTS

Jonathan Greenberg	Standard Oil Company of Ohio	Test Coordinator
Willis S. Nesbit	Entropy	Project Director
Steve Terll	Entropy	Sampling Team Leader
Henry B. Long	Entropy	Engineering Technician

SUMMARY OF RESULTS

2.1 General. Tables 2-1 and 2-2 present run-by-run summaries of the testing performed December 12 and 13, 1984, on the Unit #1 and #2 incinerators, respectively. Detailed results are provided in Appendix A, while the field and analytical data are given in Appendix B.

2.2 Discussion. From Table 2-1 and Table 2-2, the average particulate emission rates were 23.6 lb/hr for the Unit #1 incinerator and 31.0 lb/hr for the Unit #2 incinerator.

TABLE 2-1 ~

PARTICULATE TESTS SUMMARY OF RESULTS

Unit #1 Incinerator Stack			
	1	2	3
	-----	-----	-----
RUN DATE	12/12/84	12/12/84	12/12/84
TEST TRAIN PARAMETERS:			

VOLUME OF DRY GAS SAMPLED, SCF*	38.217	40.396	39.157
PERCENT ISOKINETIC	106.6	103.5	103.9
FLUE GAS PARAMETERS:			

TEMPERATURE, DEG. F	1,953	1,954	1,950
GAS FLOW RATES SCFM*, DRY	52,656	57,324	55,341
ACFM, WET	296,211	319,870	310,079
PERCENT EXCESS AIR	42.2	46.1	43.1
METHOD 5 TEST RESULTS:			

CATCH, MILLIGRAMS	173.9	68.8	140.1
GRAINS PER DSCF*	0.0702	0.0263	0.0552
LBS PER HOUR	31.69	12.91	26.19

* 68 Deg. F. - 29.92 in. Hg.

TABLE 2-2

PARTICULATE TESTS SUMMARY OF RESULTS

Unit #2 Incinerator Stack

	4	5	6
	-----	-----	-----
RUN DATE	12/13/84	12/13/84	12/13/84
TEST TRAIN PARAMETERS:			

VOLUME OF DRY GAS SAMPLED, SCF*	38.518	38.072	36.099
PERCENT ISOKINETIC	109.6	110.2	106.9
FLUE GAS PARAMETERS:			

TEMPERATURE, DEG. F	1,990	1,993	1,992
GAS FLOW RATES SCFM*, DRY	51,615	50,731	49,586
ACFM, WET	299,168	290,604	291,843
PERCENT EXCESS AIR	45.7	41.9	20.4
METHOD 5 TEST RESULTS:			

CATCH, MILLIGRAMS	183.0	106.5	230.6
GRAINS PER DSCF*	0.0733	0.0432	0.0986
LBS PER HOUR	32.44	18.77	41.90

* 68 Deg. F. - 29.92 in. Hg.

PROCESS DESCRIPTION AND OPERATION

3.1 General. The Mountaineer Carbon Company in Moundsville, West Virginia, operates two rotary calciners (kilns) for the production of calcined coke. The emissions control system serving each calciner includes an incinerator for the destruction of volatile materials. The testing covered in this report was performed at the outlet stacks exhausting the Unit #1 and Unit #2 incinerators during the production of graphite coke.

Green coke is fed into the elevated end of each inclined rotary calciner and flows countercurrently to the hot gases introduced through a natural gas-fired burner. As the coke is heated to the calciner temperature of approximately 2,700 degrees Fahrenheit, volatile hydrocarbons and water are removed and introduced into the gas stream along with entrained coke particles. When necessary, the incinerator is fired with natural gas to maintain the desired temperature.

3.2 Source Air Flow. As shown schematically in Figure 3-1, the off gases pass through a spill-over hopper and a primary hopper where raw coke and heavy particles are removed and recycled back to the calciner. The gases then pass to an incinerator where the volatile matter is reduced to carbon dioxide and water. From the incinerator, the gases are vented directly to the atmosphere through the stack.

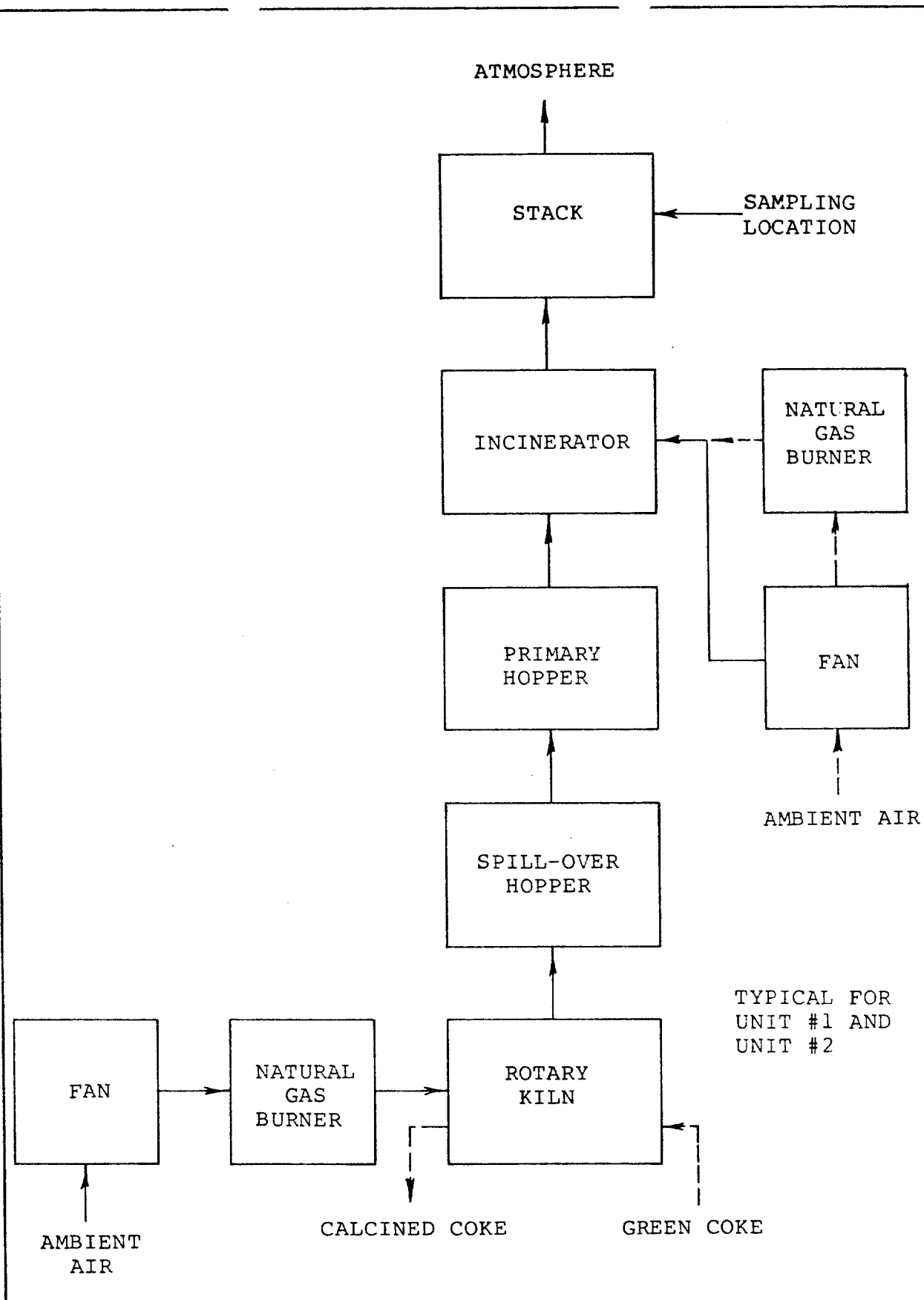


FIGURE 3-1. AIR FLOW SCHEMATIC SHOWING SAMPLING LOCATION

SAMPLING AND ANALYTICAL PROCEDURES

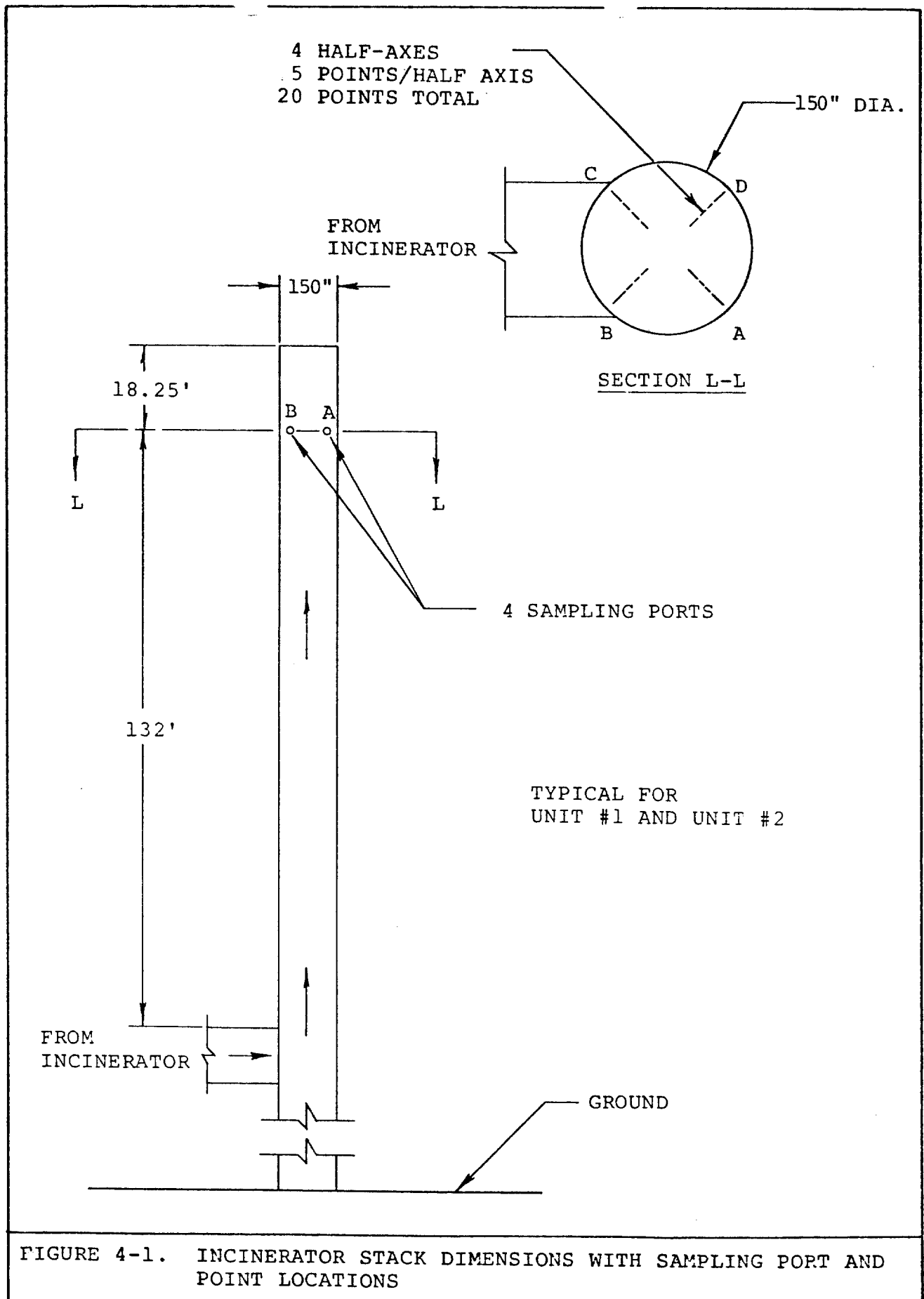
4.1 General. All sampling and analytical procedures used were those generally recommended by the United States Environmental Protection Agency and the West Virginia Air Pollution Control Commission. The sampling equipment and procedures are described in Appendix C, which is extracted from 40 CFR (Code of the Federal Regulations) Part 60.

4.2 Sampling Points. The number and location of the sampling points were determined following the procedures outlined in EPA Method 1 as promulgated September 30, 1983. The Unit #1 and Unit #2 incinerator stack cross sections were each divided into 20 equal areas, i.e., five sampling points on each of four half-axes (labeled A through D) as shown in Figure 4-1.

4.3 Flue Gas Velocity and Molecular Weight. Flue gas velocity and volumetric air flow rates were determined according to EPA Method 2. EPA Method 3 was used to determine the composition and molecular weight of the flue gases for each particulate sampling run.

4.4 Particulate Emissions. EPA Method 5 sampling and analytical procedures were used to determine the particulate emissions. The centroid of each of the 20 equal areas was sampled for three minutes, resulting in a net run time of 60 minutes.

4.5 Sampling Equipment. All sampling equipment was manufactured by Nutech Corporation or by Entropy. Pertinent calibration data is provided in Appendix D.



APPENDIX A.1

A. TEST RESULTS AND EXAMPLE CALCULATIONS

1. Unit #1 Incinerator Stack

ENTROPY

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT: Mountaineer Carbon Company, Moundsville, West Virginia

RUN	SAMPLING LOCATION	TEST TEAM LEADER		
1	Unit #1 Incinerator Stack	Willis S. Nesbit		
2	Unit #1 Incinerator Stack	Willis S. Nesbit		
3	Unit #1 Incinerator Stack	Willis S. Nesbit		
		1	2	3
	RUN DATE	12/12/84	12/12/84	12/12/84
	RUN START TIME	849	1146	1357
	RUN FINISH TIME	1006	1305	1506
	NET SAMPLING POINTS	20	20	20
Theta	NET RUN TIME, MINUTES	60.00	60.00	60.00
Dia	NOZZLE DIAMETER, INCHES	0.505	0.505	0.505
Cp	PITOT TUBE COEFFICIENT	0.840	0.840	0.840
Y	DRY GAS METER CAL. FACTOR	1.004	1.004	1.004
Pbar	BAROMETRIC PRESSURE, IN. HG.	29.40	29.40	29.40
Delta H	AVG. PRESS. DIFFERENTIAL OF ORIFICE METER, IN. H2O	1.180	1.340	1.250
Vm	VOLUME OF METERED GAS SAMPLE DRY ACTUAL CUBIC FEET	38.420	41.522	40.482
tm	DRY GAS METER TEMP., DEG. F	65	77	80
Vm(std)	VOLUME OF METERED GAS SAMPLE @ DRY STD. COND., DSCF*	38.217	40.396	39.157
Vlc	VOLUME OF WATER CATCH IN IMPINGERS & SIL. GEL., ML	169.0	170.0	170.5
Vw(std)	VOLUME OF WATER VAPOR, SCF*	7.955	8.002	8.025
%H2O	MOISTURE, PERCENT BY VOLUME	17.2	16.5	17.0
Mfd	DRY MOLE FRACTION	0.828	0.835	0.830

(continued next page)

		1	2	3
		-----	-----	-----
%CO ₂	PERCENT CO ₂ BY VOLUME, DRY	7.8	7.7	7.7
%O ₂	PERCENT O ₂ BY VOLUME, DRY	6.7	7.1	6.8
%CO+N ₂	PERCENT CO + N ₂ BY VOLUME	85.5	85.2	85.5
M _d	DRY MOLECULAR WT, LB/LB-MOLE	29.52	29.52	29.50
M _s	WET MOLECULAR WT, LB/LB-MOLE	27.53	27.61	27.55
P _s	GAS STATIC PRESS., IN. H ₂ O	-0.3	-0.2	-0.3
P _s	ABSOLUTE GAS PRESS., IN. HG.	29.38	29.38	29.38
t _s	GAS TEMPERATURE, DEG. F	1,953	1,954	1,950
Delta P	AVG VELOCITY HEAD, IN. H ₂ O	0.1052	0.1230	0.1155
v _s	FLUE GAS VELOCITY, FT/SEC	40.2	43.4	42.1
A	STACK/DUCT AREA, SQUARE IN.	17,671.0	17,671.0	17,671.0
Q _{sd}	GAS FLOW RATE, DRY SCFM *	52,656	57,324	55,341
Q _{sw}	GAS FLOW RATE, WET ACFM	296,211	319,870	310,079
%I	PERCENT ISOKINETIC	106.6	103.5	103.9
%EA	PERCENT EXCESS AIR	42.2	46.1	43.1
	METHOD 5 RESULTS:			

m _s	CATCH, MILLIGRAMS	173.9	68.8	140.1
gr/DSCF	CONCEN., GRAINS PER DSCF*	0.0702	0.0263	0.0552
Lb/Hr	EMISSION RATE, LBS/HOUR	31.69	12.91	26.19

* 68 Deg. F - 29.92 in. Hg.

ENTROPY

EXAMPLE . ARTICULATE TEST CALCULATIONS NO. 1

Unit #1 Incinerator Stack

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

$$V_m(\text{std}) = 17.64 * Y * V_m * \frac{(P_{\text{bar}} + \Delta H/13.6)}{(460 + t_m)}$$

$$V_m(\text{std}) = 17.64 * 1.004 * 38.420 * \frac{(29.40 + 1.180/13.6)}{(460 + 65)} = 38.217 \text{ DSCF}$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

$$V_w(\text{std}) = 0.04707 * V_{1c}$$

$$V_w(\text{std}) = 0.04707 * 169.0 = 7.955 \text{ SCF}$$

PERCENT MOISTURE, BY VOLUME, AS MEASURED IN FLUE GAS

$$\%H_2O = 100 * V_w(\text{std}) / (V_w(\text{std}) + V_m(\text{std}))$$

$$\%H_2O = \frac{7.955}{7.955 + 38.217} * 100 = 17.2 \%$$

DRY MOLE FRACTION OF FLUE GAS

$$M_{fd} = 1 - \%H_2O/100$$

$$M_{fd} = 1 - 17.2/100 = 0.828$$

DRY MOLECULAR WEIGHT OF FLUE GAS

$$M_d = \%CO_2 * 0.44 + \%O_2 * 0.32 + \%CO+N_2 * 0.28$$

$$M_d = 7.8*0.44 + 6.7*0.32 + 85.5*0.28 = 29.52 \text{ LB/LB-MOLE}$$

WET MOLECULAR WEIGHT OF FLUE GAS

$$M_s = (M_d * M_{fd}) + (0.18 * \%H_2O)$$

$$M_s = 29.52 * 0.828 + (0.18 * 17.2) = 27.53 \text{ LB/LB-MOLE}$$

ENTROPY

ABSOLUTE FLUE GAS PRESSURE

$$P_s = P_{bar} + P_g / 13.6$$

$$P_s = 29.40 + (-0.3 / 13.6) = 29.38 \text{ IN. HG.}$$

AVERAGE FLUE GAS VELOCITY [Note: (Delta P)avg is square of avg sq. root]

$$v_s = 85.49 * C_p * \text{SORT} \left[\frac{(\Delta P)_{avg} * (460 + t_s)}{P_s * M_s} \right]$$

$$v_s = 85.49 * 0.840 * \text{SORT} \left[\frac{0.1052 * (460 + 1953)}{29.38 * 27.53} \right] = 40.2 \text{ FT/SEC}$$

DRY VOLUMETRIC FLUE GAS FLOW RATE @ STANDARD CONDITIONS

$$Q_{sd} = \frac{60}{144} * M_{fd} * v_s * A * \frac{T_{std}}{t_s + 460} * \frac{P_s}{P_{std}}$$

$$Q_{sd} = \frac{60}{144} * 0.828 * 40.2 * 17,671.0 * \frac{528}{1953 + 460} * \frac{29.38}{29.92}$$

$$Q_{sd} = 52,656 \text{ SCFM}$$

WET VOLUMETRIC STACK GAS FLOW RATE @ FLUE GAS CONDITIONS

$$Q_{aw} = 60 / 144 * v_s * A$$

$$Q_{aw} = 60 / 144 * 40.2 * 17,671.0 = 296,211 \text{ ACFM}$$

PERCENT ISOKINETIC OF SAMPLING RATE

$$\%I = \frac{P_{std}}{T_{std}} * \frac{100}{60} * \frac{(t_s + 460) * V_m(std)}{P_s * v_s * M_{fd} * \theta * \text{Area-nozzle, sq.ft.}}$$

$$\%I = \frac{29.92}{528} * \frac{100}{60} * \frac{(1953 + 460) * 38.217}{29.38 * 40.2 * 0.828 * 60.00 * 0.0013909}$$

$$\%I = 106.6 \%$$

GRAINS PER DRY STANDARD CUBIC FOOT

$$\text{gr/DSCF} = \frac{7000}{453,592} * \frac{\text{mass}}{V_m(\text{std})}$$

$$\text{gr/DSCF} = \frac{7000}{453,592} * \frac{173.9}{38.217} = 0.0702 \text{ gr/DSCF}$$

POUNDS PER HOUR

$$\text{Lb/Hr} = 60 / 7000 * \text{gr/DSCF} * Q_{sd}$$

$$\text{Lb/Hr} = 60/7000 * 0.0702 * 52,656 = 31.69 \text{ LB/HR}$$

PERCENT EXCESS AIR

$$\%EA = \frac{\%O_2 - (0.5 * \%CO)}{(0.264 * \%N_2) - (\%O_2 - (0.5 * \%CO))} * 100$$

$$\%EA = \frac{6.7 - (0.5 * 0.0)}{0.264 * 85.5 - (6.7 - (0.5 * 0.0))} * 100 = 42.2 \%$$

A. TEST RESULTS AND EXAMPLE CALCULATIONS

2. Unit #2 Incinerator Stack

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT: Mountaineer Carbon Company, Moundsville, West Virginia

RUN		SAMPLING LOCATION		TEST TEAM LEADER	
4		Unit #2 Incinerator Stack		Willis S. Nesbit	
5		Unit #2 Incinerator Stack		Willis S. Nesbit	
6		Unit #2 Incinerator Stack		Willis S. Nesbit	
			4	5	6
			-----	-----	-----
RUN DATE			12/13/84	12/13/84	12/13/84
RUN START TIME			840	1035	1331
RUN FINISH TIME			947	1147	1439
NET SAMPLING POINTS			20	20	20
Theta	NET RUN TIME, MINUTES		60.00	60.00	60.00
Dia	NOZZLE DIAMETER, INCHES		0.505	0.505	0.505
CP	PITOT TUBE COEFFICIENT		0.840	0.840	0.840
Y	DRY GAS METER CAL. FACTOR		1.004	1.004	1.004
Pbar	BAROMETRIC PRESSURE, IN. HG.		29.50	29.50	29.50
Delta H	AVG. PRESS. DIFFERENTIAL OF ORIFICE METER, IN. H ₂ O		1.210	1.150	1.160
Vm	VOLUME OF METERED GAS SAMPLE DRY ACTUAL CUBIC FEET		40.353	39.310	38.168
tm	DRY GAS METER TEMP., DEG. F		89	81	94
Vm(std)	VOLUME OF METERED GAS SAMPLE @ DRY STD. COND., DSCF*		38.518	38.072	36.099
Vlc	VOLUME OF WATER CATCH IN IMPINGERS & SIL. GEL., ML		188.5	173.5	190.5
Vw(std)	VOLUME OF WATER VAPOR, SCF*		8.873	8.167	8.967
%H ₂ O	MOISTURE, PERCENT BY VOLUME		18.7	17.7	19.9
Mfd	DRY MOLE FRACTION		0.813	0.823	0.801

(continued next page)

ENTROPY

		4	5	6
		-----	-----	-----
%CO ₂	PERCENT CO ₂ BY VOLUME, DRY	7.1	7.3	8.9
%O ₂	PERCENT O ₂ BY VOLUME, DRY	7.1	6.7	3.9
%CO+N ₂	PERCENT CO + N ₂ BY VOLUME	85.8	86.0	87.2
M _d	DRY MOLECULAR WT, LB/LB-MOLE	29.42	29.44	29.58
M _s	WET MOLECULAR WT, LB/LB-MOLE	27.28	27.42	27.28
P _s	GAS STATIC PRESS., IN. H ₂ O	-0.3	-0.2	-0.2
P _s	ABSOLUTE GAS PRESS., IN. HG.	29.48	29.48	29.48
t _s	GAS TEMPERATURE, DEG. F	1,990	1,993	1,992
Delta P	AVG VELOCITY HEAD, IN. H ₂ O	0.1051	0.0995	0.0999
v _s	FLUE GAS VELOCITY, FT/SEC	40.6	39.5	39.6
A	STACK/DUCT AREA, SQUARE IN.	17,671.0	17,671.0	17,671.0
Q _{sd}	GAS FLOW RATE, DRY SCFM *	51,615	50,731	49,586
Q _{aw}	GAS FLOW RATE, WET ACFM	299,168	290,604	291,843
%I	PERCENT ISOKINETIC	109.6	110.2	106.9
%EA	PERCENT EXCESS AIR	45.7	41.9	20.4
	METHOD 5 RESULTS:			

m _a	CATCH, MILLIGRAMS	183.0	106.5	230.6
gr/DSCF	CONCEN., GRAINS PER DSCF*	0.0733	0.0432	0.0986
Lb/Hr	EMISSION RATE, LBS/HOUR	32.44	18.77	41.90

* 68 Deg. F - 29.92 in. Hg.

APPENDIX B.1

B. FIELD AND ANALYTICAL DATA

1. Unit #1 Incinerator Stack

ENTROPY

Preliminary Field Data

PLANT NAME MOGAR

LOCATION MOUNDSVILLE, W.VA.

SAMPLING LOCATION UNITS 1 & 2 INCINERATOR STACK

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 1168"

NIPPLE LENGTH 18

DEPTH OF DUCT 150

WIDTH (RECTANGULAR DUCT) _____

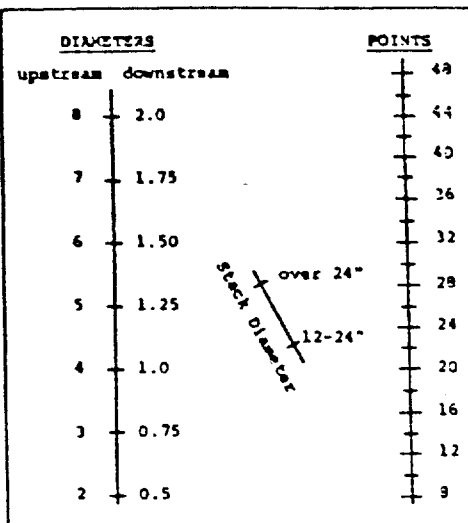
EQUIVALENT DIAMETER:

$$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(\quad)(\quad)}{(\quad + \quad)} = \underline{\hspace{2cm}}$$

DISTANCE FROM PORTS UPSTREAM DOWNSTREAM
TO NEAREST FLOW
DISTURBANCE: FEET 132 18.25

STACK DIAMETERS 11 1.46

STACK AREA = $\pi \left(\frac{150}{2} \right)^2 = 17,671 \text{ N}^2$



Point	% OF DIAMETER	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	2.6	4"	22"
2	5.2	12 1/4"	30 1/4"
3	14.6	22	40
4	22.6	34	52
5	34.2	51 1/4"	69 1/4"
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.9	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	42.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	47.7	24.2	20.1	16.9	14.6	12.3	11.6	10.5	
6		95.4	60.6	35.3	25.5	20.9	18.0	16.5	14.6	13.2	
7			89.5	57.4	35.4	26.9	22.0	18.8	16.5	14.6	13.2
8				89.5	57.4	35.4	26.9	22.0	18.8	16.5	14.6
9				96.8	65.4	41.4	37.5	29.6	25.0	21.8	19.4
10					91.9	62.3	41.1	38.2	30.6	26.2	23.0
11					97.4	68.2	47.9	41.7	38.8	31.5	27.2
12						93.3	65.4	47.0	41.2	39.3	32.3
13							97.9	60.1	43.1	40.7	39.8
14								94.3	67.5	48.2	40.2
15								98.2	71.5	55.4	47.8
16									95.1	69.1	53.5
17									98.4	72.5	57.1
18										95.6	70.3
19										98.6	73.3
20											96.1
21											98.7
22											
23											
24											

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.9

ORSAT FIELD DATA

Plant Name Moxar
 Sampling Location Inanorala #1 stack Fuel Type _____

corresponds to Run 1

Run and/or Sample No. 10 Leak Test? ☒ Date 12/12/84 Operator WSN

Time of Sample Collection	Time of Analysis	CO ₂ Reading A	O ₂ Reading B	CO Reading C	%O ₂ B-A	%CO C-B	%N ₂ 100-C
08:49	17:00	7.8	14.5	—	6.7	—	
—	—	7.8	14.5	—	6.7	—	
10:06	17:15	7.8	14.5	—	6.7	—	
Avg.		7.8	Avg.		6.7	—	85.5

(2)

Run and/or Sample No. 11 Leak Test? ☒ Date 12/12/84 Operator WSN

Time of Sample Collection	Time of Analysis	CO ₂ Reading A	O ₂ Reading B	CO Reading C	%O ₂ B-A	%CO C-B	%N ₂ 100-C
11:46	17:20	7.7	14.8	—	7.1	—	
—	—	7.7	14.8	—	7.1	—	
13:05	17:35	7.7	14.8	—	7.1	—	
Avg.		7.7	Avg.		7.1	—	85.2

(3)

Run and/or Sample No. 12 Leak Test? ☒ Date 12/12/84 Operator WSN

Time of Sample Collection	Time of Analysis	CO ₂ Reading A	O ₂ Reading B	CO Reading C	%O ₂ B-A	%CO C-B	%N ₂ 100-C
13:57	17:45	7.7	14.5	—	6.8	—	
—	—	7.7	14.5	—	6.8	—	
15:06	18:00	7.7	14.5	—	6.8	—	
Avg.		7.7	Avg.		6.8	—	85.5

Corresponds
To Run 1

[illegible]

1953

T_S

ENTROPY

PARTICULATE FIELD DATA

Run 2

COMPANY NAME Phocar RUN NUMBER 11
 ADDRESS Mountsboro, W. VA TIME START 11:46
 SAMPLING LOCATION Innervation #1 stack TIME FINISH 13:05
 DATE 12/12/84 TEAM LEADER WSN TECHNICIANS HBL, ST
 BAROMETRIC PRESSURE, IN. HG 29.40 STATIC PRESSURE, IN. H₂O -0.24
 SAMPLING TRAIN LEAK TEST VACUUM, IN. HG 15 5
 SAMPLING TRAIN LEAK RATE, CU. FT./MIN. 0.006 0.000

EQUIPMENT CHECKS		IDENTIFICATION NUMBERS	
☒ PITOTS, PRE-TEST		REAGENT BOX <u>224</u>	NOZZLE <u>814</u> DIAMETER <u>.505</u>
☒ PITOTS, POST-TEST		METER BOX <u>A.9</u>	T/C READOUT <u>WATLOW</u>
☒ ORSAT SAMPLING SYSTEM		UMBILICAL <u>U.13, U.10</u>	T/C PROBE <u>H1. TEMP</u>
☒ TEDLAR BAG		SAMPLE BOX <u>18</u>	ORSAT PUMP <u>2</u>
☒ THERMOCOUPLE @ <u>19420°F</u>		PROBE <u>WC10'</u>	TEDLAR BAG <u>10</u>

FILTER # TARE		NOMOGRAPH SET-UP		NOMOGRAPH # <u>WSN</u>	
<u>E 2258</u>	<u>.4530</u>	$\Delta H @$ <u>1.61</u>	C FACTOR <u>0.70</u>		
		METER TEMP <u>75</u>	STACK TEMP <u>1950</u>		
		% MOISTURE <u>18</u>	REF. ΔP <u>0.174</u>		

SAMPLE POINT	CLOCK TIME, MIN.	DRY GAS METER READING, CU. FT.	PITOT READING (ΔP), IN. H ₂ O	ORIFICE SETTING (ΔH), IN. H ₂ O		GAS METER TEMP. °F	PUMP VACUUM IN. HG GAUGE	FILTER BOX TEMP. °F	IMP. EXIT TEMP. °F	STACK TEMP. °F	LK. CHECK READINGS
				IDEAL	ACTUAL						
D 1	40	467.742	0.085	0.91	0.91	74	2	273	60	1965	
2	3	469.72	0.100	1.08	1.08	74	2	273	60	1969	
3	6	471.41	0.130	1.40	1.40	75	2	273	60	1965	
4	9	473.50	0.140	1.52	1.52	76	2	272	55	1970	
5	12	475.70	0.150	1.62	1.62	76	3	273	56	1968	
C 1	15/0	477.94	0.075	0.80	0.80	76	2	273	56	1963	
2	3	479.72	0.100	1.08	1.08	76	2	273	54	1940	+
3	6	481.69	0.120	1.28	1.28	76	2	273	55	1942	
4	9	483.62	0.145	1.57	1.57	76	3	273	58	1942	
5	12	485.77	0.160	1.72	1.72	77	4	272	59	1942	
B 1	30/0	488.13	0.095	1.02	1.02	77	2	270	59	1942	
2	3	490.56	0.120	1.28	1.28	77	2	272	59	1942	
3	6	491.97	0.150	1.62	1.62	77	3	272	59	1942	
4	9	494.42	0.155	1.66	1.66	78	3	272	59	1942	
5	12	496.64	0.155	1.66	1.66	80	3	272	59	1942	+
A 1	45/0	498.94	0.080	0.86	0.86	79	2	265	60	1948	
2	3	500.64	0.115	1.22	1.22	80	2	265	52	1964	
3	6	502.64	0.125	1.34	1.34	81	3	269	52	1965	
4	9	504.78	0.140	1.52	1.52	81	3	270	54	1965	
5	12	506.99	0.150	1.62	1.62	81	3	268	55	1961	
	60/0FF	509.264									

$V_M = \frac{41.522}{0.1230} \quad \Delta H = \frac{1.34}{77} \quad T_S = 1954$

ENTROPY

Run 3

EQUIPMENT CHECKS		IDENTIFICATION NUMBERS	
✓ PITOTS, PRE-TEST		REAGENT BOX <u>224</u>	NOZZLE <u>814</u> DIAMETER <u>.505</u>
✓ PITOTS, POST-TEST		METER BOX <u>A-9</u>	T/C READOUT <u>WATLOW</u>
✓ ORSAT SAMPLING SYSTEM		UMBILICAL <u>V-13, V-10</u>	T/C PROBE <u>#1-TEMP</u>
✓ TEDLAR BAG		SAMPLE BOX <u>18</u>	ORSAT PUMP <u>2</u>
✓ THERMOCOUPLE @ <u>1951</u> °F		PROBE <u>WC 10'</u>	TEDLAR BAG <u>8</u>
FILTER #	TARE	NOMOGRAPH SET-UP	
<u>E2257</u>	<u>.4521</u>	ΔH_a <u>1.61</u>	C FACTOR <u>0.70</u>
		METER TEMP <u>75</u>	STACK TEMP <u>1950</u>
		% MOISTURE <u>18</u>	REF. ΔP <u>0.174</u>

[illegible]

1950

T

ENTROPY

ARTICULATE SAMPLING LABORATORY RESULTS

Plant Name MOCAR EEI Ref. # 2711
 Sampling Location UNIT #1 INCINERATOR STACK
 Date Received 12/14/84 Date Analyzed 12/20/84 Reagent Box(es) 0224

Run Number	<u>1</u>	<u>2</u>	<u>3</u>
Run Date	<u>12/12</u>	<u>12/12</u>	<u>12/12</u>

SUMMARY OF PARTICULATE ANALYSES

Sum of Particulate, mg.	<u>628.4</u>	<u>522.0</u>	<u>592.5</u>
Total Filter Tare mg.	<u>454.1</u>	<u>453.0</u>	<u>452.1</u>
Blank Residue, mg. (<u>200</u> ml)	<u>0.4</u>	(<u>100</u> ml) <u>0.2</u>	(<u>150</u> ml) <u>0.3</u>
TOTAL PARTICULATE CATCH, mg.	<u>173.9</u>	<u>68.8</u>	<u>140.1</u>

ANALYSIS OF MOISTURE CATCH

<u>Reagent 1 (H₂O):</u>			
Final Weight, g.	<u>355.0</u>	<u>355.0</u>	<u>359.0</u>
Tared Weight, g.	<u>200.0</u>	<u>200.0</u>	<u>200.0</u>
Water Catch, g.	<u>155.0</u>	<u>155.0</u>	<u>159.0</u>
<u>Reagent 2 ()::</u>			
Final Weight, g.	<u>-</u>	<u>-</u>	<u>-</u>
Tared Weight, g.	<u>-</u>	<u>-</u>	<u>-</u>
Water Catch, g.	<u>-</u>	<u>-</u>	<u>-</u>
CONDENSED WATER, g.	<u>155.0</u>	<u>155.0</u>	<u>159.0</u>
<u>Silica Gel:</u>			
Final Weight, g.	<u>214.0</u>	<u>215.0</u>	<u>211.5</u>
Tared Weight, g.	<u>200.0</u>	<u>200.0</u>	<u>200.0</u>
ABSORBED WATER, g.	<u>14.0</u>	<u>15.0</u>	<u>11.5</u>
TOTAL WATER COLLECTED, g.	<u>169.0</u>	<u>170.0</u>	<u>170.5</u>

Blank Beaker # 63
 Final wt. mg. 71132.5
 Tare wt. mg. 71132.1
 Residue, mg. 0.4
 Volume, ml. 200
 Concen., mg/ml. .002

--- Legend ---

✓ = Final Weight
 L = Loose Particulate
 F = Filter D = Dish
 R = Rinse P = Pan

Notes and Comments

LABORATORY SAMPLE WEIGHT CALC. TIONS

Plant Name MOCAR

EEI Ref. # 2711

Run Number

1

2

3

Run Date

12/12

12/12

12/12

Sample ID/Container #

FIR-190

FIR-191

FIR-192

Tare Wt., g.

177.1545
177.1529✓
176.5245

178.9456
178.9439✓
178.4219

176.6834
176.6825✓
176.0900

SAMPLE WT., g.

6284

5220

5925

Sample ID/Container #

Tare Wt., g.

SAMPLE WT., g.

Sample ID/Container #

Tare Wt., g.

SAMPLE WT., g.

Sample ID/Container #

Tare Wt., g.

SAMPLE WT., g.

CUSTODY SHEET FOR REAGENT BOX # 0224Date of Makeup 12/7/84 Initials MSJ Locked? ☒Individual Tare of Reagent: 200 mls. of H₂O

Individual Tare of Reagent: _____ mls. of _____

Individual Silica Gel Tare Weight 200 gms.PLANT NAME MoranSAMPLING LOCATION Incinerator #1 Stack

Com. Run Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-10	12/12/84	WSN	✓	12/12/84	.65	WSN	
2-11	12/12/84	WSN	✓	12/12/84	.70	WSN	
3-12	12/12/84	WSN	✓	12/12/84	.70	WSN	

Received in Lab Date 12/14 Initials BD Locked? ☒Sampling Method: M.SZero & Span Balance
Initials BD

Filter #	Tare Weight (mgms)	Used on Test
-------------	--------------------------	--------------------

Remarks:

E2260	.4541	10 (1)
E2258	.4530	11 (2)
E2257	.4521	12 (3)
_____	_____	_____
_____	_____	_____
_____	_____	_____

APPENDIX B.2

B. FIELD AND ANALYTICAL DATA

2. Unit #2 Incinerator Stack

ENTROPY

ORSAT FIELD DATA

Plant Name Thocar

Sampling Location Incinerator #2 stack

Fuel Type _____

Run 4

Run and/or Sample No. 13 Leak Test? ☒ Date 12/13/84 Operator WSN

Time of Sample Collection	Time of Analysis	CO ₂ Reading A	O ₂ Reading B	CO Reading C	%O ₂ B-A	%CO C-B	%N ₂ 100-C
08:40	10:00	7.1	14.2	—	7.1	—	
—	—	7.1	14.2	—	7.1	—	
09:47	10:20	7.1	14.2	—	7.1	—	
Avg.		7.1	Avg.		7.1	—	85.8

Run 5

Run and/or Sample No. 14 Leak Test? ☒ Date 12/13/84 Operator WSN

Time of Sample Collection	Time of Analysis	CO ₂ Reading A	O ₂ Reading B	CO Reading C	%O ₂ B-A	%CO C-B	%N ₂ 100-C
10:35	12:00	7.3	14.0	—	6.7	—	
—	—	7.3	14.0	—	6.7	—	
11:47	12:20	7.3	14.0	—	6.7	—	
Avg.		7.3	Avg.		6.7	—	86.0

Run 6

Run and/or Sample No. 15 Leak Test? ☒ Date 12/13/84 Operator WSN

Time of Sample Collection	Time of Analysis	CO ₂ Reading A	O ₂ Reading B	CO Reading C	%O ₂ B-A	%CO C-B	%N ₂ 100-C
13:31	16:00	8.9	12.8	—	3.9	—	
—	—	8.9	12.8	—	3.9	—	
14:39	16:15	8.9	12.8	—	3.9	—	
Avg.		8.9	Avg.		3.9	—	87.2

Corresponding
Run 4

COMPANY NAME Moran RUN NUMBER 13
ADDRESS Mountsville, W. VA TIME START 08:40
SAMPLING LOCATION Incinerator #2 stack TIME FINISH 09:47
DATE 12/13/84 TEAM LEADER WSN TECHNICIANS ST, HBL
BAROMETRIC PRESSURE, IN. HG 29.50 STATIC PRESSURE, IN. H₂O -0.25
SAMPLING TRAIN LEAK TEST VACUUM, IN. HG 15 5
SAMPLING TRAIN LEAK RATE, CU. FT./MIN. 0.002 0.000

EQUIPMENT CHECKS		IDENTIFICATION NUMBERS	
☒ PITOTS, PRE-TEST		REAGENT BOX <u>228</u>	NOZZLE <u>814</u> DIAMETER <u>.505</u>
☒ PITOTS, POST-TEST		METER BOX <u>N.9</u>	T/C READOUT <u>WATLOW</u>
☒ ORSAT SAMPLING SYSTEM		UMBILICAL <u>U.13 U.10</u>	T/C PROBE <u>KTEMP</u>
☒ TEDLAR BAG		SAMPLE BOX <u>18'</u>	ORSAT PUMP <u>2</u>
THERMOCOUPLE @ <u>1985</u> °F		PROBE <u>WC 10'</u>	TEDLAR BAG <u>2</u>
FILTER #	TARE	NOMOGRAPH SET-UP	
<u>E 2253</u>	<u>.4499</u>	$\Delta H @$ <u>1.61</u>	C FACTOR <u>0.76</u>
		METER TEMP <u>90</u>	STACK TEMP <u>1925 / 1975</u>
		% MOISTURE <u>18</u>	REF. ΔP <u>0.160 / 0.164</u>

[illegible]
$$\frac{40.353}{V_M} \quad \frac{0.1051}{(\sqrt{\Delta P})^2} \quad \frac{1.21}{\Delta H} \quad \frac{89}{T_M} \quad \frac{1990}{T_S}$$

ENTROPY

Run 5

[illegible]

1993

T

ENTROPY

Run 6

[illegible]
$$\frac{38.168}{V_M} \quad \frac{0.09992}{(\sqrt{\Delta P})^2} \quad \frac{1.16}{\Delta H} \quad \frac{94}{T_M} \quad \frac{1992}{T_S}$$

ENTROPY

ARTICULATE SAMPLING LABORATORY SULTS

Plant Name MOCAR EEI Ref. # 2711
Sampling Location UNIT # 2 INCINERATOR STACK
Date Received 12/19/84 Date Analyzed 12/20/84 Reagent Box(es) 0228

Run Number	<u>4</u>	<u>5</u>	<u>6</u>
Run Date	<u>12/13</u>	<u>12/13</u>	<u>12/13</u>

SUMMARY OF PARTICULATE ANALYSES

Sum of Particulate, mg.	<u>633.4</u>	<u>558.9</u>	<u>682.9</u>
Total Filter Tare mg.	<u>449.9</u>	<u>451.8</u>	<u>451.7</u>
Blank Residue, mg. (<u>225</u> ml)	<u>0.5</u>	(<u>275</u> ml) <u>0.6</u>	(<u>275</u> ml) <u>0.6</u>
TOTAL PARTICULATE CATCH, mg.	<u>183.0</u>	<u>106.5</u>	<u>230.6</u>

ANALYSIS OF MOISTURE CATCH

<u>Reagent 1 (H₂O):</u>			
Final Weight, g.	<u>372.0</u>	<u>358.0</u>	<u>373.0</u>
Tared Weight, g.	<u>200.0</u>	<u>200.0</u>	<u>200.0</u>
Water Catch, g.	<u>172.0</u>	<u>158.0</u>	<u>173.0</u>
<u>Reagent 2 ():</u>			
Final Weight, g.	<u>-</u>	<u>-</u>	<u>-</u>
Tared Weight, g.	<u>-</u>	<u>-</u>	<u>-</u>
Water Catch, g.	<u>-</u>	<u>-</u>	<u>-</u>
CONDENSED WATER, g.	<u>172.0</u>	<u>158.0</u>	<u>173.0</u>
<u>Silica Gel:</u>			
Final Weight, g.	<u>216.5</u>	<u>215.5</u>	<u>217.5</u>
Tared Weight, g.	<u>200.0</u>	<u>200.0</u>	<u>200.0</u>
ABSORBED WATER, g.	<u>16.5</u>	<u>15.5</u>	<u>17.5</u>
TOTAL WATER COLLECTED, g.	<u>188.5</u>	<u>173.5</u>	<u>190.5</u>

Blank Beaker # 63
Final wt. mg. 71132.5
Tare wt. mg. 71132.1
Residue, mg. 0.4
Volume, ml. 200
Concen., mg/ml. .002

--- Legend ---
✓ = Final Weight
L = Loose Particulate
F = Filter D = Dish
R = Rinse P = Pan

Notes and Comments

LABORATORY SAMPLE WEIGHT CALCULATIONS

Plant Name MOCAR EEI Ref. # 2711

Run Number

4

5

6

Run Date

12/13

12/13

12/13

Sample ID/Container #

FIR-193

FIR-194

FIR-195

Tare Wt., g.

184.7004
184.6993✓
184.0659

187.4166
187.4129✓
186.8540

180.1282
180.1212✓
179.4383

SAMPLE WT., g.

.6334

.5589

.6829

Sample ID/Container #

Tare Wt., g.

SAMPLE WT., g.

Sample ID/Container #

Tare Wt., g.

SAMPLE WT., g.

Sample ID/Container #

Tare Wt., g.

SAMPLE WT., g.

CUSTODY SHEET FOR REAGENT BOX # 0228

Date of Makeup 12/7/84 Initials MEY Locked? ☒
Individual Tare of Reagent: 200 mls. of H₂O
Individual Tare of Reagent: _____ mls. of _____
Individual Silica Gel Tare Weight 200 gms.

PLANT NAME Mocar, Moundsville W.V.
SAMPLING LOCATION Incen. Stack #2

Corr. Run Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
4-13	12/13/84	HL	✓	12/13/84	75	HL	✓
5-14	12/13/84	HL	✓	12/13/84	60	HL	✓
6-15	12/13/84	HL	✓	12/13/84	95	HL	✓

Received in Lab _____ Date 12/14 Initials BD Locked? ☒

Sampling Method: _____

Zero & Span Balance
Initials BD

Filter # _____ Tare Weight (mgms) _____ Used on Test _____

Remarks:

<u>E2253</u>	<u>.4499</u>	<u>13</u>	<u>(4)</u>
<u>E2254</u>	<u>.4518</u>	<u>14</u>	<u>(5)</u>
<u>E2255</u>	<u>.4517</u>	<u>15</u>	<u>(6)</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

APPENDIX C

SAMPLING AND ANALYTICAL PROCEDURES

ENTROPY

APPENDIX D

CALIBRATION DATA

ENTROPY

CALIBRATIONS

GENERAL

All measuring equipment Entropy uses is initially calibrated before use. Equipment which can change calibration is both checked upon return from each field use and is also periodically recalibrated in full. When an instrument is found out of calibration, it is so noted in the report and appropriate adjustments are made to the final results. The equipment is then repaired and recalibrated or retired as needed. Specific equipment is handled as follows:

PITOT TUBE

All pitot tubes used by Entropy, whether separate or attached to a sampling probe, are constructed in-house or by Nutech Corporation. Prior to their initial usage, they are calibrated using EPA geometry standards. In general, if a type "S" pitot tube is assembled correctly, and positioned properly in relation to the probe nozzle, it will have an average C_p of 0.84. As long as it is not damaged, it should not change its calibration. The recalibration schedule for pitot tubes is related to the physical condition and usage of the pitot tube, not a fixed time schedule. Each pitot tube is inspected upon return to the laboratory from each field use.

DRY GAS METER AND ORIFICE METER

For the calibration of Entropy's dry gas metering systems, the protocol proposed in the Federal Register Vol. 47 No. 195, Thursday, October 7, 1982 is followed. Standard transfer meter number 1017057 (standard meter used for calibrating field metering systems) was calibrated with a spirometer at seven different flow rates between 0.25 and 1.40 cfm. Triplicate calibration runs were performed at each flow rate.

NOZZLES

Each nozzle is calibrated upon purchase, and thereafter whenever it becomes apparent that the nozzle has become damaged. Each nozzle is inspected upon return to laboratory from each field use. The diameter is measured on five different axes, with the high and low readings differing by no more than 0.004 inches as a tolerance.

TEMPERATURE MEASURING INSTRUMENTS

After each field use, the thermocouples or thermometers are calibrated against an ASTM precision mercury-in-glass thermometer across a wide range of temperatures. If the initial reading is not within $\pm 1.5\%$ of the absolute temperature reading of the standard thermometer, the instrument is adjusted until it is in the acceptable range.

MAGNEHELIC GAUGES

After each field use, each magnehelic gauge is calibrated against an inclined manometer at three different settings (low, medium, high) over the range of the individual gauges. If the readings differ more than $\pm 5\%$ from the manometer readings, the magnehelics are recalibrated.

BAROMETER

After each field use, each barometer is checked against a mercury barometer.

Dry Gas Meter Identification: 1017057

Calibration by: Bruce Hawke

Date: 8/10/84

Barometric Pressure (P_b): 29.70 in. Hg

*Date: _____

*Barometric Pressure (P_b): _____ in. Hg

ENVIRONMENTALIST, INC.

Approx. Flow Rate (Q) cfm	Spirometer #2502		Dry Gas Meter		Pressure (Δp) in. H ₂ O	Time (t) min.	Flow Rate (Q) cfm	Meter Meter Coeff. (V_{ds})	Avg. Meter Coeff. ($\bar{V}_{ds}$)
	Gas Volume (V_s) ft ³	Temp. (t_s) °F	Gas Volume (V_{ds}) ft ³	Temp. (t_{ds}) °F					
0.25	2.550	73.4	2.554	76	-0.23	9.657	0.2594	1.0039	
	2.368	73.4	2.371	76	-0.22	9.170	0.2536	1.0041	
	2.468	77	2.486	77	-0.20	10.008	0.2406	0.9933	
0.40	3.962	73.4	3.999	75	-0.43	9.958	0.3908	0.9948	
	4.071	73.4	4.104	75	-0.43	10.033	0.3985	0.9960	
	4.089	73.4	4.118	76	-0.43	10.099	0.3977	0.9989	
0.60	5.993	75.2	6.090	77	-0.90	9.995	0.5869	0.9896	
	6.330	75.2	6.438	77	-0.95	10.001	0.6196	0.9889	
	6.330	75.2	6.435	77	-1.00	10.005	0.6193	0.9894	
0.80	7.933	73.4	8.046	76	-1.5	10.000	0.7792	0.9945	
	8.151	73.4	8.260	76	-1.6	10.001	0.8005	0.9956	
	8.188	73.4	8.302	76	-1.5	10.055	0.7998	0.9948	
1.00	9.153	75.2	9.298	76	-2.0	9.436	0.9495	0.9908	
	9.171	75.2	9.326	76	-2.0	9.460	0.9490	0.9898	
	9.126	75.2	9.304	76	-2.1	9.435	0.9468	0.9875	

$$Y_{ds} = \frac{(V_s)(t_{ds} + 460)(P_b)}{(V_{ds})(t_s + 460)(P_b + (p / 13.6))}$$

$$Q = (17.64) \frac{(P_b)(V_s)}{(t_s + 460)(9)}$$

1017057

Calibration by:

Date: 8/10/84

Barometric Pressure (P_b): 29.70 in. Hg

Date: _____

*Barometric Pressure (P_b): _____ in. Hg

ENTROPY ENVIRONMENTALISTS, INC.

[illegible]

$$Y_{DS} = \frac{(V_S) (t_{DS} + 1160) (P_b)}{(V_{DS}) (t_S + 1160) (P_b + (P / 13.6))}$$

$$Q = (17.64) \frac{(P_b)(V_g)}{(t_g + 460)(\Theta)}$$

CALIBRATION BY: BDRMETER BOX NUMBER: N9DATE: 12-28-84BAROMETRIC PRESSURE (P_B): 29.96 IN. HG

*DATE: _____

*BAROMETRIC PRESSURE (P_B): _____ IN. HGSTANDARD METER NUMBER: 1017057COEFFICIENT (Y_{DS}): 0.9942

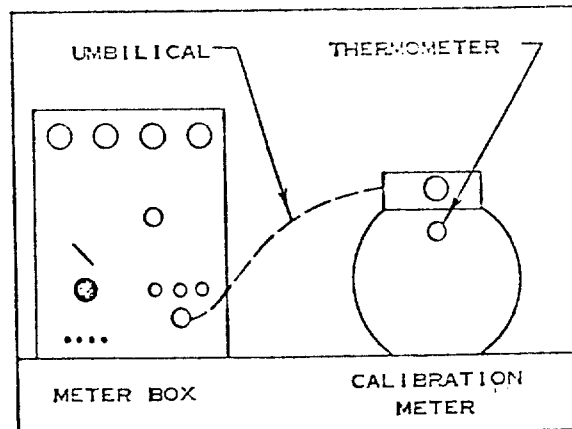
POST-TEST METER BOX CALIBRATION

NOMINAL FLOW RATE ($\tilde{Q}$) CFM	STANDARD DRY GAS METER			METER BOX METERING SYSTEM		
	GAS VOLUME (V_{DS}) FT ³	TEMP. (T_{DS}) °F	TIME (t) MIN.	ORIFICE SETTING (ΔH) IN. H ₂ O	GAS VOLUME (V_D) FT ³	TEMP. (T_D) °F
	6.367	66	10.0	1.20	6.559	86
	6.335	66	10.0	1.20	6.584	91
	6.299	66	10.0	1.20	6.626	95
VACUUM = <u>15</u> IN. HG						

METER BOX METERING SYSTEM				
NOMINAL FLOW RATE ($\tilde{Q}$) CFM	FLOW RATE (Q_D) CFM	ORIFICE FACTOR (OF)	COEFF. (Y_D)	ΔH @ IN. H ₂ O
	0.6360	4.676	0.9989	1.606
	0.6328	4.698	0.9991	1.607
	0.6292	4.715	0.9943	1.614
AVERAGE			0.997	1.61

$$\Delta H_d = \frac{0.0317 \cdot \Delta H}{P_B \cdot (t_d + 460)} \cdot \left[\frac{(t_{ds} + 460) \cdot P_B}{Y_{ds} \cdot V_{ds}} \right]^2$$

$$Y_d = \frac{Y_{ds} \cdot V_{ds} \cdot (t_d + 460) \cdot P_B}{V_d \cdot (t_{ds} + 460) \cdot (P_B + \Delta H/13.6)}$$

SCHEMATIC OF EQUIPMENT SET-UP FOR
FULL AND POST-TEST METER BOX CALIBRATIONS

INTER-LABORATORY STUDY RESULTS

DATE PRINTED: 01/12/8

(SEPTEMBER 1983)

POLLUTANT - DGM

13009

MR. BRUCE HAWKS

TRIPTY ENVIRONMENTALISTS, INC.

P.O. BOX 12291

RESEARCH TRIANGLE PARK, NC 27709

129

UNITS - CUBIC METERS

ITC - 009

OFFICE NUMBER

REPORTED VALUE

EPA VALUE

PERCENT DIFFERENCE

315

0.2945

0.2941

.1

315

0.2972

0.2976

-.1

315

0.2983

0.2984

.0

CALIBRATION BY:

BDR

METER BOX NUMBER:

N9

DATE: 9-21-84

BAROMETRIC PRESSURE (P_B): 29.48 IN. HG

*DATE:

*BAROMETRIC PRESSURE (P_B): IN. HG

STANDARD METER NUMBER:

1017057

COEFFICIENT (Y_{DS}):

0.9942

NOMINAL FLOW RATE ($\tilde{Q}$) CFM	STANDARD DRY GAS METER			METER BOX METERING SYSTEM		
	GAS VOLUME (V_{DS})	TEMP. (T_{DS})	TIME (θ)	ORIFICE SETTING (ΔH)	GAS VOLUME (V_D)	TEMP. (T_{DS})
	FT ³	°F	MIN.	IN. H ₂ O	FT ³	°F
0.4	4.197	75	10.00	0.50	4.168	81
	4.188	76	10.00	0.50	4.172	83
0.8	8.630	77	10.00	2.1	8.676	87
	8.642	77	10.00	2.1	8.738	90
1.2	13.161	77	10.00	4.8	13.361	94
	13.095	76	10.00	4.8	13.351	95

NOMINAL FLOW RATE ($\tilde{Q}$) CFM	METER BOX METERING SYSTEM			
	FLOW RATE (Q_D)	ORIFICE FACTOR	COEFF.	$\Delta H @$
	CFM	(OF)	(Y_D)	IN. H ₂ O
0.4	0.4056	3.029	1.0111	1.634
	0.4040	3.035	1.0098	1.641
0.8	0.8309	6.242	1.0021	1.617
	0.8320	6.259	1.0018	1.604
1.2	1.2671	9.498	0.9984	1.569
	1.2631	9.506	0.9978	1.576
AVERAGE			1.004	1.61

$$\Delta H_d = \frac{0.0317 \cdot \Delta H}{P_b \cdot (t_d + 460)} \cdot \left[\frac{(t_{ds} + 460) \cdot \theta}{Y_{ds} \cdot V_{ds}} \right]^2$$

$$Y_d = \frac{Y_{ds} \cdot V_{ds} \cdot (t_d + 460) \cdot P_b}{V_d \cdot (t_{ds} + 460) \cdot (P_b + \Delta H/13.6)}$$

ENTROPY

NOZZLE NUMBER: 814

[illegible]

NOTE: All diameters measured in inches.

TEMPERATURE SENSING EQUIPMENT CALIBRATION DATA

BAROMETRIC PRESSURE: 30.06 DATE: 1-13-84 CALIBRATED BY: JTC

MERCURY-IN-GLASS REFERENCE NUMBER: 1962175-ASTM3F AMBIENT TEMP.: 64

[illegible]

$$\text{CORRECTED TEMPERATURE} = T_c = T_o + .00009 (T_o - 20) (T_o - T_m)$$

$$\text{TEMPERATURE DIFFERENCE} = \Delta T = \frac{[(T_C, ^\circ\text{F} + 460) - (T_L, ^\circ\text{F} + 460)]}{T_C, ^\circ\text{F} + 460} \times 100 \leq 1.5\%$$

ENTROPY

TEMPERATURE SENSING EQUIPMENT CALIBRATION DATA

BAROMETRIC PRESSURE: 29.96 DATE: 12-28-84 CALIBRATED BY: BA
MERCURY-IN-GLASS REFERENCE NUMBER: 1962175 AMBIENT TEMP.: 66

MERCURY-IN-GLASS REFERENCE NUMBER:

AMBIENT TEMP.:

[illegible]

$$\text{CORRECTED TEMPERATURE} = T_C = T_O + .00009 (T_O - 20) (T_O - T_m)$$

$$\text{TEMPERATURE DIFFERENCE} = \Delta T = \frac{[(T_C, ^\circ\text{F} + 460) - (T_t, ^\circ\text{F} + 460)]}{T_C, ^\circ\text{F} + 460} \times 100 \leq 1.5\%$$

ENTROPY