RAMCON
ENVIRONMENTAL CORPORATION

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.

RECEIVED
JUN 22 1993
DEQ
Northwest Regional Office

SOURCE SAMPLING
for
PARTICULATE EMISSIONS

L. J. EARNEST, INC.
SHREVEPORT, LOUISIANA
June 8, 1993

Gary Alexander
L. J. Earnest, Inc.

William Joseph Sewell, II
Vice President
RAMCON Environmental Corporation

RAMCON

ENVIRONMENTAL CORPORATION

June 16, 1993

Mr. Gary Alexander
L. J. Earnest, Inc.
3508 Industrial Drive
Bossier City, Louisiana 71111

RE: Particulate Emissions Test: June 8, 1993

Dear Mr. Alexander:

Enclosed you will find four (4) copies of our report on the particulate emissions test we conducted at your asphalt plant located in Shreveport, Louisiana. Based on our test results, the average grain loading of the three test runs do pass the standards set by the State of Louisiana. Therefore, the plant is operating in compliance with State standards.

You will want to sign the report covers and send two copies to:

Mr. Otis Randall
LOUISIANA DEPT. OF ENVIRONMENTAL QUALITY
Office of Air Quality and Nuclear Energy
1525 Fairfield Avenue
Shreveport, Louisiana 71101

You will need to keep one copy of the report at the plant.

We certainly have enjoyed working with you. Please let us know if we can be of further assistance.

Sincerely,

W Sewell

William Joseph Sewell, II
Vice President

WJSii:wpc
Enclosures

RAMCON BUILDING, 6707 FLETCHER CREEK COVE, MEMPHIS, TENNESSEE 38133
TELEPHONE 800/458-4567 IN TENNESSEE 901/387-0500 FAX 901/387-0400

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SECTION A.

1. INTRODUCTION

On June 8, 1993 personnel from RAMCON Environmental Corporation conducted a source emissions test for particulate emissions compliance at L. J. Earnest, Inc.'s Astec drum-mix asphalt plant located in Shreveport, Louisiana. RAMCON personnel conducting the test were Allen Turner, Team Leader, Chuck Hughes and Charles Dick. Tommy South was responsible for the laboratory analysis including taring the beakers and filters and recording final data in the laboratory record books. Custody of the samples was limited to Mr. Turner and Mr. South.

The purpose of the test was to determine if the rate of particulate emissions from this plant's baghouse is below or equal to the allowable emissions limit set by the State of Louisiana.

2. TEST RESULTS

Table I summarizes the test results. The grain loading limitation for EPA is .04 gr/dscf as specified in 39 FR 9314, March 8, 1974, 60.92 Standards for Particulate Matter (1), as amended. The allowable emissions for the State of Louisiana are the same as those set by EPA.

Mr. Otis Randall of Louisiana's Dept. of Environmental Quality, Office of Air Quality and Nuclear Energy observed the testing conducted by RAMCON Environmental. Charles Dick of RAMCON Environmental conducted the opacity test which ranged from zero (0) to ten (10) percent on all three (3) runs and therefore meets N.S.P.S. requirements.

SUMMARY OF TEST RESULTS

TABLE I

June 8, 1993

Test Run	Time	Actual Emissions gr/dscf	Isokinetic Variation	Emissions lbs/hr
1	11:46 - 12:53	0.0252	109.2%	5.93
2	13:47 - 14:56	0.0214	98.1%	6.21
3	13:58 - 17:05	0.0195	98.2%	5.43
	Average:	0.0220		5.86

On the basis of these test results, the average grain loading of the three test runs is below the .04 gr/DSCF allowable emissions limitation set by the State of Louisiana. Therefore, the plant is operating in compliance with State standards.

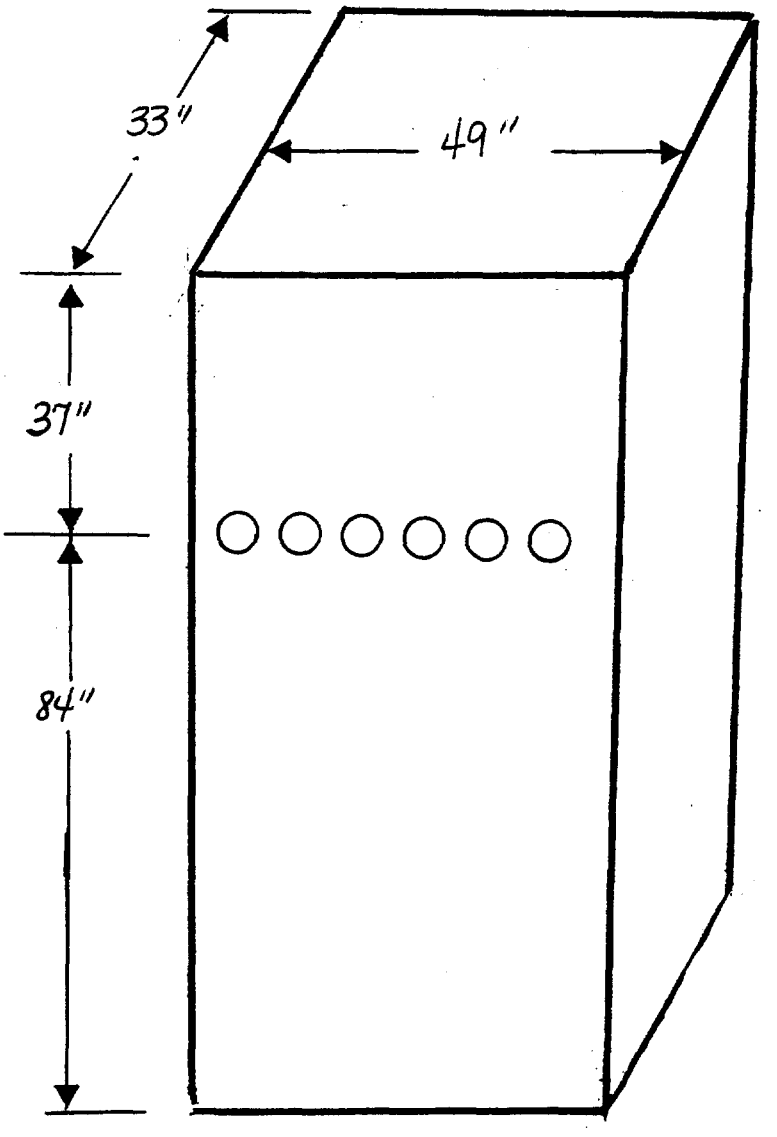
3. TEST PROCEDURES

(a) Method Used: Method 5 source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

(b) Problems Encountered: No problems were encountered that affected testing.

(c) Sampling Site: The emissions test was conducted after a baghouse on a rectangular stack measuring 33" x 49" with an equivalent diameter of 39.4". Six (6) sampling ports were placed 37" down (0.9 diameters upstream) from the top of the stack and 84" up (2.1 diameters downstream) from the last flow disturbance. The ports were evenly spaced on 8.2" centers. The two outside ports are 4.1" from the side walls of the stack. Thirty (30) points were sampled, five (5) through each port for two (2) minutes each for a total testing time of sixty (60) minutes.

Points on a Diameter	Probe Mark
1	3.3"
2	9.9"
3	16.5"
4	23.1"
5	29.7"



SECTION B:

THE SOURCE

THE SOURCE

L. J. Earnest, Inc. employs an Astec drum mix asphalt plant which is used to manufacture hot mix asphalt for road pavement. The process consists of blending prescribed portions of cold feed materials (sand, gravel, screenings, chips, etc.) uniformly and adding sufficient hot asphalt oil to bind the mixture together. After the hot asphalt mix is manufactured at the plant, it is transported to the location where it is to be applied. The hot asphalt mix is spread evenly over the surface with a paver then compacted with a heavy roller to produce the final product.

The following is a general description of the plant's manufacturing process: The cold feed materials (aggregate) are dumped into separate bins which in turn feed a common continuous conveyor. The aggregate is dispensed from the bins in accordance with the desired formulation onto the cold feed system conveyor, to an inclined weigh conveyor, then to a rotating drum for continuous mixing and drying at approximately 300°F. When recycled asphalt mix is used, it is added halfway down the drum through a separate conveyor. The required amount of hot asphalt oil is then injected onto and mixed into the dried aggregate. The now newly formed hot asphalt mix is pulled to the top of a storage silo by a conveyor. The hot asphalt mix is then discharged from the storage silo through a slide gate into waiting dump trucks which transports the material to a final destination for spreading. The rated capacity of the plant will vary with each aggregate mix and moisture content with a 5% surface moisture removal.

The drum mixer uses a burner fired with natural gas to heat air to dry the aggregate, and the motion of the rotating drum to blend the aggregate. The air is drawn into the system via an exhaust fan. After passing through the gas burner and the mixing drum, the air passes through a baghouse. The baghouse is manufactured by Astec. The exhaust gases are drawn through the baghouse and discharged to the atmosphere through the stack. The design pressure drop across the tube sheet is 2-6 inches of water. The particulate matter, which is removed by the baghouse, is reinjected into the drum mixer.

Form REC#

DATA ON FACILITY BEING STACK TESTED

COMPANY NAME L.J. Earnest COMPANY REP. Ray Daigh PHONE (318) 631-7714

LOCATION OF FACILITY 3950 West 70 st Shreport La. ORIGINAL START-UP DATE 6-1990 DESIGNED CAPACITY 400 TPH

OEM _____ MODEL NO. _____ TYPE _____ AC TYPE 30

1 Time (24 HR) NOTE: check small box in column when moisture sample is taken	2 Fuel Use ✓ #Fuel Oil ✓ Nat. Gas ✓ Propane ___ Coal ___ other	3 Burner Setting	4 Blower Pressure	5 Production Rate ___ Mix ✓ Aggregate TPH	5 Production Rate ___ RAP TPH	6 Asphalt Cement %	7 Mix Temp. °F	8 Exhaust Gas Temp. °F	9 ___ Venturi Scrubber ___ Baghouse Pressure Drop in w.g.	9 Water Pressure psi	10 Ambient Temp. °F	11 Relative Humidity %	12 Exhaust Damper Position
11:40	—	23.6		323		17.5	318	275	.15	4			
11:55	—	25.4		334.4		17.6	318	278	.15	4			
12:10	—	30.0		339.1		17.9	315	284	.15	4			
12:25	—	35.3		335.4		17.6	313	288	.15	4			
12:40	—	32.7		328.7		17.3	326	296	.15	4			
12:55	—	34.7		327.8		17.2	319	294	.15	4			
1:45	—	32.7		332.5		17.5	330	291	.15	4			
2:00	—	30.0		330.7		17.3	325	288	.15	4			
2:15	—	31.4		332.5		17.5	315	286	.15	4			
2:30	—	30.2		331.6		17.4	324	285	.15	4			
2:45	—	30.5		330.5		17.3	324	284	.15	4			
3:55	—	25.5		334.2		17.6	325	283	.15	4			
4:10	—	40.6		339.2		17.9	328	295	.15	4			
4:25	—	40.8		338.5		17.8	326	296	.15	4			
4:40	—	39.3		332.5		17.4	320	294	.15	4			
4:55	—	39.3		333.5		17.3	322	294	.15	4			

DATA SUMMARY ON STACK BEING TESTED

AGGREGATE

1. Name/type of mix 3 W. C.
2. Name/type of 2nd mix (if used) _____
3. Type/temperature of Liquid Asphalt AC 30 / 320 °F
4. Sieve/Screening analysis: _____ % Passing;

	1st mix / 2nd mix		1st mix / 2nd mix		1st mix / 2nd mix
1"	100 /	3/8"	80 /	#10	44 /
3/4"	100 /	#200	5.6 /	#40	26 /
1/2"	95 /	#4	60 /	#8	14 /

CONTROL SYSTEM

Manufacturer Standard Haven

A. Baghouse:

1. Type of bags 100% Nomex # of bags _____ Sq. ft. of bags _____
2. Air to cloth ratio _____ Designed ACFM 65,000
3. Type of cleaning - pulse jet ✓ reverse air _____ plenum pulse _____ other _____
4. Cleaning cycle time 9 sec Interval between cleaning cycle 9 sec
5. Pulse pressure on cleaning cycle 70 psi

B. Scrubber:

1. Type - Venturi _____ Wet Washer _____

   Spray Booth _____ Other _____
2. Gallons per minute through system _____
3. Water source _____ (i.e., pond, lagoon, etc.)
4. Number of spray nozzles _____

Company Name _____ Date _____

Company Representative _____

1. Aggregate bins: Virgin aggregate is fed individually into bins by type. It is metered onto a conveyor belt running under the bins to a shaker screen. The proportion to each aggregate type is determined by the job mix formula and pre-set to be metered out to meet these specifications.

2. Preliminary oversize screen: The aggregate is fed through a shaker screen where oversize rocks and foreign material is screened out of the mix.

3. Weigh conveyor belt: The aggregate is conveyed to the rotary drum dryer on a conveyor belt which weighs the material. The production rate is determined by this weight reading.

4. Rotary drum/dryer mixer: The aggregate is fed into the rotary drum dryer where it is tumbled by flighting into a veil in front of a flame which drives off the moisture. Further mixing is also accomplished in an outer shell of this drum. Hot liquid asphalt is injected in the outer shell of the drum where it is mixed with the aggregate.

5. Burner: The fuel fired burner is used to provide the flame which drys the aggregate.

6. Knock off baffling: A baffling plate is inserted in the "dirty" side plenum as a knock out for heavy particles in the air stream. These particles fall to the bottom of the baghouse.

7. Baghouse: The hot gases are pulled through the bags into the clean air plenum. The solid particulate matter is trapped on the dust coat buildup on the bags. A bag cleaning cycle consisting of jet burst of air from the inside (or clean air side) of the bags sends a large bubble of air down the inside of the bags shaking loose buildup on the bag surface. This particulate matter is collected at the bottom of the baghouse and reinjected into the drum mixer where it is used as part of the finished product.

8. Liquid asphalt storage: The liquid asphalt is stored in this heated tank until it is needed in the mixer. The amount of asphalt content and its temperature are pre-set for each different type job.

9. Conveyor to surge/storage bin: The finished product of aggregate mixed with liquid asphalt is conveyed to a surge bin.

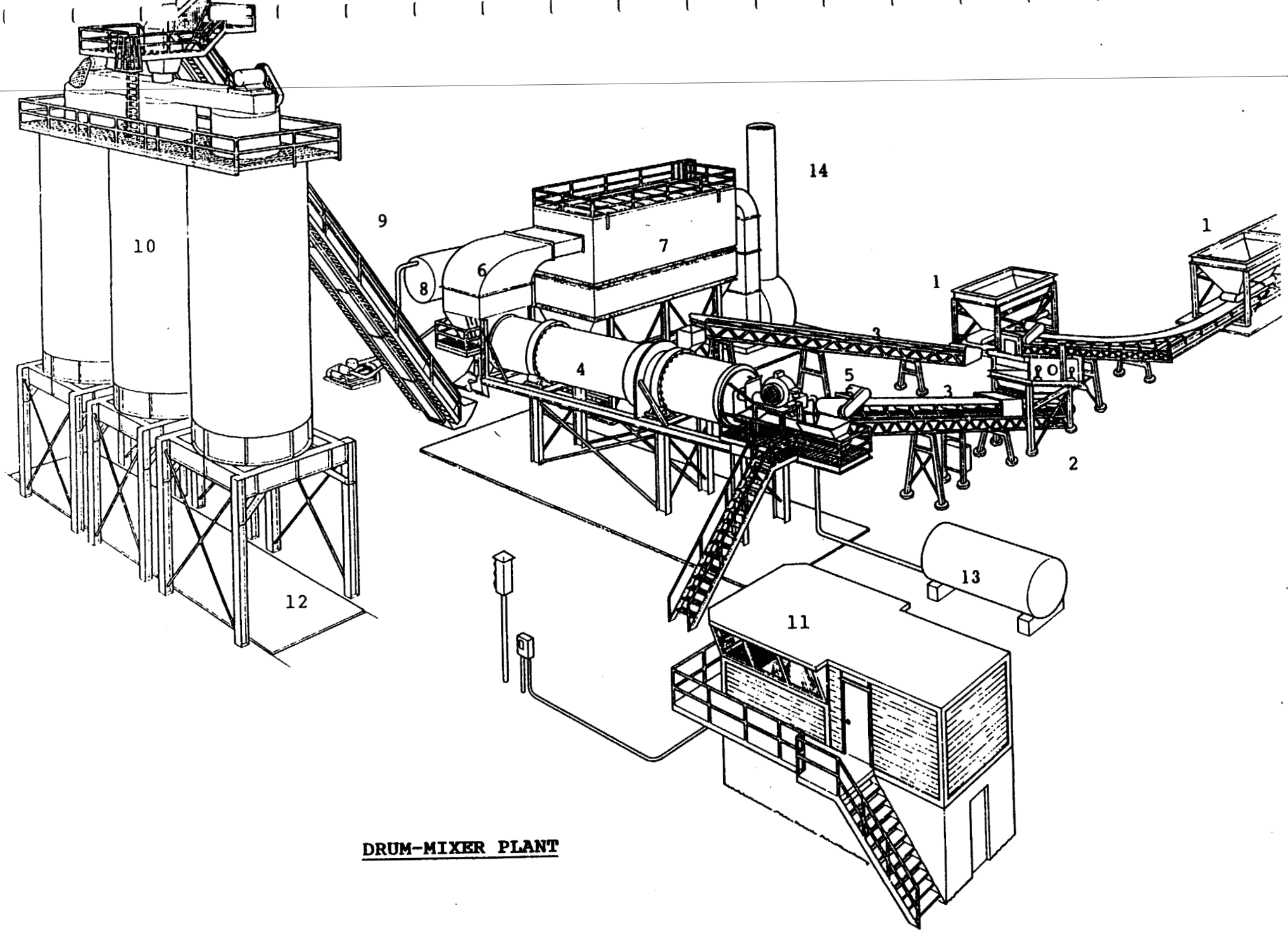
10. Surge/Storage bin: The asphaltic cement is dumped into this surge bin and metered out to dump trucks which pull underneath a slide gate at the bottom of the bin.

11. Control/operators house: The entire plant operation is controlled from this operator's house.

12. Truck loading scale: As the trucks receive the asphalt from the storage/surge bin, they are weighed on the lading scale which tells the plant operator the amount of asphalt that is being trucked on each individual load.

13. Fuel storage.

14. Stack



DRUM-MIXER PLANT

SECTION C:

EQUIPMENT USED

EQUIPMENT USED

Equipment used to conduct the particulate emissions test was:

A. A Lear Siegler PM-100 stack sampler with appropriate auxiliary equipment and glassware (with train set up according to the schematic on the next page).

B. An Airguide Instruments Model 211-B (uncorrected) aneroid barometer for checking the barometric pressure.

C. Weston dial thermometers to check meter temperatures or an Analogic Model 2572 Digital Thermocouple to check stack temperatures.

D. A Hays 621 Analyzer to measure the oxygen, carbon dioxide and carbon monoxide content of the stack gases or, for non-combustion sources, a Bacharach Instrument Company Fyrite for gas analysis.

E. Schleicher and Schuell Type 1-HV filters with a porosity of .03 microns.

F. Reagent- or ACS-grade acetone with a residue of ≤ .001.

SECTION D:

LABORATORY PROCEDURES AND RESULTS

Form REC#8

SAMPLE ANALYTICAL DATA FORM

Company Name L. J. EARNEST 6/8/93

Sample Location Shreveport, LA

Blank Volume (V_a) 100 ml

Date/Time wt. blank 6/14 8:30A

Date/Time wt. blank 6/14 2:30P

Relative Humidity in Lab 50 %

Density of Acetone (ρ_a) .7857 mg/ml

Gross wt. 101.0920 g

Gross wt. 101.0920 g

Ave. Gross wt. 101.0920 g

Tare wt. 101.0919 g

Weight of blank (m_{ab}) .0001 g

Acetone blank residue concentration (C_a) : (C_a) = (m_{ab}) / (V_a) (ρ_a) = (.000001 mg/g)

Acetone Blank Wt. : $W_a = C_a V_{aw} \rho_a$ = (.000001)(400)(.7857) = (.0003 g)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	400	400	
Date/Time of wt. 6/14 8:30A Gross wt.	g	170.9205	171.8955	165.1120
Date/Time of wt. 6/14 2:30P Gross wt.	g	170.9205	171.8955	165.1115
Average Gross wt.	g	170.9205	171.8955	165.1118
Tare wt.	g	170.8896	171.8694	165.0890
Less Acetone blank wt. (W_a)	g	.0003	.0003	.0003
Weight of particulate in acetone rinse (m_a)	g	.0306	.0258	.0225

Filter Numbers	#	TS00175	TS00216	TS00215
Date/Time of wt. 6/14 8:30A Gross wt.	g	.6003	.6100	.5998
Date/Time of wt. 6/14 2:30P Gross wt.	g	.6001	.6100	.5998
Average Gross wt.	g	.6002	.6100	5998
Tare wt.	g	.5737	.5820	.5752

Weight of particulate on filter (m_f)	g	.0265	.0280	.0246
Weight of particulate in acetone rinse (m_a)	g	.0306	.0258	.0225
Total weight of particulate (m_n)	g	.0571	.0538	.0471

NOTE: In no case should a blank residue greater than 0.01 mg/g (or 0.001% of the blank weight) be subtracted from the sample weight.

Remarks:

Signature of Analyst Thomas Smith Signature of Reviewer

D:\DONNA\FORMS\LAB\SAMPLE.TBL

S. J. Cornet
Company Name

Date

REFERENCE METHOD 3: GAS ANALYSIS BY FYRITE

FUEL	F_o FACTORS
WOOD	1.0540
BARK	1.0830
ANTHRACITE	1.0699
BITUMINOUS	1.1398
LIGNITE	1.0761
OIL	1.3465
GAS	1.7489
PROPANE	1.5095
BUTANE	1.4791

$O_2\% = 20.9 - [F_o \times CO_2\%]$

RUN #1: ____ = 20.9 - [____ x ____]

RUN #2: ____ = 20.9 - [____ x ____]

RUN #3 ____ = 20.9 - [____ x ____]

RUN 1:	$CO_2\%$	3.0	$CO_2\%$	3.2	$CO_2\%$	3.2	AVG.	
	$O_2\%$	14.0	$O_2\%$	13.8	$O_2\%$	13.8	AVG.	
	$N_2\%$		$N_2\%$		$N_2\%$		AVG.	
RUN 2:	$CO_2\%$	3.0	$CO_2\%$	3.0	$CO_2\%$	3.0	AVG.	
	$O_2\%$	14.0	$O_2\%$	14.0	$O_2\%$	14.0	AVG.	
	$N_2\%$		$N_2\%$		$N_2\%$		AVG.	
RUN 3:	$CO_2\%$	3.0	$CO_2\%$	3.0	$CO_2\%$	3.0	AVG.	
	$O_2\%$	14.0	$O_2\%$	14.0	$O_2\%$	14.2	AVG.	
	$N_2\%$		$N_2\%$		$N_2\%$		AVG.	

SECTION E:

CALCULATIONS

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993

SUMMARY OF TEST DATA

			06-08-93 Run #1	06-08-93 Run #2	06-08-93 Run #3
		start	11:46	13:47	13:58
		finish	12:53	14:56	17:05
	SAMPLING TRAIN DATA				
1.	Sampling time, minutes	Θ	60.00	60.00	60.00
2.	Sampling nozzle diameter, inches	D_n	0.200	0.200	0.200
3.	Sampling nozzle cross-section area, ft²	A_n	0.000218	0.000218	0.000218
4.	Isokinetic variation	I	109.2	98.1	98.2
5.	Sample gas volume — meter condition, cf	V_m	36.445	40.671	39.287
6.	Average meter temperature, °R	T_m	562	566	570
7.	Average orifice pressure drop, inches H_2O	dH	1.05	1.22	1.21
8.	Total particulate collected, mg.	M_n	57.10	53.80	47.10
	VELOCITY TRAVERSE DATA				
9.	Stack area, ft²	A	11.23	11.23	11.23
10.	Absolute stack gas pressure, inches Hg.	P_s	29.90	29.90	29.90
11.	Barometric pressure, inches Hg.	P_{bar}	29.90	29.90	29.90
12.	Average absolute stack temperature, R°	T_s	707	700	707
13.	Average $\sqrt{}$vel. head, (C_p = .84)	$\sqrt{}$dP	1.09	1.25	1.22
14.	Average stack gas velocity, ft/second	V_s	74.49	83.98	82.57
	STACK MOISTURE CONTENT				
15.	Total water collected by train, ml	V_{ic}	269.70	213.80	221.10
16.	Moisture in stack gas, percent (%)	B_{ws}	26.68	20.70	21.89
	EMISSIONS DATA				
17.	Stack gas flow rate, dscf/hr	Q_{sd}	1,647,884.6	2,029,442.7	1,945,966.2
18.	Stack gas flow rate, cfm	acfm	50,191	56,586	55,636
19.	Particulate concentration, gr/dscf	C_s	0.0252	0.0214	0.0195
20.	Particulate concentration, lb/hr	E	5.93	6.21	5.43
	ORSAT DATA				
21.	Percent CO_2 by volume	CO_2	3.1	3.0	3.0
22.	Percent O_2 by volume	O_2	13.9	13.7	14.1
23.	Percent CO by volume	CO	0.0	0.0	0.0
24.	Percent N_2 by volume	N_2	83.0	83.3	82.9

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993
SOURCE: BAGHOUSE

DRY GAS VOLUME

$$V_{m(std)} =$$

$$V_m \left[\frac{T_{(std)}}{T_m}\right] \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right] = 17.64 \frac{°R}{\in. Hg} \; Y \; V_m \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

Where:

$V_{m(std)}$	=	Dry gas volume through meter at standard conditions, ft^3.
V_m	=	Dry gas volume measured by meter, ft^3.
P_{bar}	=	Barometric pressure at orifice meter, in. Hg.
P_{std}	=	Standard absolute pressure, (29.92 in. Hg.).
T_m	=	Absolute temperature at meter, °R.
T_{std}	=	Standard absolute temperature, (528°R).
ΔH	=	Avg. pressure drop across orifice meter, in. H_2O.
Y	=	Dry gas meter calibration factor.
13.6	=	Inches of water per Hg.

Run #1:

$$V_{m(std)} = (17.64)\ (1.018)\ (36.445) \left[\frac{(29.90) + \frac{1.05}{13.6}}{562}\right] = 34.909 \text{ dscf}$$

Run #2:

$$V_{m(std)} = (17.64)\ (1.018)\ (40.671) \left[\frac{(29.90) + \frac{1.22}{13.6}}{566}\right] = 38.698 \text{ dscf}$$

Run #3:

$$V_{m(std)} = (17.64)\ (1.018)\ (39.287) \left[\frac{(29.90) + \frac{1.21}{13.6}}{570}\right] = 37.118 \text{ dscf}$$

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993
SOURCE: BAGHOUSE

TOTAL CONTAMINANTS BY WEIGHT: GRAIN LOADING

Particulate Concentration: $C_s^{`}$ gr/dscf

$$C_s^{`} = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{M_n}{V_{m(std)}}\right]$$

Where:

$C_s^{`}$ = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, gr/dscf.

M_n = Total amount of particulate matter collected, mg.

$V_{m(std)}$ = Dry gas volume through meter at standard conditions, cu. ft.

Run #1:

$$C_s^{`} = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{57.10}{34.909} \right] = 0.0252 \text{ gr/dscf}$$

Run #2:

$$C_s^{`} = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{53.80}{38.698} \right] = 0.0214 \text{ gr/dscf}$$

Run #3:

$$C_s^{`} = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{47.10}{37.118} \right] = 0.0195 \text{ gr/dscf}$$

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993
SOURCE: BAGHOUSE

DRY MOLECULAR WEIGHT

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

Where:

M_d	=	Dry molecular weight, lb/lb-mole.
$\%CO_2$	=	Percent carbon dioxide by volume, dry basis.
$\%O_2$	=	Percent oxygen by volume, dry basis.
$\%N_2$	=	Percent nitrogen by volume, dry basis.
%CO	=	Percent carbon monoxide by volume, dry basis.
0.264	=	Ratio of O_2 to N_2 in air, v/v.
0.28	=	Molecular weight of N_2 or CO, divided by 100.
0.32	=	Molecular weight of O_2 divided by 100.
0.44	=	Molecular weight of CO_2 divided by 100.

Run #1:

$$M_d = 0.44\ (3.1\%) + 0.32\ (13.9\%) + 0.28\ (.00\% + 83.0\%) = 29.06\ \frac{lb}{lb\text{-}mole}$$

Run #2:

$$M_d = 0.44\ (3.0\%) + 0.32\ (13.7\%) + 0.28\ (.00\% + 83.3\%) = 29.03\ \frac{lb}{lb\text{-}mole}$$

Run #3:

$$M_d = 0.44\ (3.0\%) + 0.32\ (14.1\%) + 0.28\ (.00\% + 82.9\%) = 29.04\ \frac{lb}{lb\text{-}mole}$$

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993
SOURCE: BAGHOUSE

WATER VAPOR CONDENSED

$$V_{wc_{std}} = [V_f - V_i] \left[\frac{P_w \; R \; T_{(std)}}{M_w \; P_{(std)}}\right] = 0.04707 \; [V_f - V_i]$$

$$V_{wsg_{std}} = [W_f - W_i] \left[\frac{R \; T_{(std)}}{M_w \; P_{(std)}}\right] = 0.04715 \; [W_f - W_i]$$

Where:

0.04707	=	Conversion factor, ft^3/ml.
0.04715	=	Conversion factor, ft^3/g.
Vwc_{std}	=	Volume of water vapor condensed (std. cond.), ml.
$Vwsg_{std}$	=	Volume of water vapor collected in silica gel (standard conditions), ml.
$V_f - V_i$	=	Final volume of impinger contents less initial volume, ml.
$W_f - W_i$	=	Final weight of silica gel less initial weight, g.
P_w	=	Density of water, 0.002201 lb/ml.
R	=	Ideal gas constant, 21.85 in.Hg. (cu.ft./lb-mole)(°R).
M_w	=	Molecular weight of water vapor, 18.0 lb/lb-mole.
T_{std}	=	Absolute temperature at standard conditions, 528°R.
P_{std}	=	Absolute pressure at standard conditions, 29.92 inches Hg.

Run 1:

$$V_{wc(std)} = (0.04707) \; (\; 262.00 \;) = 12.3 \text{ cu. ft}$$
$$V_{wsg(std)} = (0.04715) \; (\; 7.70 \;) = 0.4 \text{ cu. ft}$$

Run 2:

$$V_{wc(std)} = (0.04707) \; (\; 206.00 \;) = 9.7 \text{ cu. ft}$$
$$V_{wsg(std)} = (0.04715) \; (\; 7.80 \;) = 0.4 \text{ cu. ft}$$

Run 3:

$$V_{wc(std)} = (0.04707) \; (\; 215.00 \;) = 10.1 \text{ cu. ft}$$
$$V_{wsg(std)} = (0.04715) \; (\; 6.10 \;) = 0.4 \text{ cu. ft}$$

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993
SOURCE: BAGHOUSE

MOISTURE CONTENT OF STACK GASES

$$B_{ws} = \left[\frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{wc_{std}} + V_{wsg_{std}} + V_{mstd}} \right] \times 100$$

Where:

B_{ws} = Proportion of water vapor, by volume, in the gas stream.

V_m = Dry gas volume measured by dry gas meter, dcf.

Vwc_{std} = Volume of water vapor condensed, corrected to standard conditions, scf.

$Vwsg_{std}$ = Volume of water vapor collected in silica gel corrected to std. cond., scf.

Run 1:

$$B_{ws} = \frac{12.3 + 0.4}{12.3 + 0.4 + 34.909} \times 100 = 26.68\ \%$$

Run 2:

$$B_{ws} = \frac{9.7 + 0.4}{9.7 + 0.4 + 38.698} \times 100 = 20.70\ \%$$

Run 3:

$$B_{ws} = \frac{10.1 + 0.3}{10.1 + 0.3 + 37.118} \times 100 = 21.89\ \%$$

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993
SOURCE: BAGHOUSE

MOLECULAR WEIGHT OF STACK GASES

$$M_s = M_d (1 - B_{ws}) + 18 (B_{ws})$$

Where:

M_s = Molecular weight of stack gas, wet basis (lb./lb.-mole).

M_d = Molecular weight of stack gas, dry basis (lb./lb.-mole).

Run #1:

$$M_s = 29.06 \ (1 - 0.2668) + 18 \ (0.2668) = 26.11 \ \frac{lb}{lb\text{-}mole}$$

Run #2:

$$M_s = 29.03 \ (1 - 0.2070) + 18 \ (0.2070) = 26.75 \ \frac{lb}{lb\text{-}mole}$$

Run #3:

$$M_s = 29.04 \ (1 - 0.2189) + 18 \ (0.2189) = 26.62 \ \frac{lb}{lb\text{-}mole}$$

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993
SOURCE: BAGHOUSE

STACK GAS VELOCITY

$$V_s = K_p \quad C_p \quad [\sqrt{\Delta P}]\ \text{avg} \quad \sqrt{\frac{T_s(\text{avg})}{P_s \quad M_s}}$$

Where:

- V_s = Average velocity of gas stream in stack, ft/sec.
- K_p = 85.49 ft/sec [(g/g-mole) — (mm Hg)/(°K)(mm H_2O)]$^{1/2}$
- C_p = Pitot tube coefficient, dimensionless.
- ΔP = Velocity head of stack gas, in. H_2O.
- P_{bar} = Barometric pressure at measurement site, in. Hg.
- P_g = Stack static pressure, in. Hg.
- P_s = Absolute stack gas pressure, in. Hg. = $P_{bar} + P_g$
- P_{std} = Standard absolute pressure, 29.92 in. Hg.
- t_s = Stack temperature, °F.
- T_s = Absolute stack temperature, °R. = 460 + t_s.
- M_s = Molecular weight of stack gas, wet basis, lb/lb-mole.

Run #1:

$$V = (85.49)\ (0.84)\ (1.09)\ \sqrt{\frac{707}{(29.90)\ (26.11)}} = 74.49 \text{ ft/sec}$$

Run #2:

$$V = (85.49)\ (0.84)\ (1.25)\ \sqrt{\frac{700}{(29.90)\ (26.75)}} = 83.98 \text{ ft/sec}$$

Run #3:

$$V = (85.49)\ (0.84)\ (1.22)\ \sqrt{\frac{707}{(29.90)\ (26.62)}} = 82.57 \text{ ft/sec}$$

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993
SOURCE: BAGHOUSE

STACK GAS FLOW RATE

$$Q_{sd} = 3600 \left[1 - B_{wc} \right] V_s \; A \left[\frac{T_{std}}{T_{stk}} \right] \left[\frac{P_s}{P_{std}} \right]$$

Where:

- Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions (dscf/hr).
- A = Cross sectional area of stack (ft^2).
- 3600 = Conversion factor (sec/hr).
- T_{stk} = Absolute stack temperature (°R).
- T_{std} = Standard absolute temperature (528°R).
- P_{bar} = Barometric pressure at measurement site (in. Hg.).
- P_g = Stack static pressure (in. Hg.).
- P_s = Absolute stack gas pressure (in. Hg.) = $P_{bar} + P_g$
- P_{std} = Standard absolute pressure (29.92 in. Hg.).

Run #1: Q_{sd} =

$$3600 \; (1 - 0.2668) \; (74.49) \; (11.23) \left[\frac{528}{707} \right] \left[\frac{29.90}{29.92} \right] = 1{,}647{,}884.6 \; \frac{dscf}{hr}$$

Run #2: Q_{sd} =

$$3600 \; (1 - 0.2070) \; (83.98) \; (11.23) \left[\frac{528}{700} \right] \left[\frac{29.90}{29.92} \right] = 2{,}029{,}442.7 \; \frac{dscf}{hr}$$

Run #3: Q_{sd} =

$$3600 \; (1 - 0.2189) \; (82.57) \; (11.23) \left[\frac{528}{707} \right] \left[\frac{29.90}{29.92} \right] = 1{,}945{,}966.2 \; \frac{dscf}{hr}$$

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993
SOURCE: BAGHOUSE

EMISSIONS RATE FROM STACK

$$E = \left[\frac{(C_s^{`}) \quad (Q_{sd})}{7{,}000 \text{ gr/lb}} \right]$$

Where:

E = Emissions rate, lbs/hr.

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, gr/dscf.

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, dscf/hr.

Run #1:

$$E = \frac{(0.0252) \quad (1{,}647{,}884.6)}{7000} = 5.93 \text{ lb/hr}$$

Run #2:

$$E = \frac{(0.0214) \quad (2{,}029{,}442.7)}{7000} = 6.21 \text{ lb/hr}$$

Run #3:

$$E = \frac{(0.0195) \quad (1{,}945{,}966.2)}{7000} = 5.43 \text{ lb/hr}$$

NAME: L. J. EARNEST
LOCATION: SHREVEPORT, LOUISIANA

DATE: JUNE 8, 1993
SOURCE: BAGHOUSE

ISOKINETIC VARIATION

$$I = 100\ T_s \left[\frac{(0.002669)\ (V_{ic} + \left(\frac{Y_i\ V_m}{T_m}\right)\ (P_{bar} + \Delta H/13.6)}{60\quad \theta\quad V_s\quad P_s\quad A_n} \right]$$

Where:

- I = Percent isokinetic sampling.
- 100 = Conversion to percent.
- T_s = Absolute average stack gas temperature, °R.
- 0.002669 = Conversion factor, Hg - ft³/ml - °R.
- V_{ic} = Total volume of liquid collected in impingers and silica gel, ml.
- T_m = Absolute average dry gas meter temperature, °R.
- P_{bar} = Barometric pressure at sampling site, in. Hg.
- ΔH = Average pressure differential across the orifice meter, in. H_2O.
- 13.6 = Specific gravity of mercury.
- 60 = Conversion seconds to minutes.
- Θ = Total sampling time, minutes.
- V_s = Stack gas velocity, ft/sec.
- P_s = Absolute stack gas pressure, in. Hg.
- A_n = Cross sectional area of nozzle, ft².
- Y_i = Calibration factor.

Run #1:

$$I = (100)\ (707) \left[\frac{(0.002669)\ (269.70) + \frac{(1.018)\ (36.445)}{562}\left[29.90 + \frac{1.05}{13.6}\right]}{60\quad (60.00)\quad (74.49)\quad (29.90)\quad (0.000218)} \right] = 109.2\%$$

Run #2:

$$I = (100)\ (700) \left[\frac{(0.002669)\ (213.80) + \frac{(1.018)\ (40.671)}{566}\left[29.90 + \frac{1.22}{13.6}\right]}{60\quad (60.00)\quad (83.98)\quad (29.90)\quad (0.000218)} \right] = 98.1\%$$

Run #3:

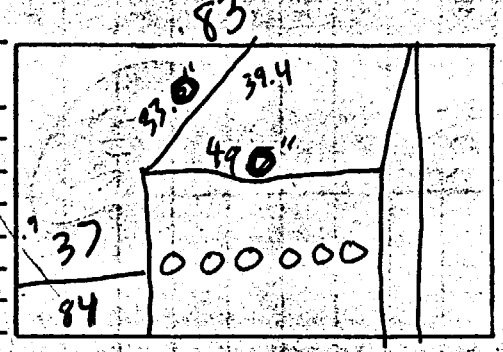
$$I = (100)\ (700) \left[\frac{(0.002669)\ (221.10) + \frac{(1.018)\ (39.287)}{570}\left[29.90 + \frac{1.21}{13.6}\right]}{60\quad (60.00)\quad (82.57)\quad (29.90)\quad (0.000218)} \right] = 98.2\%$$

SECTION F:

FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant: S.J. Cornest
Location: Shreveport La.
Operator: Allen Turner
Date: 6-8-93
Run No.: 1
Sample Box No.: 1
Meter Box No.: C-282
Meter H @: 1.50
C Factor: 1.018
Pitot Tube Coefficient Cp: .84



Schematic of Stack Cross Section

Ambient Temperature: 95
Barometric Pressure: 29.90
Assumed Moisture, %: 18
Probe Length, m(ft): 4 ft
Nozzle Identification No.: .0002182
Avg. Calibrated Nozzle Dia., (in.): .20/.20/.20
Probe Heater Setting: 4
Leak Rate, m^3/min. (cfm): 0 at 8 in Hg
Probe Liner Material: stainless steel
Static Pressure, mm Hg (in. Hg): +.01
Filter No.: TS-00175

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	462	336.2
INITIAL	200	328.5
DIFFERENCE	262	7.7

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
1	11:46 / 11:48	2	237	.35	.29	199.2 / 200.0	90	80	228 / 237	68
2	11:50	2	248	.35	.29	200.5	100	80	232	68
3	11:52	2	239	.36	.30	201.1	102	80	241	68
4	11:54	2	239	.28	.23	201.8	104	80	242	68
5	11:56	2	239	.28	.23	202.3	106	80	242	68
1	11:57 / 11:59	3	238	.70	.58	203.1	106	80	262	68
2	12:01	3	237	1.0	.83	204.3	112	80	265	68
3	12:03	3	237	.95	.79	205.2	114	.86	255	66
4	12:05	3	237	.95	.79	206.4	114	.86	255	66
5	12:07	3	231	.70	.58	207.5	116	.86	243	61
1	12:08 / 12:10	5	240	2.0	1.7	208.8	120	88	246	59
2	12:12	5	246	2.2	1.8	210.5	120	88	247	59
3	12:14	5	249	2.2	1.8	212.3	120	88	252	59

Form #REC-05

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-8-93 LOCATION Shreveport La. TEST NO. 1

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME Vm (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	12:16	5	250	1.8	1.5	214.2	120	90	256	56
5	12:18	5	250	1.9	1.6	215.4	122	90	264	56
1	12:20 / 12:22	4	247	1.5	1.2	216.7	118	90	268	56
2	12:24	4	252	1.5	1.2	218.7	120	90	268	57
3	12:26	4	254	1.6	1.3	220.2	120	90	232	57
4	12:28	4	254	1.6	1.3	220.8	120	90	230	57
5	12:30	3	253	1.0	.83	222.0	120	90	225	58
1	12:31 / 12:33	3	247	1.5	1.2	223.7	120	90	233	58
2	12:35	3	254	1.6	1.3	224.7	120	90	254	57
3	12:37	3	255	1.6	1.3	226.0	124	90	254	57
4	12:39	3	255	1.1	.91	227.1	124	90	256	57
5	12:41	3	255	1.1	.91	228.5	124	90	262	58
1	12:43 / 12:45	3	247	1.5	1.2	229.5	120	90	260	58
2	12:47	3	254	1.5	1.2	231.0	120	90	260	58
3	12:49	3	254	1.5	1.2	232.4	120	90	260	58
4	12:51	3	254	1.8	1.5	233.9	122	90	260	58
5	12:53	3	254	1.8	1.5	235.645	122	90	260	58

RAMCON ENVIRONMENTAL CORPORATION

Plant S. J. Cornet

Location Shreveport Sa.
Operator Allen Turner
Date 6-8-93
Run No. 2
Sample Box No. 1
Meter Box No. C-282
Meter H @ 1.50
C Factor 1.018
Pitot Tube Coefficient Cp .84

.76

Schematic of Stack Cross Section

Ambient Temperature 95
Barometric Pressure 29.90
Assumed Moisture, % 18
Probe Length, m(ft) 4 ft
Nozzle Identification No. 0002192
Avg. Calibrated Nozzle Dia., (in.) .20/.20/.20
Probe Heater Setting 4
Leak Rate, m^3/min. (cfm) 0 at 6 inhg
Probe Liner Material stainless steel
Static Pressure, mm Hg (in. Hg) +.01
Filter No. TS-00216

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	406	477.1
INITIAL	200	469.3
DIFFERENCE	206	7.8

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H20	PRESSURE DIFF. ORF. MTR in H20	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
1	1347 / 13:49	4	250	2.1	1.6	2359 / 237.3	104	90	244	65
2	13:51	4	250	2.1	1.6	239.0	112	90	255	60
3	13:53	3	256	2.0	1.5	240.4	120	90	255	60
4	13:55	3	256	1.8	1.4	241.8	120	90	254	60
5	13:57	3	244	1.8	1.4	243.1	120	90	254	60
1	13:59 / 14:01	4	251	2.1	1.6	244.8	120	90	251	60
2	14:03	4	251	2.1	1.6	246.8	120	90	251	60
3	14:05	4	251	2.1	1.6	248.7	120	90	251	60
4	14:07	4	253	1.8	1.4	249.7	122	90	263	60
5	14:09	3	253	1.5	1.1	251.1	122	90	263	62
1	14:11 / 14:13	3	247	1.8	1.4	252.6	118	90	266	62
2	14:15	3	240	1.8	1.4	253.8	122	90	266	64
3	14:17	3	240	1.8	1.4	255.3	122	90	268	64

Form #REC-05

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-8-93 LOCATION [illegible] TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME Vm (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	14:19	2	245	1.5	1.1	256.7	126	94	~~238~~ 250	65
5	14:21	2	238	1.3	.99	258.0	126	94	~~238~~ 252	65
1	~~14:22~~ 14:24	4	230	2.2	1.7	259.6	126	94	247	65
2	14:26	4	~~238~~	2.2	1.7	261.0	126	94	245	65
3	14:28	4	231	2.0	1.5	262.5	126	94	242	65
4	14:30	4	229	2.0	1.5	264.0	126	94	246	65
5	14:32	4	229	2.0	1.5	265.8	126	94	246	65
1	~~14:34~~ 14:36	2	238	1.2	.91	266.9	120	90	254	65
2	14:38	2	235	1.2	.91	268.1	120	90	254	65
3	14:40	2	230	1.2	.91	269.9	120	94	255	64
4	14:42	2	230	.70	.53	270.8	122	94	255	67
5	14:44	2	233	.70	.53	271.7	122	94	256	67
1	~~14:46~~ 14:48	2	233	1.1	.84	272.7	120	94	241	68
2	14:50	2	232	1.1	.84	273.4	120	94	234	68
3	14:52	2	230	1.0	.76	274.4	120	94	234	68
4	14:54	2	233	1.0	.76	275.5	120	94	231	68
5	14:56	2	237	.70	.53	276.571	120	94	230	68

RAMCON ENVIRONMENTAL CORPORATION

Plant: S. J. Cement

Location: Shreveport La.

Operator: [illegible]

Date: 6-8-93

Run No.: 3

Sample Box No.: 1

Meter Box No.: C-282

Meter H @: 1.50

C Factor: 1.018

Pitot Tube Coefficient Cp: .84

Schematic of Stack Cross Section

Ambient Temperature: 95

Barometric Pressure: 29.90

Assumed Moisture, %: 18

Probe Length, m(ft): 4 ft

Nozzle Identification No.: 0002192

Avg. Calibrated Nozzle Dia., (in.): .20/.20/.20

Probe Heater Setting: 4

Leak Rate, m³/min. (cfm): 0 at 6-Hg

Probe Liner Material: Stainless steel

Static Pressure, mm Hg (in. Hg): +.01

Filter No.: TS-00215

	FINAL	INITIAL	DIFFERENCE
IMPINGER VOLUME, ml	415	200	215
SILICA GEL WEIGHT, g	353.9	347.8	6.1

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H_2O	PRESSURE DIFF. ORF. MTR in H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
1	3:56 / 3:58	2	250	.50	.38	276.2 / 277.4	110	90	250	58
2	4:00	2	250	.50	.38	278.3	110	90	252	58
3	4:02	2	252	.35	.27	279.0	118	90	225	58
4	4:04	2	252	.50	.38	279.5	118	90	225	58
5	4:06	2	252	.50	.38	280.6	120	90	225	58
1	4:09 / 4:11	2	240	.75	.57	281.5	120	90	225	58
2	4:13	2	230	.75	.57	282.4	120	90	225	58
3	4:15	2	231	.75	.57	283.4	120	90	230	58
4	4:17	2	236	.75	.57	284.6	120	90	233	58
5	4:19	2	238	.20	.15	285.2	120	90	236	69
1	4:21 / 4:23	3	230	1.5	1.1	286.2	120	96	247	~~84~~ 68
2	4:25	3	247	1.6	1.2	287.7	130	96	258	58
3	4:27	5	249	2.0	1.5	289.1	130	96	255	58

Form #REC-05

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-8-93 LOCATION Sherpat Sa. TEST NO. 3

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft.^{3})	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	4:29	5	250	2.0	1.5	290.8	130	98	253	57
5	4:31	5	250	2.0	1.5	292.4	130	98	252	58
1	~~4:32~~ 4:34	5	242	2.5	1.9	294.0	128	98	252	59
2	4:36	5	251	2.5	1.9	295.5	128	98	254	58
3	4:38	5	251	2.5	1.9	297.1	130	98	254	59
4	4:40	5	253	2.5	1.9	298.8	130	98	257	59
5	4:42	5	251	2.0	1.5	300.6	130	100	256	59
1	~~4:44~~ 4:46	5	249	2.0	1.5	301.9	120	100	245	59
2	4:48	5	252	2.1	1.6	303.7	130	100	257	59
3	4:50	5	251	2.1	1.6	305.1	130	100	258	59
4	4:52	5	251	2.1	1.6	306.7	130	100	258	59
5	4:54	5	252	1.8	1.4	308.4	130	100	256	62
1	~~4:55~~ 4:57	5	252	1.8	1.4	309.9	130	100	256	62
2	4:59	5	252	1.8	1.4	311.5	130	100	256	62
3	5:01	5	250	1.8	1.4	312.8	130	100	256	62
4	5:03	5	250	1.8	1.4	314.1	130	100	256	62
5	5:05	5	250	1.8	1.4	315.987	130	100	256	62

SECTION G:

CALIBRATION

4A

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? ____ yes (explain below) ✓ no

α_1 = 1.3 ° (<10°), α_2 = 0.8 ° (<10°), β_1 = 0.5 ° (<5°),

β_2 = 1.8 ° (<5°)

γ = 2.9 °, θ = 1.7 °, A = .97 cm (in.)

z = A sin γ = .05 cm (in.); <0.32 cm (<1/8 in.),

w = A sin θ = .03 cm (in.); <.08 cm (<1/32 in.)

P_A .48 cm (in.) P_b .49 cm (in.)

D_t = .38 cm (in.)

Comments: _____

Calibration required? ____ yes ✓ no

4B

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) _____ no

α_1 = 2.3 ° (<10°), α_2 = .5 ° (<10°), β_1 = 1.8 ° (<5°),
β_2 = 1.8 ° (<5°)

γ = 3.2 °, θ = 1.0 °, A = .98 cm (in.)

z = A sin γ = .05 cm (in.); <0.32 cm (<1/8 in.),
w = A sin θ = .02 cm (in.); <.08 cm (<1/32 in.)

P_A .49 cm (in.) P_b .49 cm (in.)

D_t = .38 cm (in.)

Comments: _____

Calibration required? _____ yes ✓ no

RAMCON ENVIRONMENTAL CORPORATION

Lear Siegler Stack Sampler

Nozzle Diameter Calibration

Date _____ Signature _____

Nozzle No.	Average Diameter	Nozzle No.	Average Diameter
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

Pitot Tube Calibration (S Type)

Pitot Tube Identification No. 44 Date 6-9-91

Calibrated by: S Buck

"A" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp (s) cm H_2O (in. H_2O)	$C_p(s)$	DEVIATION $C_{p(s)}-\bar{C}_p(A)$
1	2.2	3.3	.816	.004
2	1.8	2.7	.816	.004
3	1.1	1.6	.829	.009
		$\bar{C}_p$ (SIDE A)	.820	

"B" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp(s) cm H_2O in. H_2O)	$C_p(s)$	DEVIATION $C_p(s)-\bar{C}_p(B)$
1	2.2	3.3	.816	.004
2	1.8	2.7	.816	.004
3	1.1	1.6	.829	.009
		$\bar{C}_p$ (SIDE B)	.820	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} |C_p(s)-\bar{C}_p(\text{A OR B})|}{3} \leftarrow \text{MUST BE} \leq 0.01$$

$$|\bar{C}_p(\text{SIDE A})-\bar{C}_p(\text{SIDE B})| \leftarrow \text{MUST BE} \leq 0.01$$

$$C_{p(s)} = C_p(std)\sqrt{\frac{\Delta p\ std}{\Delta p_s}}$$

Form No. EED-17-1

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-5-90 Thermocouple number 44

Ambient temperature 20 °C Barometric pressure 29.88 in. Hg

Calibrator S Turner Reference: mercury-in-glass ✓

other _____

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	Ice Bath	32	32	0
B	Boiling water	212	212	0
C	Boiling oil	381	381	0
D	ambient			

[a]Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

RAMCON

Lear Siegler Stack Sampler

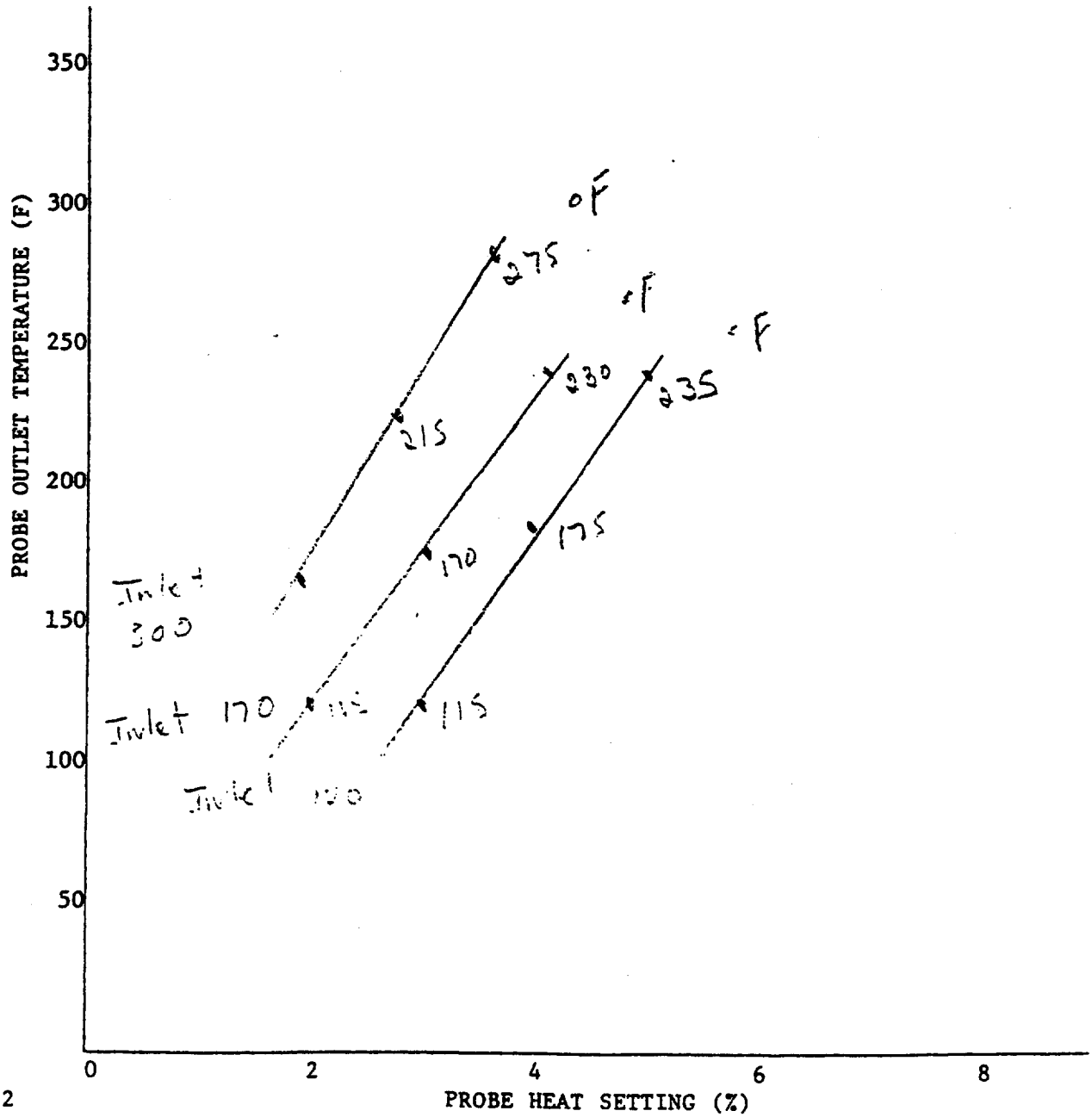
Heating Probe Calibration

Probe No. 414 Probe Length 4'

Date of Calibration 5-7-89 Signature Sam Turner

Name of Company to be tested _____

Note: 3 ft. probe - 5 min. warmup
6 ft. probe - 15 min. warmup
10 ft. probe - 30 min. warmup
Calibration flow rate = .75 CFM



Form No. EED-17-2

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-5-89 Thermocouple number Hotbox

Ambient temperature 20 °C Barometric pressure 29.88 in. Hg

Calibrator S Turner Reference: mercury-in-glass ✓

other _____

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C F	Thermocouple potentiometer temperature, °C F	Temperature difference,[b] %
A	ice bath	32	32	0
B	oven	200	200	0
C	oven	350	350	0
D	ambient			

[a]Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number _____ Date 6-14-93 Meter box number C-282 Plant _____

Barometric pressure, P_b = 29.95 in. Hg Dry gas meter number 147810 Pretest Y _____

	Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average (t_d)[a], °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i $\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
15.148	2.0	10	548.995 / 554.142	78	105 / 119	90 / 90	101	17.71		1.03	1.52
10.117	1.0	10	538.383 / 544.70	78	110 / 118	88 / 90	101.5	16.38		1.03	1.46
10.117	3.0	10	528.326 / 538.493	78	105 / 130	88 / 90	101	9.58		1.02	1.50 (1.49)
										Y = 1.03	

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y $\pm$0.05Y.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Quality Assurance Handbook M4-2.4A

Form #REC-01

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number _____ Date 5-28-93 Meter box number C-282 Plant _____

Barometric pressure, P_b = 29.84 in. Hg Dry gas meter number 147810 Pretest Y _____

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i $\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
1.0	~~10~~ 5	193.584 / 198.642	80	112 / 118	84 / 84	99.5	8:25	5"	1.021	1.507
2.0	10	182.833 / 193.058	80	100 / 120	80 / 84	96	11:75	7"	1.002	1.538
3.0	~~10~~ 14	161.849 / 173.705	80	100 / 120	80 / 80	95	13:06	5"	1.031	1.457
									Y = 1.018	1.500

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y $\pm$0.05Y.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Quality Assurance Handbook M4-2.4A

SECTION H:

RAMCON PERSONNEL

Name: Mr. Sumner Buck
Title: President

Qualifications: Mr. Buck is a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis. He is a graduate of the EPA 450 "Source Sampling for Particulate Pollutant's" course and the 474 "Continuous Emissions Monitoring" courses outlined by EPA at Research Triangle Park, N.C. He has been directly involved in conducting and supervising air emission testing for over 15 years. He has personally conducted over 400 air emission tests. He currently sponsors and directs visual emission certification schools for US EPA Method 9.

Project Duties: Mr. Buck is responsible for the overall supervision of each testing project. This includes the correspondence to the State Regulatory Agency and the plant personnel regarding scheduling, testing requirements, etc. He will assist in supervision of the project preparation for each team involved and the overall organization between the testing crew(s) and facility.

Name: Mr. Joe Sewell
Title: Vice President

Qualifications: Mr. Sewell is currently serving as the Vice President of RAMCON Environmental Corporation. Mr. Sewell is a graduate of Christian Brothers University in Memphis, Tennessee where he obtained a Bachelor of Science degree in Chemical Engineering. He has conducted and supervised air emissions testing projects ranging a broad spectrum of facility process categories. His accomplishments include the development of the instrumental branch of emissions testing utilizing continuous emission monitors and gas chromatography. Mr. Sewell performs a major role in the upgrading of testing capabilities and professional quality that RAMCON Environmental Corporation offers.

Project Duties: Mr. Sewell provides staff engineering and project administration to ensure the integrity of the requested services. He serves as the primary contact person for RAMCON Environmental Corporation handling all correspondence between the facility personnel involved in the project and respective state agency representative(s). He provides project leadership to

RAMCON Environmental Corporation field supervisors and managers involved in the testing project.

Name: Mr. Ray Jenkins
Title: Source Sampling Director

Qualifications: Mr. Jenkins is serving as the Source Sampling Director for RAMCON Environmental Corporation. He was promoted to this leadership position after gaining a significant amount of experience in conducting and providing field supervision of a variety of air testing projects. Mr. Jenkins has personally conducted and/or supervised all of the prevalent EPA approved procedures with expertise in the instrumental analyzer procedures. He graduated from Memphis State University obtaining a Bachelor of Science degree in Biology. He is also currently certified to conduct US EPA Reference Method 9 for the visual determination of emission opacity.

Project Duties: Mr. Jenkins provides project leadership to the Team Leaders and Field Technicians. He ensures the test crew(s) involved in the test project will be properly informed to his respective duties and responsibilities during the testing process. Mr. Jenkins also serves as the Quality Assurance/Quality Control Coordinator and provides guidance in QA/QC to each Team Leader with regard to sample integrity.

Name: Mr. Tommy South
Title: Laboratory Technician

Qualifications: Mr. South is currently serving as Laboratory Technician. He is proficient in conducting many analysis procedures such as front and back-half particulate analysis, titrations, extractions, etc.

Project Duties: Mr. South conducts the laboratory analysis on the particulate samples. He is also responsible for accepting the remaining field samples from the Field Sample Bank Manager and performing inspection as to integrity. He documents the transfer on the chain of custody forms and distributed the subcontracted samples to the respective laboratories.

Name: Chuck Hughes
Title: Team Leader

Qualifications: Mr. Hughes is currently serving RAMCON Environmental Corporation as an Isokinetic Team Leader. He is proficient in all sampling procedures employing this type of testing. He is currently certified in conducting US EPA Reference Method 9 for opacity.

Project Duties: Mr. Hughes is responsible for conducting isokinetic sampling procedures at the facility. He is also responsible for preparation and calibration of the necessary equipment for the project. His duties on-site include assembling the sample train, operation of the sampling equipment, sample recovery, and quality assurance/quality control checks.

Name: Mr. Allen Turner
Title: Team Leader

Qualifications: Mr. Turner has been employed with RAMCON Environmental Corporation for five years. Altogether, he has sampled approximately 300 stacks of all types. Mr. Turner became qualified for a Team Leader in 1988 and has served as such since that time. He is a current V.E. reader and continues his studies at State Technical Institute in Memphis, Tennessee. Mr. Turner has extensive experience in EPA Methods 1-9.

Project Duties: Mr. Turner is responsible for isokinetic sampling procedures, including but not limited to, Method 5 for particulate, multi-metals, PAH, calibration and cleaning of necessary equipment for his testing. His duties on-site include assembling the sample train, leak checking the system, operation of the train and recording the test data on the field data forms.

SECTION I:

VISIBLE EMISSIONS