MOCAR MOUNTAINEER CARBON COMPANY

P. O. BOX 577, MOUNDSVILLE, WV 26041
PHONE 304 845-1380

Dale Farley Review
Please comment 1-11-85

January 7, 1985

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 (^{o}F)							Draft Incin. (In H_2O)	Draft Stack (In H_2O)	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 conveniately 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.

JAH/GWM/lsm/2280
01-02-85

TABLE 2

MOUNTAINEER CARBON COMPANY

TIMING OF TESTING RUNS

Run No.	Test Date	Hour Start	Hour Stop	Shift Hour Reported	Kiln No.
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

JAH/GWM/lsm/2281
01-02-85

TABLE 3

MOUNTAINEER CARBON COMPANY

ACTUAL AND ALLOWANCE EMISSION RATE SUMMARIES

Kiln No.	Date	Three-Run Average Throughput (Tons/Hr)	Three-Run Average Emission Rate (Lb/Hr)	Allowable Emission Rate (Lb/Hr)[c]
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.

JAH/GWM/lsm/2282
01-04-85

TABLE 4

PRODUCTION DATA SHEET FOR DECEMBER 12

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

LEAD OPERATOR: JPG
LINE OPERATOR: JDW
OPERATOR HELPER: RDW
SUPERVISOR: RFY/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											
SILO 6C8-1	TPH	W52011	.0	.0	.0	.0	.0	.0	.0	1.48	.19
SILO 6C8-1	PCT	Y52011	.0	.0	.0	.0	.0	.0	.0	5.51	.69
SILO 6C8-2	TPH	W52021	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO 6C8-2	PCT	Y52021	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO 6C8-3	TPH	W52031	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO 6C8-3	PCT	Y52031	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO 6C8-4	TPH	W52041	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO 6C8-4	PCT	Y52041	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO 6C8-5	TPH	W52051	.0	.0	.0	.0	.0	.0	.0	.99	.12
SILO 6C8-5	PCT	Y52051	.0	.0	.0	.0	.0	.0	.0	2.95	.37
SILO 6C8-6	TPH	W52061	32.81	35.94	35.96	36.11	31.61	33.24	35.75	30.40	33.98
SILO 6C8-6	PCT	Y52061	100.00	100.00	100.00	100.00	100.00	100.00	100.00	91.49	98.94
TOTAL	TPH	WA5200	33.14	36.00	35.98	35.09	31.48	33.33	35.71	32.17	34.11
INCINERATOR											
DRAFT INCINERATOR	IN H2O	P1182	-.776	-.755	-.732	-.711	-.731	-.748	-.766	-.773	-.749
DRAFT STACK	IN H2O	P1183	-2.000*	-2.000*	-2.000*	-1.998*	-1.999*	-1.997	-1.998	-1.998	-1.999
TEMPERATURE SETTLING CHAMBER	DEG F	T1187	1868	1855	1805	1808	1825	1875	1850	1824	1839
TEMPERATURE DUCT	DEG F	T1188	1912	1905	1862	1861	1870	1917	1899	1875	1888
TEMPERATURE ZONE 1	DEG F	T1174	2356	2382	2416	2387	2360	2294	2362	2379	2367
TEMPERATURE ZONE 2	DEG F	T1170	2319	2335	2366	2368	2340	2286	2323	2342	2335
TEMPERATURE ZONE 3	DEG F	T1139	2316	2329	2357	2366	2339	2290	2319	2338	2332
TEMPERATURE ZONE 4	DEG F	T1177	2225	2237	2260	2274	2251	2205	2228	2247	2241
TEMPERATURE BREECHING	DEG F	T1192	2066	2077	2100	2117	2096	2055	2071	2091	2084
TEMPERATURE STACK	DEG F	T1193	1926	1936	1952	1975	1962	1938	1943	1957	1949
OXYGEN	PCT 02	A1175	10.00*	10.00*	10.00*	10.00*	10.00*	10.00*	10.00*	10.00*	.0
CARBON MONOXIDE	PCT CO	A1176	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0
DAMPER POSITION	PCT OP	Z1185	27.4	27.4	27.4	28.2	28.5	28.5	28.5	28.5	28.0
NATURAL GAS (BUSTLE)	SCFM	F1142	.0	.0	.0	.0	.0	.0	.0	.0	.0
COMBUSTION AIR (BUSTLE)	SCFM	F1170	8123	7851	8311	10109	10636	10335	9329	9426	9265
NATURAL GAS (START-UP)	SCFM	F1102	.0	.0	.0	.0	.0	.0	.0	.0	.0
COMBUSTION AIR (START-UP)	SCFM	FW1137	1396	1407	1444	1460	1512	1523	1522	1531	1474

TABLE 5

PRODUCTION DATA SHEET FOR DECEMBER 13

MOUNTAINEER CARBON COMPANY
NO. 2 UNIT PRODUCTION ANALYSIS (SHIFT)

LEAD OPERATOR: JPG
LINE OPERATOR: BEH
OPERATOR HELPER: RDW
SUPERVISOR: RFY/JLB

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

			HOUR ONE	HOUR TWO	HOUR THREE	HOUR FOUR	HOUR FIVE	HOUR SIX	HOUR SEVEN	HOUR EIGHT	SHIFT AVERAGE
RAW MATERIALS											
SILO GCS-1	TPH	W52012	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO GCS-1	PCT	Y52012	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO GCS-2	TPH	W52022	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO GCS-2	PCT	Y52022	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO GCS-3	TPH	W52032	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO GCS-3	PCT	Y52032	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO GCS-4	TPH	W52042	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO GCS-4	PCT	Y52042	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO GCS-5	TPH	W52052	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO GCS-5	PCT	Y52052	.0	.0	.0	.0	.0	.0	.0	.0	.0
SILO GCS-6	TPH	W52062	33.55	35.43	34.45	31.27	26.51	35.82	34.63	31.81	32.93
SILO GCS-6	PCT	Y52062	100.00	100.00	97.22	100.00	80.00	100.00	100.00	100.00	97.15
TOTAL	TPH	WB5200	33.55	35.43	34.45	31.27	26.51	35.82	34.63	31.81	32.93
INCINERATOR											
DRAFT INCINERATOR	IN H2O	P2182	-.501	-.532	-.505	-.579	-.670	-.377	-.328	-.488	-.497
DRAFT STACK	IN H2O	P2183	-1.955	-1.960	-1.971	-1.977	-1.981	-1.978	-1.989	-1.967	-1.972
TEMPERATURE SETTLING CHAMBER	DEG F	T2187	1810	1793	1753	1730	1845	1867	1707	1746	1781
TEMPERATURE DUCT	DEG F	T2188	2048	2036	2008	1996	2075	2034	1946	1991	2017
TEMPERATURE ZONE 1	DEG F	T2174	2321	2351	2379	2335	2273	2321	2383	2297	2333
TEMPERATURE ZONE 2	DEG F	T2170	2145	2161	2245	2271	2056	2088	2178	2119	2158
TEMPERATURE ZONE 3	DEG F	T2139	2375	2392	2388	2382	2325	2344	2422	2385	2377
TEMPERATURE ZONE 4	DEG F	T2177	2317	2331	2328	2324	2271	2286	2363	2331	2319
TEMPERATURE BREECHING	DEG F	T2192	2219	2228	2223	2221	2169	2184	2260	2227	2216
TEMPERATURE STACK	DEG F	T2193	1972	1977	1973	1969	1937	1944	1996	1985	1969
OXYGEN	PCT O2	A2175	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0
CARBON MONOXIDE	PCT CO	A2176	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0
DAMPER POSITION	PCT OP	Z2185	26.6	26.4	26.4	26.4	26.4	24.0	23.8	27.3	25.9
NATURAL GAS (BUSTLE)	SCFM	F2142	.0*	.0*	.0*	.0*	.0*	169	.0	.0	21
COMBUSTION AIR (BUSTLE)	SCFM	F2170	8829	8804	10214	9322	6749	8685	10326	12553	9435
NATURAL GAS (START-UP)	SCFM	F2102	.0	.0	.0	.0	.0	.0	.0	.0	.0
COMBUSTION AIR (START-UP)	SCFM	FW2137	1404	1398	1423	1429	1438	1403	1386	1436	1415

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

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.

TABLE OF CONTENTS

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.

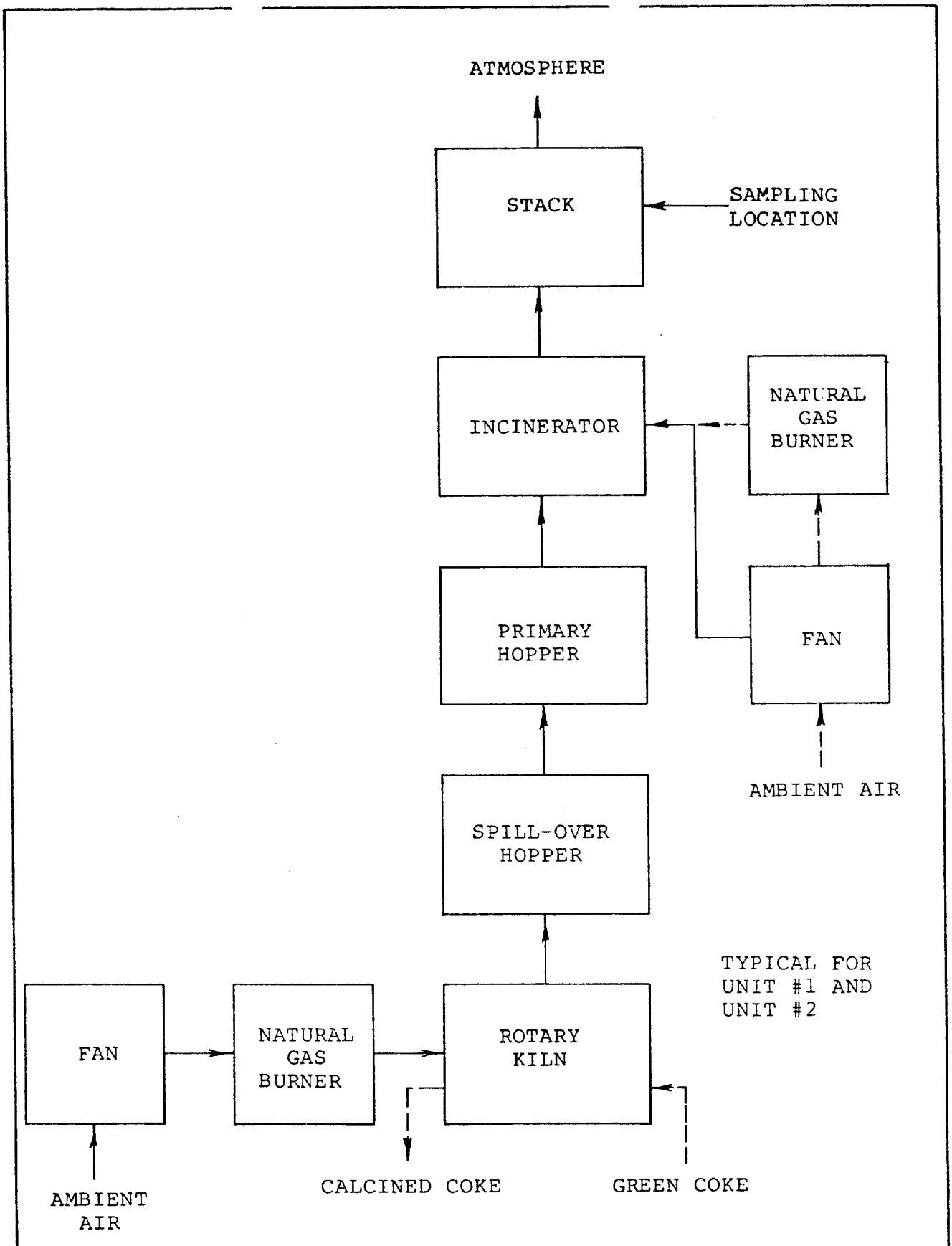


FIGURE 3-1. AIR FLOW SCHEMATIC SHOWING SAMPLING LOCATION

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 (labled 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.

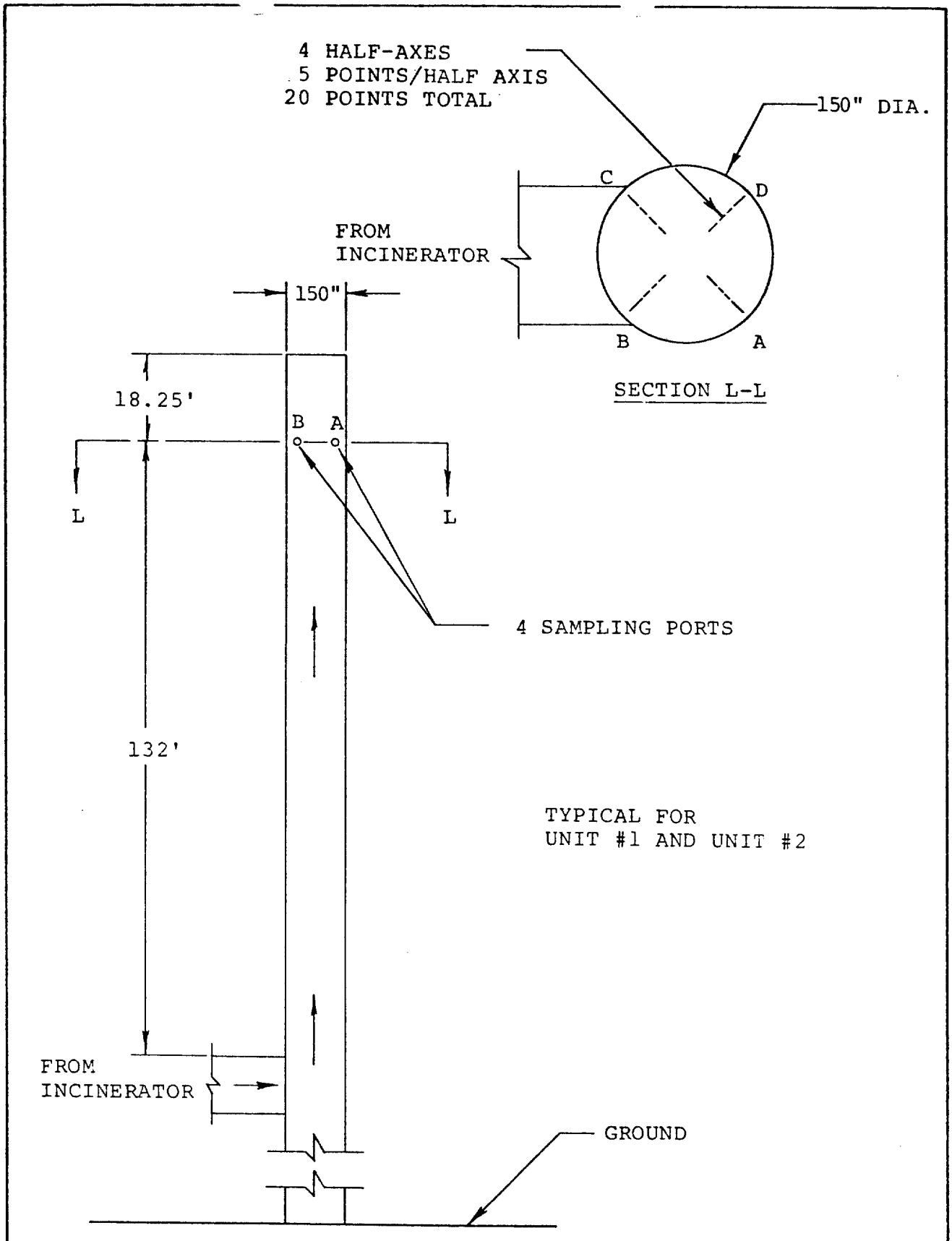


FIGURE 4-1. INCINERATOR STACK DIMENSIONS WITH SAMPLING PORT AND POINT LOCATIONS

A. TEST RESULTS AND EXAMPLE CALCULATIONS

1. Unit #1 Incinerator Stack

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
%CO2	PERCENT CO2 BY VOLUME, DRY	7.8	7.7	7.7
%O2	PERCENT O2 BY VOLUME, DRY	6.7	7.1	6.8
%CO+N2	PERCENT CO + N2 BY VOLUME	85.5	85.2	85.5
Md	DRY MOLECULAR WT, LB/LB-MOLE	29.52	29.52	29.50
Ms	WET MOLECULAR WT, LB/LB-MOLE	27.53	27.61	27.55
Ps	GAS STATIC PRESS., IN. H2O	-0.3	-0.2	-0.3
Ps	ABSOLUTE GAS PRESS., IN. HG.	29.38	29.38	29.38
ts	GAS TEMPERATURE, DEG. F	1,953	1,954	1,950
Delta p	AVG VELOCITY HEAD, IN. H2O	0.1052	0.1230	0.1155
vs	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
Qsd	GAS FLOW RATE, DRY SCFM *	52,656	57,324	55,341
Qaw	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:			
mn	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.

EXAMPLE . ARTICULATE TEST CALCULATIC 3 NO. 1

Unit #1 Incinerator Stack

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

$$Vm(std) = 17.64 * Y * Vm * \frac{(Pbar + Delta\ H/13.6)}{(460 + tm)}$$

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

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

$$Vw(std) = 0.04707 * Vlc$$

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

PERCENT MOISTURE, BY VOLUME, AS MEASURED IN FLUE GAS

$$\%H2O = 100 * Vw(std) / (Vw(std) + Vm(std))$$

$$\%H2O = \frac{7.955}{7.955 + 38.217} * 100 = 17.2\ \%$$

DRY MOLE FRACTION OF FLUE GAS

$$Mfd = 1 - \%H2O/100$$

$$Mfd = 1 - 17.2/100 = 0.828$$

DRY MOLECULAR WEIGHT OF FLUE GAS

$$Md = \%CO2 * 0.44 + \%O2 * 0.32 + \%CO+N2 * 0.28$$

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

WET MOLECULAR WEIGHT OF FLUE GAS

$$Ms = (Md * Mfd) + (0.18 * \%H2O)$$

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

ABSOLUTE FLUE GAS PRESSURE

$$Ps = Pbar + Ps / 13.6$$

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

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

$$vs = 85.49 * Cp * SQRT\left[\frac{(\text{Delta p})avg * (460 + ts)}{Ps * Ms}\right]$$

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

DRY VOLUMETRIC FLUE GAS FLOW RATE @ STANDARD CONDITIONS

$$Qsd = \frac{60}{144} * Mfd * vs * A * \frac{Tstd}{ts + 460} * \frac{Ps}{Pstd}$$

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

$$Qsd = 52,656 \text{ SCFM}$$

WET VOLUMETRIC STACK GAS FLOW RATE @ FLUE GAS CONDITIONS

$$Qaw = 60 / 144 * vs * A$$

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

PERCENT ISOKINETIC OF SAMPLING RATE

$$\%I = \frac{Pstd}{Tstd} * \frac{100}{60} * \frac{(ts + 460) * Vm(std)}{Ps * vs * Mfd * Theta * Area\text{-}nozzle, sq.ft.}$$

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

$$\%I = 106.6 \%$$

GRAINS PER DRY STANDARD CUBIC FOOT

$$gr/DSCF = \frac{7000}{453,592} * \frac{mgs}{Vm(std)}$$

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

POUNDS PER HOUR

$$Lb/Hr = 60 / 7000 * gr/DSCF * Qsd$$

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

PERCENT EXCESS AIR

$$\%EA = \frac{\%O2 - (0.5 * \%CO)}{(0.264 * \%N2) - (\%O2 - (0.5*\%CO))} * 100$$

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

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. H2O	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
%H2O	MOISTURE, PERCENT BY VOLUME	18.7	17.7	19.9
Mfd	DRY MOLE FRACTION	0.813	0.823	0.801

(continued next page)

		4	5	6
%CO2	PERCENT CO2 BY VOLUME, DRY	7.1	7.3	8.9
%O2	PERCENT O2 BY VOLUME, DRY	7.1	6.7	3.9
%CO+N2	PERCENT CO + N2 BY VOLUME	85.8	86.0	87.2
Md	DRY MOLECULAR WT, LB/LB-MOLE	29.42	29.44	29.58
Ms	WET MOLECULAR WT, LB/LB-MOLE	27.28	27.42	27.28
Ps	GAS STATIC PRESS., IN. H2O	-0.3	-0.2	-0.2
Ps	ABSOLUTE GAS PRESS., IN. HG.	29.48	29.48	29.48
ts	GAS TEMPERATURE, DEG. F	1,990	1,993	1,992
Delta P	AVG VELOCITY HEAD, IN. H2O	0.1051	0.0995	0.0999
Vs	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
Qsd	GAS FLOW RATE, DRY SCFM *	51,615	50,731	49,586
Qaw	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:			
mg	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.

B. FIELD AND ANALYTICAL DATA

1. Unit #1 Incinerator Stack

Preliminary Field Data

PLANT NAME MOCAR

LOCATION MOUNDSVILLE, W. VA.

SAMPLING LOCATION UNITS 1&2 INCINERATOR STACK

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 168"

NIPPLE LENGTH 18

DEPTH OF DUCT 150

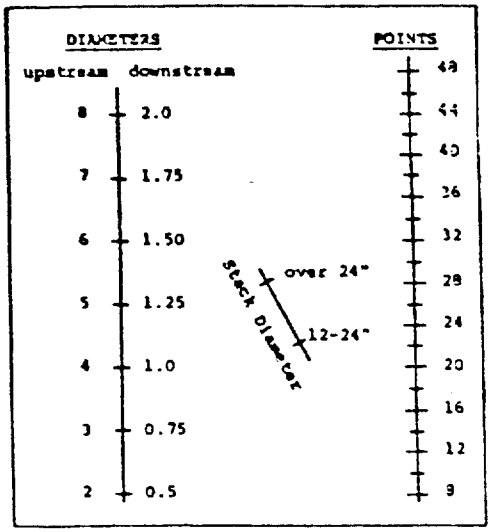
WIDTH (RECTANGULAR DUCT) _____

EQUIVALENT DIAMETER:

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

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE:	UPSTREAM	DOWNSTREAM
FEET	132	18.25
STACK DIAMETERS	11	1.46

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



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	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.9	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	69.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

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											95.8

Point	% OF DIAMETER	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	2.6	4"	22"
2	8.2	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			
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23			
24			

ENTROPY
ENVIRONMENTALISTS, INC

ORSAT FIELD DATA

Plant Name Mocar

Sampling Location Incinerator #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

PARTICULATE FIELD DATA

Corresponds To Run 1

COMPANY NAME Mocar
ADDRESS Moundsville, W.VA
SAMPLING LOCATION Incinerator, #1 Stack
DATE 12/12/84 TEAM LEADER WSN TECHNICIANS WSN, ST
BAROMETRIC PRESSURE, IN. HG 29.40 STATIC PRESSURE, IN. H_2O -0.30
SAMPLING TRAIN LEAK TEST VACUUM, IN. HG 15 5
SAMPLING TRAIN LEAK RATE, CU. FT./MIN. 2.000 0.000

RUN NUMBER 10
TIME START 08:49
TIME FINISH 10:06

EQUIPMENT CHECKS

- ✓ PITOTS, PRE-TEST
- ___ PITOTS, POST-TEST
- ✓ ORSAT SAMPLING SYSTEM
- ✓ TEDLAR BAG
- ___ THERMOCOUPLE @ 1945 °F

IDENTIFICATION NUMBERS

REAGENT BOX 224 NOZZLE 814 DIAMETER .505
METER BOX N-9 T/C READOUT WATLOW
UMBILICAL U-13, U-10 T/C PROBE HI TEMP
SAMPLE BOX 18 ORSAT PUMP 2
PROBE WC 6' TEDLAR BAG 2

FILTER # E2260 **TARE** .4521

NOMOGRAPH SET-UP NOMOGRAPH # WSN

$\Delta H_@$ 1.61 C FACTOR 0.72
METER TEMP 70 STACK TEMP 1925
% MOISTURE 15 REF. ΔP 0.168

SAMPLE POINT	CLOCK TIME, MIN.	DRY GAS METER READING, CU. FT.	PITOT READING (ΔP), IN. H_2O	ORIFICE SETTING (ΔH), IN. H_2O IDEAL	ORIFICE SETTING (ΔH), IN. H_2O ACTUAL	GAS METER TEMP. °F	PUMP VACUUM IN. HG GAUGE	FILTER BOX TEMP. °F	IMP. EXIT TEMP. °F	STACK TEMP. °F	LK. CHECK READINGS
A 1	0/0	428.982	0.070	0.77	0.77	62	2	270	50	1956	
2	3	430.76	0.085	0.94	0.94	63	2	270	50	1978	
3	6	432.42	0.120	1.32	1.32	64	2	270	50	1985	
4	9	434.29	0.120	1.32	1.32	65	2	270	50	1980	
5	12	436.52	0.130	1.44	1.44	68	2	270	50	1962	
B 1	15/0	438.45	0.075	0.83	0.83	64	2	270	50	1910	
2	3	440.26	0.100	1.10	1.10	68	2	273	54	1930	
3	6	442.25	0.120	1.32	1.32	68	2	268	55	1945	
4	9	443.89	0.130	1.44	1.44	68	2	268	55	1960	
5	12	446.13	0.135	1.50	1.50	66	3	269	55	1958	
C 1	30/0	448.26	0.065	0.72	0.72	64	2	270	55	1925	
2	3	449.80	0.095	1.05	1.05	66	2	273	55	1953	
3	6	451.83	0.110	1.22	1.22	67	2	272	55	1958	
4	9	453.68	0.120	1.32	1.32	66	2	272	55	1960	
5	12	455.59	0.130	1.44	1.44	66	3	274	55	1958	
D 1	45/0	457.72	0.075	0.83	0.83	62	2	274	55	1935	
2	3	459.38	0.090	1.00	1.00	64	2	270	56	1948	
3	6	461.16	0.100	1.10	1.10	65	2	268	58	1951	
4	9	463.05	0.130	1.44	1.44	65	2	267	58	1952	
5	12	465.54	0.130	1.44	1.44	65	2	264	59	1956	
	END	467.402									

V_M	$\frac{0.1052}{(\sqrt{\Delta P})^2}$	ΔH	T_M	T_S
38.42	0.1052	1.18	65	1953

ENTROPY

PARTICULATE FIELD DATA

Run 2

COMPANY NAME Mocar — RUN NUMBER 11
ADDRESS Moundsville, W.VA — TIME START 11:46
SAMPLING LOCATION Incinerator #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. H_2O -0.24
SAMPLING TRAIN LEAK TEST VACUUM, IN. HG 15 5
SAMPLING TRAIN LEAK RATE, CU. FT./MIN. 0.006 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRE-TEST
- ✓ PITOTS, POST-TEST
- ✓ ORSAT SAMPLING SYSTEM
- ✓ TEDLAR BAG
- ✓ THERMOCOUPLE @ 1942 °F

IDENTIFICATION NUMBERS

REAGENT BOX 224 — NOZZLE 814 — DIAMETER .505
METER BOX N-9 — T/C READOUT WATLOW
UMBILICAL V-13, V-10 — T/C PROBE HI-TEMP
SAMPLE BOX 18 — ORSAT PUMP 2
PROBE WC18' — TEDLAR BAG 10

FILTER #	TARE
E 2258	.4530

NOMOGRAPH SET-UP — NOMOGRAPH # WSN

$\Delta H_@$ 1.61 — C FACTOR 0.70
METER TEMP 75 — STACK TEMP 1950
% MOISTURE 18 — REF. ΔP 0.174

SAMPLE POINT	CLOCK TIME, MIN.	DRY GAS METER READING, CU. FT.	PITOT READING (ΔP), IN. H_2O	ORIFICE SETTING (ΔH), IN. H_2O IDEAL	ORIFICE SETTING (ΔH), IN. H_2O ACTUAL	GAS METER TEMP. °F	PUMP VACUUM IN. HG GAUGE	FILTER BOX TEMP. °F	IMP. EXIT TEMP. °F	STACK TEMP. °F	LK. CHECK READINGS
D 1	0/0	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	30/6	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/OFF	509.264									

V_M	$(\sqrt{\Delta P})^2$	ΔH	T_M	T_S
41.522	0.1230	1.34	77	1954

ENTROPY

PARTICULATE FIELD DATA

Run 3

COMPANY NAME Mocar — RUN NUMBER 12
ADDRESS Moundsville, W.VA — TIME START 13:57
SAMPLING LOCATION Incinerator #1 stack — TIME FINISH 15:06
DATE 12/12/84 — TEAM LEADER WSN — TECHNICIANS ST, HBL
BAROMETRIC PRESSURE, IN. HG 29.40 — STATIC PRESSURE, IN. H_2O -0.26
SAMPLING TRAIN LEAK TEST VACUUM, IN. HG 15 5
SAMPLING TRAIN LEAK RATE, CU. FT./MIN. 0.006 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRE-TEST
- ✓ PITOTS, POST-TEST
- ✓ ORSAT SAMPLING SYSTEM
- ✓ TEDLAR BAG
- THERMOCOUPLE @ 1951 °F

IDENTIFICATION NUMBERS

REAGENT BOX 224 — NOZZLE 814 — DIAMETER .505
METER BOX N-9 — T/C READOUT WATLOW
UMBILICAL V-13, V-10 — T/C PROBE #1 - TEMP
SAMPLE BOX 18 — ORSAT PUMP 2
PROBE WC 10' — TEDLAR BAG 8

FILTER #	TARE
E2257	.4521

NOMOGRAPH SET-UP — NOMOGRAPH # WSN

$\Delta H_@$ 1.61 — C FACTOR 0.70
METER TEMP 75 — STACK TEMP 1950
% MOISTURE 18 — REF. ΔP 0.174

SAMPLE POINT	CLOCK TIME, MIN.	DRY GAS METER READING, CU. FT.	PITOT READING (ΔP), IN. H_2O	ORIFICE SETTING (ΔH), IN. H_2O IDEAL	ORIFICE SETTING (ΔH), IN. H_2O ACTUAL	GAS METER TEMP. °F	PUMP VACUUM IN. HG GAUGE	FILTER BOX TEMP. °F	IMP. EXIT TEMP. °F	STACK TEMP. °F	LK. CHECK READINGS
A 1	0/0	509.933	0.080	0.86	0.86	77	2	270	57	1925	
2	3	511.56	0.100	1.08	1.08	77	2	270	57	1936	
3	6	513.62	0.125	1.32	1.32	78	2	272	57	1947	
4	9	515.59	0.135	1.46	1.46	78	3	273	57	1956	
5	12	517.87	0.150	1.62	1.62	79	3	273	57	1964	
B 1	15/0	520.02	0.080	0.86	0.86	78	2	272	57	1930	
2	3	521.75	0.110	1.18	1.18	78	2	273	57	1943	
3	6	523.67	0.125	1.32	1.32	79	2	273	54	1951	
4	9	525.60	0.140	1.52	1.52	79	2	269	59	1956	
5	12	528.20	0.160	1.70	1.70	79	3	265	60	1962	
C 1	30/0	530.30	0.080	0.86	0.86	80	2	265	62	1931	
2	3	531.98	0.095	1.00	1.00	80	2	265	62	1950	
3	6	533.86	0.115	1.22	1.22	82	2	269	60	1958	
4	9	535.82	0.130	1.38	1.38	82	2	264	60	1962	
5	12	538.46	0.140	1.52	1.52	82	3	265	60	1964	
D 1	45/0	540.42	0.085	0.91	0.91	82	2	268	58	1937	
2	3	542.36	0.100	1.08	1.08	82	2	269	57	1950	
3	6	544.17	0.115	1.22	1.22	82	2	270	56	1953	
4	9	546.05	0.125	1.32	1.32	82	2	270	56	1962	
5	12	548.37	0.145	1.57	1.57	82	3	270	55	1963	
	60/OFF	550.415									

V_M	$(\sqrt{\Delta P})^2$	ΔH	T_M	T_S
40.482	0.1155	1.25	80	1950

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	1	2	3
	Run Date	12/12	12/12	12/12

SUMMARY OF PARTICULATE ANALYSES

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

ANALYSIS OF MOISTURE CATCH

Reagent 1 (H_2O):			
Final Weight, g.	355.0	355.0	359.0
Tared Weight, g.	200.0	200.0	200.0
Water Catch, g.	155.0	155.0	159.0
Reagent 2 ( ):			
Final Weight, g.	–	–	–
Tared Weight, g.	–	–	–
Water Catch, g.	–	–	–
CONDENSED WATER, g.	155.0	155.0	159.0
Silica Gel:			
Final Weight, g.	214.0	215.0	211.5
Tared Weight, g.	200.0	200.0	200.0
ABSORBED WATER, g.	14.0	15.0	11.5
TOTAL WATER COLLECTED, g.	169.0	170.0	170.5

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 # 0224

Date of Makeup 12/7/84 Initials MS Locked? ✓

Individual Tare of Reagent: 200 mls. of H_2O

Individual Tare of Reagent: _____ mls. of _____

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME Mocar

SAMPLING 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? ✓

Zero & Span Balance Initials BD

Sampling Method: M.S

Filter #	Tare Weight (mgms)	Used on Test
E2260	.4541	10 (1)
E2258	.4530	11 (2)
E2257	.4521	12 (3)

Remarks:

ENTROPY ENVIRONMENTALISTS, INC.

B. FIELD AND ANALYTICAL DATA

2. Unit #2 Incinerator Stack

ORSAT FIELD DATA

Plant Name Mocar

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

PARTICULATE FIELD DATA

Corresponding Run 4

COMPANY NAME Mocar — RUN NUMBER 13
ADDRESS Moundsville, 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. H_2O -0.25
SAMPLING TRAIN LEAK TEST VACUUM, IN. HG 15 5
SAMPLING TRAIN LEAK RATE, CU. FT./MIN. 0.002 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRE-TEST
- ✓ PITOTS, POST-TEST
- ✓ ORSAT SAMPLING SYSTEM
- ✓ TEDLAR BAG
- ✓ THERMOCOUPLE @ 1985 °F

IDENTIFICATION NUMBERS

REAGENT BOX 228 — NOZZLE 814 — DIAMETER .505
METER BOX N.9 — T/C READOUT WATLOW
UMBILICAL U.13, V.10 — T/C PROBE HI TEMP
SAMPLE BOX 18 — ORSAT PUMP 2
PROBE WC10 — TEDLAR BAG 2

FILTER #	TARE
E2253	.4499

NOMOGRAPH SET-UP — NOMOGRAPH # WSN

$\Delta H_@$ 1.61 — C FACTOR 0.76
METER TEMP 90 — STACK TEMP 1925 / 1975
% MOISTURE 18 — REF. ΔP 0.160 / 0.164

SAMPLE POINT	CLOCK TIME, MIN.	DRY GAS METER READING, CU. FT.	PITOT READING (ΔP), IN. H_2O	ORIFICE SETTING (ΔH), IN. H_2O IDEAL	ORIFICE SETTING (ΔH), IN. H_2O ACTUAL	GAS METER TEMP. °F	PUMP VACUUM IN. HG GAUGE	FILTER BOX TEMP. °F	IMP. EXIT TEMP. °F	STACK TEMP. °F	LK. CHECK READINGS
D 5	0/0	551.253	0.130	1.52	1.52	89	2	256	64	1990	
4	3	553.86	0.125	1.46	1.46	88	3	258	64	1999	
3	6	556.03	0.120	1.39	1.39	88	2	266	62	1996	
2	9	558.12	0.115	1.30	1.30	88	2	270	62	1956	
1	12	560.30	0.095	1.08	1.08	88	2	270	62	1953	
C 5	15/0	562.09	0.125	1.40	1.46	87	2	273	60	1995	
4	3	564.29	0.115	1.30	1.30	88	2	273	60	2000	
3	6	566.46	0.100	1.13	1.13	88	2	270	60	2000	
2	9	568.30	0.095	1.08	1.08	88	2	272	60	1994	
1	12	570.17	0.080	0.91	0.91	89	2	273	59	1988	
B 5	30/0	571.93	0.125	1.46	1.46	88	2	270	62	1998	
4	3	574.12	0.115	1.30	1.30	89	2	272	63	2000	
3	6	576.21	0.100	1.13	1.13	89	2	273	64	1997	
2	9	578.17	0.085	0.96	0.96	89	2	273	65	1994	
1	12	579.99	0.080	0.91	0.91	89	2	273	65	1979	
A 5	45/0	581.68	0.125	1.46	1.46	88	3	266	62	2000	
4	3	584.02	0.110	1.24	1.24	89	2	267	62	2000	
3	6	586.02	0.100	1.13	1.13	89	2	267	62	2000	
2	9	587.96	0.095	1.08	1.08	91	2	268	62	1996	
1	12	589.86	0.080	0.91	0.91	92	2	268	65	1969	
	W/Off	591.606									

40.353	0.1051	1.21	89	1990
V_M	$(\sqrt{\Delta P})^2$	ΔH	T_M	T_S

ENTROPY

PARTICULATE FIELD DATA

Run 5

COMPANY NAME Mocar — RUN NUMBER 14
ADDRESS Moundsville, W.V.A. — TIME START 10:35
SAMPLING LOCATION Incinerator #2 Stack — TIME FINISH 11:47
DATE 12/13/84 — TEAM LEADER WSN — TECHNICIANS ST, HBL
BAROMETRIC PRESSURE, IN. HG 29.50 — STATIC PRESSURE, IN. H_2O -0.23
SAMPLING TRAIN LEAK TEST VACUUM, IN. HG 15 5
SAMPLING TRAIN LEAK RATE, CU. FT./MIN. 0.004 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRE-TEST
- ✓ PITOTS, POST-TEST
- ✓ ORSAT SAMPLING SYSTEM
- ✓ TEDLAR BAG
- ✓ THERMOCOUPLE @ 1970 °F

IDENTIFICATION NUMBERS

REAGENT BOX 228 — NOZZLE 81F — DIAMETER .505
METER BOX N-9 — T/C READOUT WATLOW
UMBILICAL U-13, U-10 — T/C PROBE HI-TEMP
SAMPLE BOX 18 — ORSAT PUMP 2
PROBE WC 6' — TEDLAR BAG 10

FILTER #	TARE
E2254	.4518

NOMOGRAPH SET-UP — NOMOGRAPH # WSN

$\Delta H_@$ 1.61 — C FACTOR 0.76
METER TEMP 90 — STACK TEMP 1975
% MOISTURE 17 — REF. ΔP 0.164

SAMPLE POINT	CLOCK TIME, MIN.	DRY GAS METER READING, CU. FT.	PITOT READING (ΔP), IN. H_2O	ORIFICE SETTING (ΔH), IN. H_2O IDEAL	ORIFICE SETTING (ΔH), IN. H_2O ACTUAL	GAS METER TEMP. °F	PUMP VACUUM IN. HG GAUGE	FILTER BOX TEMP. °F	IMP. EXIT TEMP. °F	STACK TEMP. °F	LK. CHECK READINGS
A 1	0/0	592.682	0.070	0.81	0.81	85	2	270	65	1962	
2	3	593.72	0.095	1.08	1.08	83	2	272	64	1998	
3	6	595.77	0.110	1.24	1.24	82	2	273	65	2000	
4	9	597.74	0.120	1.39	1.34	82	2	270	65	2000	
5	12	599.85	0.125	1.44	1.44	80	2	270	63	2000	
B 1	15/0	601.95	0.080	0.91	0.91	76	2	273	64	1996	
2	3	603.76	0.085	0.97	0.97	75	2	273	62	1999	
3	6	605.54	0.095	1.08	1.08	75	2	273	64	2000	
4	9	607.35	0.110	1.24	1.24	75	2	272	62	2000	
5	12	609.52	0.120	1.39	1.39	75	3	270	62	1998	
C 1	30/0	611.83	0.080	0.91	0.91	78	2	272	62	1967	DWN 4:11 - 11:13
2	3	613.57	0.095	1.08	1.08	79	2	270	63	1996	
3	6	615.46	0.095	1.08	1.08	81	2	270	64	2000	
4	9	617.42	0.110	1.24	1.24	83	2	270	62	1987	
5	12	619.41	0.120	1.39	1.39	84	3	267	62	1999	
D 1	45/0	621.49	0.075	0.86	0.86	84	2	272	64	1974	
2	3	623.46	0.090	1.03	1.03	86	2	272	64	1996	
3	6	625.31	0.105	1.20	1.20	87	2	270	64	1985	
4	9	627.28	0.100	1.15	1.15	89	2	272	63	1998	
5	12	629.22	0.125	1.44	1.44	90	3	273	64	1996	
	W/OFF	631.392									

V_M	$\frac{\Delta P}{(\sqrt{\Delta P})^2}$	ΔH	T_M	T_S
39.31	0.09934	1.15	81	1993

ENTROPY

PARTICULATE FIELD DATA

Run 6

COMPANY NAME Mocar — RUN NUMBER 15
ADDRESS Moundsville W.VA — TIME START 13:31
SAMPLING LOCATION Incinerator #2 stack — TIME FINISH 14:39
DATE 12/13/84 — TEAM LEADER WSN — TECHNICIANS ST, HBL
BAROMETRIC PRESSURE, IN. HG 29.50 — STATIC PRESSURE, IN. H_2O -0.22
SAMPLING TRAIN LEAK TEST VACUUM, IN. HG 15 5
SAMPLING TRAIN LEAK RATE, CU. FT./MIN. 0.002 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRE-TEST
- ✓ PITOTS, POST-TEST
- ✓ ORSAT SAMPLING SYSTEM
- ✓ TEDLAR BAG
- ✓ THERMOCOUPLE @ 1980 °F

IDENTIFICATION NUMBERS

REAGENT BOX 228 — NOZZLE 814 — DIAMETER .505
METER BOX N.9 — T/C READOUT WATLOW
UMBILICAL U.10, U.13 — T/C PROBE HITEMP
SAMPLE BOX 18 — ORSAT PUMP 2
PROBE WC 10' — TEDLAR BAG 8

FILTER #	TARE
E2255	.4517

NOMOGRAPH SET-UP — NOMOGRAPH # WSN

$\Delta H_@$ 1.61 — C FACTOR 0.76
METER TEMP 90 — STACK TEMP 1975
% MOISTURE 17 — REF. ΔP 0.164

SAMPLE POINT	CLOCK TIME, MIN.	DRY GAS METER READING, CU. FT.	PITOT READING (ΔP), IN. H_2O	ORIFICE SETTING (ΔH), IN. H_2O IDEAL	ORIFICE SETTING (ΔH), IN. H_2O ACTUAL	GAS METER TEMP. °F	PUMP VACUUM IN. HG GAUGE	FILTER BOX TEMP. °F	IMP. EXIT TEMP. °F	STACK TEMP. °F	LK. CHECK READINGS
D 1	0/0	632.900	0.080	0.93	0.93	84	2	272	64	1972	
2	3	633.74	0.090	1.02	1.02	85	2	273	64	1980	
3	6	635.59	0.100	1.14	1.14	86	2	270	64	1994	
4	9	637.56	0.110	1.28	1.28	86	2	273	65	2000	
5	12	639.58	0.125	1.44	1.44	88	3	272	65	2000	
C 1	15/0	641.69	0.080	0.93	0.93	92	2	270	64	1982	
2	3	643.56	0.090	1.02	1.02	94	2	273	64	2000	
3	6	645.40	0.100	1.16	1.16	96	2	273	64	2000	
4	9	647.32	0.110	1.28	1.28	98	2	270	65	2000	
5	12	649.37	0.110	1.28	1.28	100	2	272	65	2000	
B 1	30/0	651.39	0.075	0.86	0.86	102	2	270	64	1978	
2	3	653.18	0.085	0.97	0.97	100	2	273	64	1983	
3	6	655.00	0.100	1.14	1.14	99	2	270	64	1989	
4	9	657.08	0.115	1.32	1.32	97	3	270	64	2000	
5	12	659.24	0.120	1.39	1.39	97	3	272	64	2000	
A 1	45/0	661.08	0.080	0.93	0.93	97	2	272	64	1980	
2	3	662.93	0.095	1.08	1.08	96	2	270	66	1996	
3	6	664.79	0.110	1.28	1.28	96	2	272	66	1990	
4	9	666.90	0.115	1.32	1.32	97	3	270	66	1992	
5	12	668.93	0.120	1.39	1.39	96	3	270	67	2000	
	48 OFF	671.068									

V_M	$(\sqrt{\Delta P})^2$	ΔH	T_M	T_S
38.168	0.09992	1.16	94	1992

ENTROPY

ARTICULATE SAMPLING LABORATORY SULTS

Plant Name MOCAR EEI Ref. # 2711

Sampling Location UNIT # 2 INCINERATOR STACK

Date Received 12/14/84 Date Analyzed 12/20/84 Reagent Box(es) 0228

Run Number	4	5	6
Run Date	12/13	12/13	12/13

SUMMARY OF PARTICULATE ANALYSES

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

ANALYSIS OF MOISTURE CATCH

Reagent 1 (H_2O):			
Final Weight, g.	372.0	358.0	373.0
Tared Weight, g.	200.0	200.0	200.0
Water Catch, g.	172.0	158.0	173.0
Reagent 2 ( ):			
Final Weight, g.	–	–	–
Tared Weight, g.	–	–	–
Water Catch, g.	–	–	–
CONDENSED WATER, g.	172.0	158.0	173.0
Silica Gel:			
Final Weight, g.	216.5	215.5	217.5
Tared Weight, g.	200.0	200.0	200.0
ABSORBED WATER, g.	16.5	15.5	17.5
TOTAL WATER COLLECTED, g.	188.5	173.5	190.5

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 #	FER-193	FER-194	FER-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.			

ENTROPY ENVIRONMENTALISTS, INC.

CUSTODY SHEET FOR REAGENT BOX # 0228

Date of Makeup 12/7/84 Initials MEY Locked? ✓

Individual Tare of Reagent: 200 mls. of H_2O

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 Number	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? ✓

Zero & Span Balance Initials BD

Sampling Method: _____

Remarks:

Filter #	Tare Weight (mgms)	Used on Test
E2253	.4499	13 (4)
E2254	.4518	14 (5)
E2255	.4517	15 (6)

ENTROPY ENVIRONMENTALISTS, INC.

APPENDIX C

SAMPLING AND ANALYTICAL PROCEDURES

APPENDIX D

CALIBRATION DATA

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 Cp 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 tranfer 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 Hawks

Date: 8/10/84 Barometric Pressure (P_b): 29.70 in. Hg

*Date: _____ *Barometric Pressure (P_b): _____ in. Hg

ENTROPY ENVIRONMENTALISTS, INC.

Approx. Flow Rate (Q) cfm	Spirometer #2502 Gas Volume (V_s) ft^3	Spirometer #2502 Temp. (t_s) °F	Dry Gas Meter Gas Volume (V_{ds}) ft^3	Dry Gas Meter Temp. (t_{ds}) °F	Pressure (Δp) in. H_2O	Time (θ) min.	Flow Rate (Q) cfm	Meter Meter Coeff. (Y_{ds})	Avg. Meter Coeff. ($\bar{Y}_{ds}$)
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	

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

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

Dry Gas Meter Identification: 1017057 Calibration by: Bruce Hawke

Date: 8/10/84 Barometric Pressure (P_b): 29.70 in. Hg

ENTROPY ENVIRONMENTALISTS, INC.

*Date: _____ *Barometric Pressure (P_b): _____ in. Hg

Approx. Flow Rate (Q) cfm	Spirometer		Dry Gas Meter		Pressure (Δp) in. H_2O	Time (θ) min.	Flow Rate (Q) cfm	Meter Meter Coeff. (Y_{ds})	Avg. Meter Coeff. ($\bar{Y}_{ds}$)
	Gas Volume (V_s) ft^3	Temp. (t_s) °F	Gas Volume (V_{ds}) ft^3	Temp. (t_{ds}) °F					
1.20	9.281	77	9.446	78	-2.7	8.239	1.0990	0.9910	
	9.608	77	9.807	78	-2.9	8.085	1.1594	0.9886	
	9.144	77	9.344	78	-3.1	7.636	1.1683	0.9880	
1.40	9.098	73.4	9.228	76	-3.7	6.831	1.3082	0.9999	
	9.135	73.4	9.267	76	-3.8	6.775	1.3243	1.0000	
	9.126	73.4	9.277	76	-3.9	6.776	1.3228	0.9982	

$\bar{Y}_{DS} = 0.9942$

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

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

CALIBRATION BY: BDR

METER BOX NUMBER: N9

DATE: 12-28-84

BAROMETRIC PRESSURE (P_B): 29.96 IN. HG

*DATE: _____

*BAROMETRIC PRESSURE (P_B): _____ IN. HG

STANDARD METER NUMBER: 1017057

COEFFICIENT (Y_{DS}): 0.9942

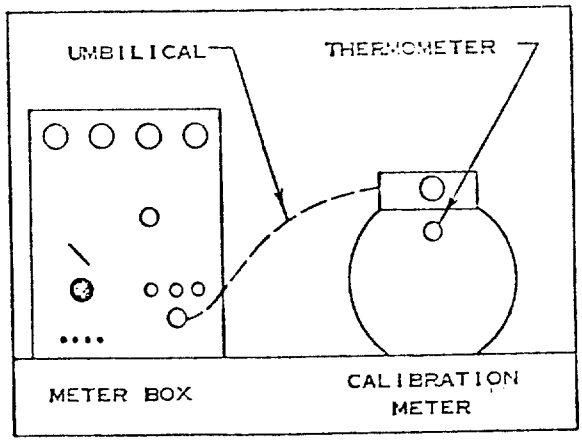
POST-TEST METER BOX CALIBRATION

	STANDARD DRY GAS METER			METER BOX METERING SYSTEM		
NOMINAL FLOW RATE ($\tilde{Q}$) CFM	GAS VOLUME (V_{DS}) FT^3	TEMP. (T_{DS}) ^oF	TIME (θ) MIN.	ORIFICE SETTING (ΔH) IN. H_2O	GAS VOLUME (V_D) FT^3	TEMP. (T_D) ^oF
	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 = 15 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_2O
	0.6360	4.676	0.9969	1.606
	0.6328	4.698	0.9991	1.607
	0.6292	4.715	0.9943	1.614
	AVERAGE		0.997	1.61

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

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



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
IR. BRUCE HAWKS
NTROPY ENVIRONMENTALISTS, INC.
.O. BOX 12291
ESEARCH TRIANGLE PARK, NC 27709

N9

UNITS - CUBIC METERS

ITE - 009

ORIFICE 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}): 0.994Z

NOMINAL FLOW RATE ($\tilde{Q}$) CFM	STANDARD DRY GAS METER			METER BOX METERING SYSTEM		
	GAS VOLUME (V_{DS}) FT³	TEMP. (T_{DS}) °F	TIME (θ) MIN.	ORIFICE SETTING (ΔH) IN.H_2O	GAS VOLUME (V_D) FT³	TEMP. (T_{DS}) °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) CFM	ORIFICE FACTOR (OF)	COEFF. (Y_D)	ΔH@ IN. H_2O
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

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

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

NOZZLE NUMBER: 814

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
2/27/84	PLO	.494	.497	.497	.495	.497	0.496
4/5/84	JNC	.496	.493	.496	.494	.496	0.495
8/10/84	GMC	.494	.492	.491	.492	.494	0.493
9/21/84	BDR	.495	.496	.496	.497	.498	0.496
12/7/84	SSH	.506	.505	.502	.506	.506	0.505

NOTE: All diameters measured in inches.

TEMPERATURE SENSING EQUIPMENT CALIBRATION DATA

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

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

CALIBRATION SYSTEM USED	POTENTIOMETER I.D. NUMBER	THERMOCOUPLE/ THERMOMETER I.D. NUMBER	REFERENCE THERMOMETER TEMPERATURE T_o (°F)	T_c (°F)	MEAN TEMPERATURE OF Hg COLUMN T_m (°F)	THERMOCOUPLE/ THERMOMETER TEMPERATURE T_t (°F)	ΔT^B ≤1.5%
ice water	DS-1	WC-6-1	32	32	51	31	0.2
	"	WC-6-2	32	32	51	31	0.2
	"	WC-10-1	32	32	51	31	0.2
	"	WC-10-2	32	32	51	30	0.4
	"	WC-10-3	32	32	51	32	0.0
ambient air	"	WC-6-1	64	64	64	62	0.4
	"	WC-6-2	64	64	64	61	0.6
	"	WC-10-1	64	64	64	63	0.2
	"	WC-10-2	64	64	64	65	-0.2
	"	WC-10-3	64	64	64	64	0.0
hot water	"	WC-6-1	212	214	120	214	0.0
	"	WC-6-2	212	214	120	213	0.1
	"	WC-10-1	212	214	120	213	0.1
	"	WC-10-2	212	214	120	214	0.0
	"	WC-10-3	212	214	120	214	0.0
hot oil	"	WC-6-1	364	371	138	368	0.4
	"	WC-6-2	364	371	138	370	0.1
	"	WC-10-1	364	371	138	371	0.0
	"	WC-10-2	364	371	138	369	0.2
	"	WC-10-3	364	371	138	370	0.1

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

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

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

CALIBRATION SYSTEM USED	POTENTIOMETER I.D. NUMBER	THERMOCOUPLE/ THERMOMETER I.D. NUMBER	REFERENCE THERMOMETER TEMPERATURE T_o (°F)	REFERENCE THERMOMETER TEMPERATURE T_c (°F)	MEAN TEMPERATURE OF Hg COLUMN T_m (°F)	THERMOCOUPLE/ THERMOMETER TEMPERATURE T_t (°F)	ΔT^B $\leq 1.5\%$
hot water	watlow 1972	WC-6-2	212	214	117	213	0.2
		WC-10-2	212	214	117	214	0.0

CORRECTED TEMPERATURE = $T_C = T_o + .00009\ (T_o - 20)(T_o - T_m)$

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