RAMCON

ENVIRONMENTAL CORPORATION

RAMCON BUILDING 223 SCOTT STREET MEMPHIS, TENNESSEE 38112 TELEPHONE 901 / 458-7000 TELEX 53-806

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
MATTINGLY CONSTRUCTION COMPANY
EASTON, MARYLAND
June 25 & 26, 1984

Gene Yocum
Mattingly Construction Co.

G. Sumner Buck, III
President

Sam Turner
Team Leader

RAMCON ENVIRONMENTAL CORPORATION

RAMCON BUILDING 223 SCOTT STREET MEMPHIS, TENNESSEE 38112 TELEPHONE 901 / 458-7000 TELEX 53-806

July 2, 1984

Mr. Gene Yocum
Mattingly Construction Company
P.O. Box 97
Cumberland, MD 21502

Subject: Particulate Emissions Test - Easton, Maryland Plant

Dear Mr. Yocum:

Enclosed are four copies of our report on particulate emissions. Based on our test results, your plant does pass both EPA new source performance standards and those set by the State of Maryland. The average of the four test runs was in compliance.

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

Mr. Don Andrew
Office of Environmental Programs
P.O. Box 13387
Baltimore, MD 21203

We certainly have enjoyed working with you and hope to serve you again in the future.

Sincerely,

G. Sumner Buck, III
President

GSBIII:kr

Enclosures

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C. Sampling Site: The emissions test was conducted after a baghouse on a round stack with a diameter of 45.5". The sampling ports were placed 20" down (0.44 diameters upstream) from the top of the stack and 88" up (1.93 diameters downstream) from the last flow disturbance. Twenty four points were sampled, twelve through each port for three minutes each.

Points on a Diameter	Plus 8" Standoff	Probe Mark
1		9.0"
2		11.0"
3		13.4"
4		16.1"
5		19.4"
6		24.2"
7		37.3"
8		42.1"
9		45.4"
10		48.1"
11		50.5"
12		52.5"

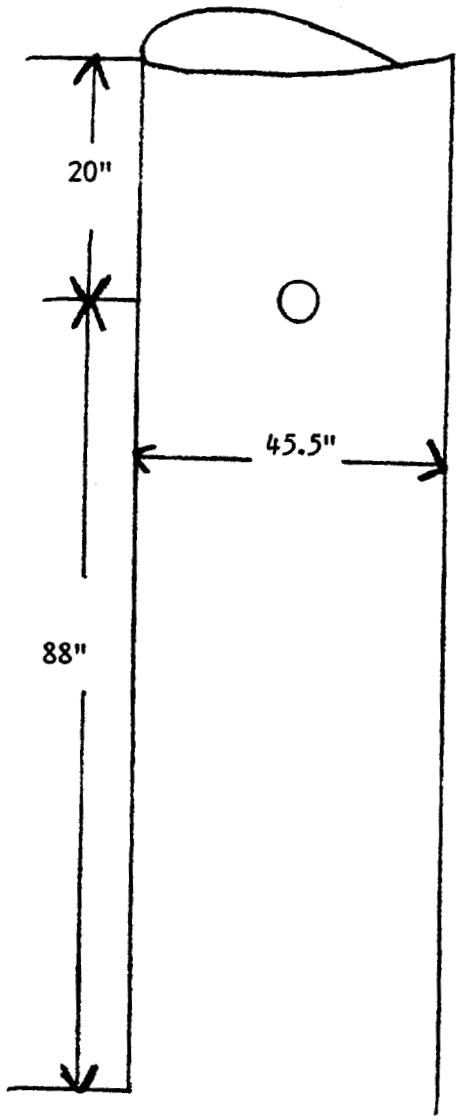


TABLE I

SUMMARY OF TEST RESULTS
June 25 & 26, 1984

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	07:29 to 09:09	0.0262 gr/SCF	93%	4.9 lbs/hr
2	09:52 to 11:16	0.0137 gr/SCF	94%	2.6 lbs/hr
3	11:58 to 15:16	0.0107 gr/SCF	89%	2.1 lbs/hr
4	07:26 to 08:50	0.0183 gr/SCF	97%	3.8 lbs/hr
Average		0.0172 gr/SCF		3.4 lbs/hr

On the basis of these test results, the average grain loading of the four test runs was below the .04 gr/SCF limit set by EPA and the .03 gr/SCF limit set by the State of Maryland. Therefore, the plant is operating in compliance with the State of Maryland and Federal standards.

III. TEST PROCEDURES

A. Method Used: The 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. All four test runs were sampled at three minutes each.

B. Problems Encountered: Test run number three was inadvertently sampled at an isokinetic rate below 90%. A low isokinetic sampling rate tends to bias a test against the source. Since all four runs easily pass emissions standards, RAMCON Environmental recommends the regulatory authorities accept all four runs as demonstration of compliance.

IV. THE SOURCE

Mattingly Construction Company employs a Standard Havens drum mix asphalt plant which is used to manufacture asphalt concrete 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 and 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 four separate bins which in turn feed a common continuous belt 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 recycle asphalt mix is used, it is added approximately halfway down the drum through a separate weigh 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 transport 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 to heat air to dry the aggregate, and the motion of the rotating drum to blend the aggregate and hot asphalt oil thoroughly. 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 Standard Havens. The exhaust gasses are drawn through the baghouse and discharged to the atmosphere through the stack. The design pressure drop across the tube sheet is 1 - 4 inches of water. The particulate matter, which is removed by the baghouse is reinjected into the drum mixer.

IV. THE SOURCE

PLANT DATA (6)

COMPANY NAME Mattingly Const. Company

COMPANY REP. _____ DATE 6/25/84 Phone # _____

DATA SOURCE Asphalt Plant

PLANT LOCATION Easton, MD

PLANT MANUFACTURER SH PLANT MODEL NO. LOWRIDER PLANT TYPE PORTABLE DM.

MIX SPECIFICATION NO. _____ OIL SPECIFICATION NO. _____

SIEVE/SCREENING ANALYSIS _____

TIME: START _____ STOP _____ A.T. _____ °F R.H. _____ %

TIME 24 HOUR	FUEL OIL ☑ NATURAL GAS ☐ PROPANE ☐	BURNER SETTING	AGGREGATE TPH	RECYCLE TPH	ASPHALT	MIX TEMPERATURE °F	VENTURI ☐ Baghouse ☑ DIFFERENTIAL
8:30	#2 FUEL OIL	34%	300	—	300°	290°	
8:49	"	38%	300	—	308°	273°	
9105	"	39%	300	—	303°	292°	
9:30	"	40%	300	—	302°	300°	
9:50	"	40%	300	—	303°	285°	
10:19	"	32%	300	—	304°	285°	
10:50	"	41%	300	—	306°	281°	
11:20	"	40%	300	—	302°	292°	
12:08	"	40%	300	—	306	283°	
12:40	"	40%	300	—	299°	290°	
15	"	40%	300	—	305°	283°	
09	"	43%	300	—	285°	266°	
4:28	"	46%	300	—	316°	281°	

REMARKS:

DATA SUMMARY

Plant

1. Manufacturer of plant STANDARD HAVENS.
2. Designed maximum operating capacity 325 TPH @ 5 % moisture.
3. Actual operation rate 300 TPH @ 5 % moisture.
4. Startup date 5-14-84.
5. Type of fuel used in dryer #2 FUEL OIL.
6. Quanity of fuel consumption 1.3 GPT.

Aggregate

7. Name/type of mix SN.
8. Percent asphalt in mix 6.4 % %.
9. Temperature of asphalt 300°.
10. Sieve/Screening analysis: % Passing;

1"		3/8"		#40	
3/4"		#4		#80	
1/2"		#10		#200	

Baghouse

11. Manufacturer STANDARD HAVENS.
12. No. of bags 672. Type of bags 14oz NOMEX 100%.
13. Air to cloth ratio 5.3:1. Designed ACFM 32,000.
14. Square feet of bags 5,341 ft³ 5,478 ft.²
15. Type of cleaning; pulse jet ✓, reverse air ____, plenum pulse ____, other ____.
16. Cleaning cycle time ____.
17. Interval between cleaning cycle ____.
18. Pressure drop across baghouse ____ psi.
19. Pulse pressure on cleaning cycle ____ psi.

COMPANY NAME MATTINGLY DATE ____

COMPANY REPRESENTATIVE

1. Aggregate bins: Virgin and recycled aggregate is fed individually into each of the bins by type. It is metered onto a conveyor belt running under the bins to a shaker screen. The proportion of 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 gas flame which drives off the moisture. Further mixing is also accomplished in this drum. Hot liquid asphalt is injected approximately one-third of the way down the inclined drum where it is mixed with the aggregate.

5. Burner: The fuel fired burner is used to dry the rough aggregate and sand in the rotating drum as well as reheat recycled asphalt when it is part of the mix.

6. Knock off baffleing: A baffleing 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 gasses 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.

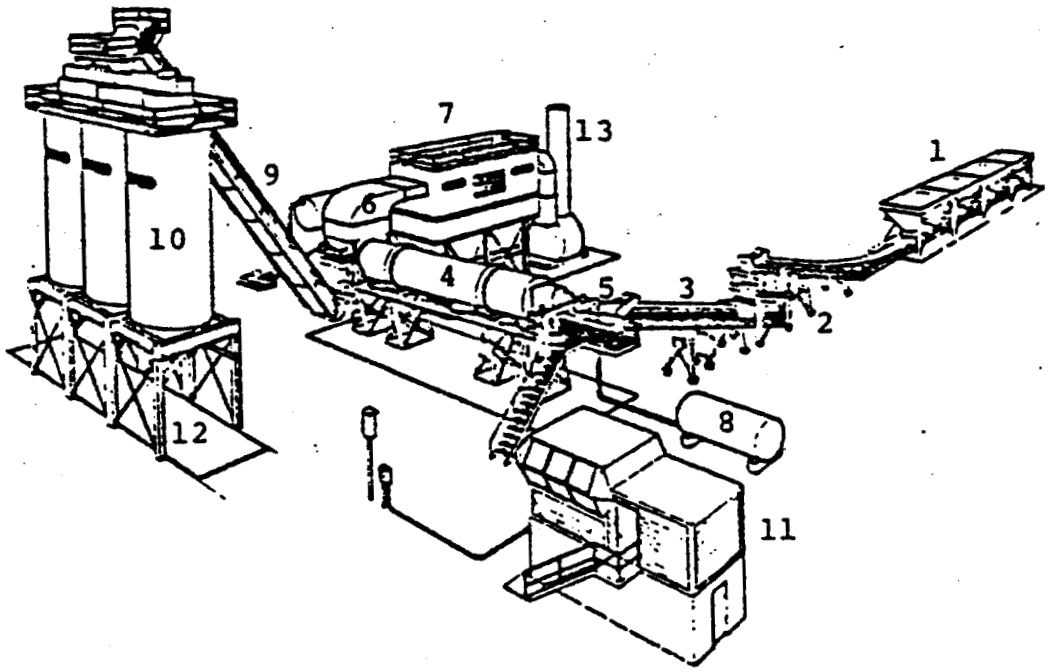
10. Surge/storage bin: The asphaltic cement is dumped into this surge bin and metered out to dump trucks which pull underneath slide gate at the bottom of the bin.

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 loading scale which tells the plant operator the amount of asphalt that is being trucked on each individual load.

13. Stack

1. Aggregate Feed Bins
2. Preliminary Oversize Screen
3. Weigh Conveyor Belt
4. Rotary Drum Dryer/Mixer
5. Burner
6. Knock Out Baffleing
7. Baghouse
8. Liquid Asphalt Storage
9. Conveyor to Surge/Storage Bin(s)
10. Surge/Storage Bin
11. Control/Operators' House
12. Truck Loading Scale
13. Stack



DRUM-MIXER PLANT

V. EQUIPMENT USED

Equipment used on conducting the particulate emissions test was:

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

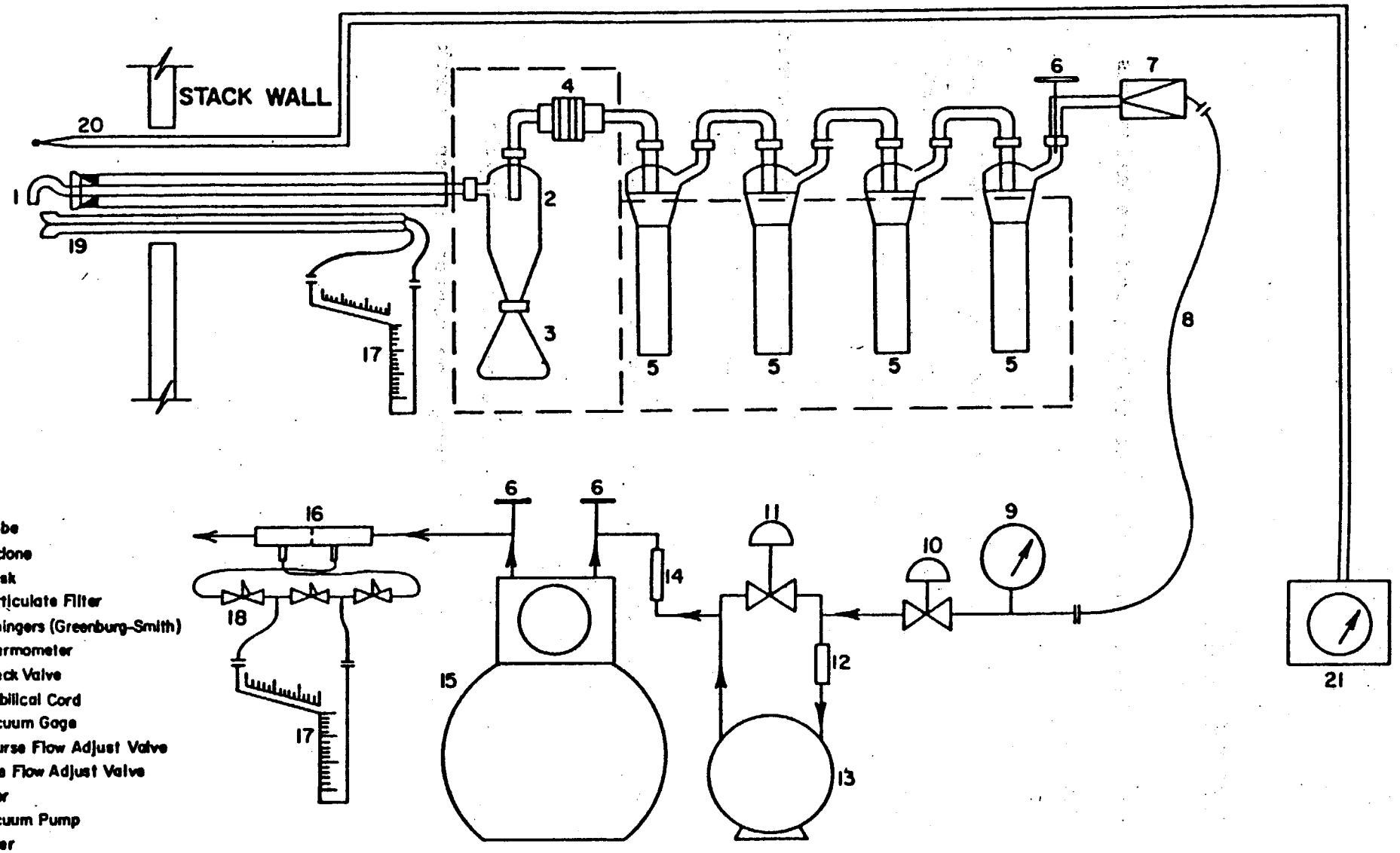
B. A Fisher Scientific 211-B airguide (uncorrected) aneroid barometer was used to check the barometric pressure.

C. Weston dial thermometers were used to check both stack and meter temperatures.

D. A Hays 621 Analyzer was used to measure the oxygen, carbon dioxide and carbon monoxide content of the stack gases.

V. EQUIPMENT USED

VI. LABORATORY PROCEDURES & RESULTS



1) Probe
2) Cyclone
3) Flask
4) Particulate Filter
5) Impingers (Greenburg-Smith)
6) Thermometer
7) Check Valve
8) Umbilical Cord
9) Vacuum Gage
10) Course Flow Adjust Valve
11) Fine Flow Adjust Valve
12) Oiler
13) Vacuum Pump
14) Filter
15) Dry Gas Meter
16) Orifice Tube
17) Incline Manometer
18) Solenoid Valves
19) Pitot
20) Thermocouple
21) Pyrometer

SAMPLING TRAIN
USED FOR ISOKINETIC SAMPLING

LABORATORY PROCEDURES FOR PARTICULATE SAMPLING

I. Field Preparation

A. FILTERS: Fiberglass 4" sampling filters are prepared as follows:

Filters are removed from their box and numbered on the back side with a felt pen. The numbering system is continuous from job to job. The filters are placed in a dessicator to dry for at least 24 hours. Clean plastic petri dishes, also numbered, top and bottom, are placed in the dessicator with the filters. After dessication, the filters are removed one at a time and weighed on the Sartorius analytical balance, then placed in the correspondingly numbered petri dish. Weights are then recorded in the lab record book. Three filters are used for each complete particulate source emissions test and there should be several extra filters included as spares.

B. SILICA GEL: Silica Gel used for the test is prepared as follows:

Approximately 200 g of silica gel is placed in a wide mouth "Mason" type jar and dried in an oven (175°C for two hours). The open jars are removed and placed in a dessicator until cool (2 hours) and then tightly sealed. The jars are then numbered and weighed on the triple beam balance to the closest tenth of a gram, and this weight is recorded for each sealed jar. The number of silica gel jars used is the same as the number of filters. Silica gel should be indicating type, 6-16 mesh.

II. Post-Testing Lab Analysis

A. FILTERS: The filters are returned to the lab in their sealed glass filter holder which was used in field sampling. In the lab these holders are opened. The filter is placed in its petri dish with the lid off and returned to the dessicator for at least 24 hours. The top half of the filter holder is washed into the corresponding probe wash bottle and the bottom half of the filter holder is washed into the corresponding impinger catch bottle. (See II, C and D). After dessication, the filters are reweighed. The final weight is recorded in the lab record book. The filter pick up weight is calculated and recorded also. This procedure is repeated for all filters used in the field.

Alternately, the test team may opt to oven dry the filters at 220°F for two to three hours, weigh the sample, and use this weight as a final weight.

B. SILICA GEL: The sealed silica gel jars should be reweighed on the triple-beam balance and their weights recorded as shown on previous page.

C. PROBE RINSINGS: In all tests, a probe wash-out analysis will be necessary. These samples are returned in sealed Mason jars and consist of A.R. Acetone with an unknown solid content. Clean 250 ml beakers are used to make this analysis. These should be immaculately washed and rinsed with deionized water, then oven dried at 105°C for about one hour. The beakers should be moved to the dessicator to cool for ninety (90) minutes, then labeled with a pencil and weighed on the Sartorius analytical balance. Any variance from this procedure should be duplicated exactly when reweighing, as this procedure has been found to be quite sensitive. After preparing the necessary number of beakers (one for each probe wash and one blank) the Mason jars should be opened, poured into the beaker, and any material remaining on the jar walls rinsed with an acetone wash bottle into the beaker. The amount of liquid in the beaker should be noted on the analysis form. The acetone rinsings are evaporated on a warming plate. The liquid is kept swirled with an air sweep to prevent "bumping". When the acetone is evaporated the beakers are weighed as in Section II A.

D. IMPINGER CATCH: In some testing cases, the liquid collected in the impingers must be analyzed for solids content. This involves a similar procedure to the probe wash solids determination, except that the liquid is deionized water.

E. ACETONE: Conduct a blank analysis of acetone in the 1 gallon glass container. This acetone will be used in the field for rinsing the probe, nozzle, and top half of the filter holder. Performing such a blank analysis prior to testing will insure that the quality of the acetone to be used will not exceed the .001% residual purity standard.

WEIGHING PROCEDURE — SARTORIUS ANALYTICAL BALANCE

The Sartorius balance is accurate to approximately +0.2 mg and has a maximum capacity of 200 g. It is equipped with "pre-weighing" which enables an unknown mass to be quickly weighed to a +1 g level with no adjustment. It also has a tare weighing feature which is for quick net gain measurement without subtraction. Before weighing an item, the balance should first be zeroed. This step should be taken before every series of weighings. To do this, the balance should have all weight adjustments at "zero" position. The beam arrest lever (on the lower left hand side toward the rear of the balance) is then slowly pressed downward to full release position. The lighted vernier scale on the front of the cabinet should align the "zero" with the mark on the cabinet. If it is not so aligned, the adjustment knob on the right hand side (near the rear of the cabinet) should be turned carefully until the marks align. Now return the beam arrest to horizontal arrest position. The balance is now "zeroed".

To weigh an item, it is first placed on the pan. And the sliding doors are closed to avoid air current disturbance. The weight adjustment knob on the right hand side must be at "zero". The beam arrest is then slowly turned upward. The lighted scale at the front of the cabinet will now indicate the weight of the item in grams. If the scale goes past the divided area, the item then exceeds 100 g weight (about 3-1/2 ounces) and it is necessary to arrest the balance (beam arrest lever) and move the lever for 100 g weight away from you. It is located on the left hand side of the cabinet near the front, and is the knob closest to the side of the cabinet. The balance is now set to weigh items between 100 and 200 grams. The balance will not weigh items greater than 200 grams in mass, and trying to do this might harm the balance. Remember — this is a delicate precision instrument.

After the beam is arrested, in either weight range, the procedure is now the same. When the weight of the item in grams is found, "dial in" that amount with the two knobs on the left hand side (near the 100 g lever) color coded yellow and green. As you dial the weight, the digits will appear on the front of the cabinet. When the proper amount is dialed, carefully move the arrest lever down with a slow, steady turn of the wrist. The lighted dial will appear, and the right hand side knob (front of cabinet) is turned to align the mark with the lower of the two lighted scale divisions which the mark appears between. When these marks are aligned, the two lighted digits along with the two indicated on the right hand window on the cabinet front are the fractional weight in grams (the decimal would appear before the lighted digits) and the whole number of grams weight is the amount "dialed in" on the left.

In general, be sure that the beam is in "arrest" position before placing weight on or taking weight off of the pan. Don't "dial in" weight unless the beam is arrested, either. The balance is sensitive to even a hand on the table near the balance, so be careful and painstaking in every movement while weighing.

SAMPLE ANALYTICAL DATA FORM

Plant Location Mattingly Const Co.

Sample Location Easton, Maryland

Relative humidity in lab

Density of acetone (ρ_a) .7899 g/ml

		RUN 1	RUN 2	RUN 3
Acetone rinse container number	#	PW1	PW2	PW3
Acetone rinse volume (V_{aw})	ml	200	200	200
Acetone blank residue concentration (C_a)	mg/g	0	0	0
$W_a = C_a V_{aw} \rho_a$ = (0)(200)(.7899) =	g	0	0	0
Date/time of wt 6-27-84 4:15 pm Gross wt	g	151.3684	150.8955	125.2734
Date/time of wt 6-25-84 7 pm Gross wt	g	151.3692	150.8963	125.2738
Average Gross wt	g	151.3688	150.8959	125.2736
Tare wt	g	151.2429	150.8218	125.2443
Less acetone blank wt (W_a)	g	0	0	0
Wt of particulate in acetone rinse (m_a)	g	.1259	.0741	.0292
Filter numbers	#	RV52	RV43	RV46
Date/time of wt 6-27-84 4:15 pm Gross wt	g	[illegible]	[illegible]	.6831
Date/time of wt 6-25-84 7 pm Gross wt	g	.6339	.6449	.6833
Average Gross wt	g	.6339	.6448	.6832
Tare wt	g	.6766	.6748	.6784
Weight of particulate on filters(s) (m_f)	g	-.0427	-.0302	.0048
Weight of particulate in acetone rinse	g	.1259	.0741	.0292
Total weight of particulate (m_n)	g	.0832	.0439	.0340
		0.0259	0.0135	0.0105

Note: In no case should a blank residue 0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks Parts of filters in Run 1 & 2 were lost in Probe wash.

Signature of analyst Sam Tuyay

Signature of reviewer Susan Scott

SAMPLE ANALYTICAL DATA FORM

Plant Location Mattingly Const. Co.

Sample Location Easton, MD

Relative humidity in lab _____

Density of acetone (ρ_a) .7899 g/ml

		RUN 4	~~RUN 2~~	~~RUN 3~~
Acetone rinse container number	#	pw4		
Acetone rinse volume (V_{aw})	ml	200		
Acetone blank residue concentration (C_a)	mg/g	0		
$W_a = C_a V_{aw} \rho_a$ = (0)(0)(.7899) =	g	0		
Date/time of wt 6-27-84 4:30pm Gross wt	g	142.3087		
Date/time of wt _____ Gross wt	g	142.3091		
Average Gross wt	g	142.3089		
Tare wt	g	142.2049		
Less acetone blank wt (W_a)	g	0		
Wt of particulate in acetone rinse (m_a)	g	.1040		
Filter numbers	#	RV31		
Date/time of wt 6-27-84 4:30pm Gross wt	g	.6469		
Date/time of wt _____ Gross wt	g	.6467		
Average Gross wt	g	.6468		
Tare wt	g	.6842		
Weight of particulate on filters(s) (m_f)	g	-.0374		
Weight of particulate in acetone rinse	g	.1040		
Total weight of particulate (m_n)	g	.0666		

Note: In no case should a blank residue 0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks Parts of filter loss in Probe Wash

Signature of analyst Sam Turner

Signature of reviewer _____

VII. CALCULATIONS

NAME: MATTINGLY CONSTRUCTION CO.

LOCATION: EASTON, MARYLAND

			date	6/25/84	6/25/84	6/25/8
	SUMMARY OF TEST DATA			RUN # 1	RUN # 2	RUN #
	SAMPLING TRAIN DATA		start	07:29	09:52	11:58
			finish	09:09	11:16	15:16
1	Sampling time, minutes		θ	72	72	72
2	Sampling nozzle diameter, in.		Dn	.266	.266	.266
3	Sampling nozzle cross-sectional area, ft^2		An	.000383	.000383	.000383
4	Isokinetit variation		I	93	94	89
5	Sample gas volume - meter conditions, cf.		Vm	52.71	54.42	53.86
6	Average meter temperature, °R		Tm	556	567	568
7	Average oriface pressure drop, in.H_2O		ΔH	1.29	1.34	1.38
8	Total particulate collected mg.		Mn	83.2	43.9	34.0
	VELOCITY TRAVERSE DATA					
9	Stack area,ft^2.		A	11.3	11.3	11.3
10	Absolute stack gas pressure, in Hg.		Ps	29.45	29.45	29.45
11	Barometric pressure, in. Hg.		Pbar	29.40	29.40	29.40
12	Average absolute stack temperature, °R		Ts	737	730	727
13	Average $\sqrt{\text{velocity head}}$, (Cp= .79)		$\sqrt{\Delta P}$	.91	.89	.91
14	Average stack gas velocity ft./ sec.		Vs	59	57	59
	STACK MOISTURE CONTENT					
15	Total water collected by train, ml.		Vic	322.0	292.0	267.0
16	Moisture in stack gas, %		Bws	23.7	21.7	20.5
	EMISSIONS DATA:					
17	Stack gas flow rate, dscf/hr. (000's)		Qsd	1,299	1,304	1,353
18	Total particulate concentration, gr/dscf		Cs	.0262	.0137	.0107
19	Total particulate concentration, lbs/hr		E	4.9	2.6	2.1
20	Total particulate concentration, lbs/mbtu		E^1	.0	.0	.0
	ORSAT DATA					
21	Percent CO2 by volume		CO2	6.0	6.0	6.(
22	Percent O2 by volume		O2	15.0	15.0	15.(
23	Percent CO by volume		CO	.0	.0	.(
24	Percent N2 by volume		N2	79.0	79.0	79.(

Buzzycalc

NAME: MATTINGLY CONSTRUCTION CO.

LOCATION: EASTON, MARYLAND date 6/26/84 0

	SUMMARY OF TEST DATA		RUN # 4	RUN #	RUN #
	SAMPLING TRAIN DATA	start	07:26	00000	00000
		finish	08:50	00000	00000
1	Sampling time, minutes	θ	72	0	0
2	Sampling nozzle diameter, in.	Dn	.266	.000	.000
3	Sampling nozzle cross-sectional area, ft^2	An	.000383	.000000	.000000
4	Isokinetit variation	I	97	0	0
5	Sample gas volume - meter conditions, cf.	Vm	59.97	.00	.00
6	Average meter temperature, °R	Tm	554	0	0
7	Average oriface pressure drop, in.H_2O	ΔH	1.62	.00	.00
8	Total particulate collected mg.	Mn	66.6	.0	.0
	VELOCITY TRAVERSE DATA				
9	Stack area, ft^2.	A	11.3	.0	.0
10	Absolute stack gas pressure, in Hg.	Ps	29.50	.00	.00
11	Barometric pressure, in. Hg.	Pbar	29.45	.00	.00
12	Average absolute stack temperature, °R	Ts	733	0	0
13	Average $\bar{\sqrt{\text{velocity head}}}$, (Cp= .79)	$\bar{\sqrt{\Delta P}}$	.98	.00	.00
14	Average stack gas velocity ft./ sec.	Vs	63	0	0
	STACK MOISTURE CONTENT				
15	Total water collected by train, ml.	Vic	327.0	.0	.0
16	Moisture in stack gas, %	Bws	21.6	.0	.0
	EMISSIONS DATA:				
17	Stack gas flow rate, dscf/hr. (000's)	Qsd	1,436	0	0
18	Total particulate concentration, gr/dscf	Cs	.0183	.0000	.0000
19	Total particulate concentration, lbs/hr	E	3.8	.0	.0
20	Total particulate concentration, lbs/mbtu	E^1	.0	.0	.0
	ORSAT DATA				
21	Percent CO2 by volume	CO2	6.0	.0	.0
22	Percent O2 by volume	O2	15.0	.0	.0
23	Percent CO by volume	CO	.0	.0	.0
24	Percent N2 by volume	N2	79.0	.0	.0

Buzzycalc

Dry Gas Volume :

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

Where:

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

V_m = Dry Gas Volume measured by meter, cu.ft.

P_{bar} = Barometric pressure at oriface meter, in. Hg.

P_{std} = Standard absolute pressure,(29.92 in. Hg.)

T_m = Absolute temperature at meter $^\circ R$

T_{std} = Standard absolute temperature ($528^\circ R$)

ΔH = Average pressure drop across oriface meter, in.H_2O

Y = Dry gas meter calibration factor

13.6 = inches water per inches Hg.

Run # 1 $V_{m(std)} = 17.64 \quad (.99)(52.71) \left[\frac{(29.40) + \frac{1.29}{13.6}}{556} \right] = 48.83$ dscf

Run # 2 $V_{m(std)} = 17.64 \quad (.99)(54.42) \left[\frac{(29.40) + \frac{1.34}{13.6}}{567} \right] = 49.44$ dscf

Run # 3 $V_{m(std)} = 17.64 \quad (.99)(53.86) \left[\frac{(29.40) + \frac{1.38}{13.6}}{568} \right] = 48.85$ dscf

Dry Gas Volume :

$$V_{m(std)} = V_m \left| \frac{T_{(std)}}{T_m} \right| \left| \frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{(std)}} \right| = 17.64 \frac{^\circ R}{in.Hg.} \; Y \; V_m \left| \frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right|$$

Where:

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

V_m = Dry Gas Volume measured by meter, cu.ft.

P_{bar} = Barometric pressure at oriface meter, in. Hg.

P_{std} = Standard absolute pressure,(29.92 in. Hg.)

T_m = Absolute temperature at meter $^\circ R$

T_{std} = Standard absolute temperature (528°R)

ΔH = Average pressure drop across oriface meter, in.H_2O

Y = Dry gas meter calibration factor

13.6 = inches water per inches Hg.

Run # 4 $V_{m(std)} = 17.64 \quad (.99)(59.97) \left| \frac{(29.45) + \frac{1.62}{13.6}}{554} \right| = 55.90$ dsc

Run # $V_{m(std)} = 17.64 \quad (.00)(.00) \left| \frac{(.00) + \frac{.00}{13.6}}{0} \right| = .00$ dsc

Run # $V_{m(std)} = 17.64 \quad (.00)(.00) \left| \frac{(.00) + \frac{.00}{13.6}}{0} \right| = .00$ dsc

Total contamints 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 mater in stack gas, dry basis, corrected to standard conditions, g/dsf

M_n = Total amount of particulate mater colected, mg.

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

Run # 1: $$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{83.2}{48.83} \right] = .0262 \text{ gr./dscf.}$$

Run # 2: $$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{43.9}{49.44} \right] = .0137 \text{ gr./dscf.}$$

Run # 3: $$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{34.0}{48.85} \right] = .0107 \text{ gr./dscf.}$$

Total contamints 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 mater in stack gas, dry basis, corrected to standard conditions, g/dsf

M_n = Total amount of particulate mater colected, mg.

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

Run # 4: $C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{66.6}{55.90} \right] = .0183$ gr./dscf.

Run # : $C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{.0}{.00} \right] = .0000$ gr./dscf.

Run # 3: $C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{.0}{.00} \right] = .0000$ gr./dscf.

Water vapor condenced :

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

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

Where:

0.04707 = Conversion factor $ft.^3/ml.$

0.04715 = Conversion factor $ft.^3/g.$

$V_{wc_{std}}$ = Volume of water vapor condenced (standard conditions) scf.

$V_{wsg_{std}}$ = Volume of water vapor collected in silica gel (stadard conditions)

V_f = Final volume of impinger contents, mi.

V_i = Initial volume of impinger contents

P = Density of water, (0.002201 lb/ml).

R = Ideal gas constant, 21.85 (in.Hg.)(cu.ft./lb.-mole)($^\circ$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) (305.0) = 14.4 cu.ft
$V_{wsg(std)}$ = (0.04715) (17.0) = .8 cu.ft

Run # 2: $V_{wc(std)}$ = (0.04707) (275.0) = 12.9 cu.ft
$V_{wsg(std)}$ = (0.04715) (17.0) = .8 cu.ft

Run # 3: $V_{wsg(std)}$ = (0.04707) (255.0) = 12.0 cu.ft
$V_{wc(std)}$ = (0.04715) (12.0) = .6 cu.ft

Water vapor condenced :

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

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

Where:

0.04707 = Conversion factor ft^3/ml.

0.04715 = Conversion factor ft^3/g.

$V_{wc_{std}}$ = Volume of water vapor condenced (standard conditions) scf.

$V_{wsg_{std}}$ = Volume of water vapor collected in silica gel (stadard conditions)

V_f = Final volume of impinger contents, ml.

V_i = Initial volume of impinger contents

ρ = Density of water, (0.002201 lb/ml).

R = Ideal gas constant, 21.85 (in.Hg.)(cu.ft./lb.-mole)($^\circ$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 # 4 : $V_{wc(std)}$ = (0.04707) (307.0) = 14.5 cu.ft
$V_{wsg(std)}$ = (0.04715) (20.0) = .9 cu.ft

Run # : $V_{wc(std)}$ = (0.04707) (.0) = .0 cu.ft
$V_{wsg(std)}$ = (0.04715) (.0) = .0 cu.ft

Run # 5: $V_{wsg(std)}$ = (0.04707) (.0) = .0 cu.ft
$V_{wc(std)}$ = (0.04715) (.0) = .0 cu.ft

Moisture content of stack gases: $$B_{ws} = \frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{wc_{std}} + V_{wsg_{std}} + V_{m\ std}} \times 100$$

Where:

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

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

$V_{wc_{std}}$ = Volume of water vapor condenced corrected to stanndard conditions (scf).

$V_{wsg_{std}}$ = Volume of water vapor collected in silica gel corcted to standard conditions (scf).

Run # 1: $$B_{ws} = \frac{14.4 + .8}{14.4 + .8 + 48.83} \times 100 = 23.7\ \%$$

Run # 2: $$B_{ws} = \frac{12.9 + .8}{12.9 + .8 + 49.44} \times 100 = 21.7\ \%$$

Run # 3: $$B_{ws} = \frac{12.0 + .6}{12.0 + .6 + 48.85} \times 100 = 20.5\ \%$$

==========

Molecular weight of stack gases: $M_s = M_d\ (1-B_{ws}) + (B_{ws})$.

Where:

M_s = Molecular weight of stack gas, wet basis, (lb.1le).

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

Run # 1: $M_s = 29.6\ (1-\ .237\ ) + 18\ (\ .237\ ) = 26.8$ (lb./lb.-mole).

Run # 2: $M_s = 29.6\ (1-\ .217\ ) + 18\ (\ .217\ ) = 27.1$ (lb./lb.-mole).

Run # 3: $M_s = 29.6\ (1-\ .205\ ) + 18\ (\ .205\ ) = 27.2$ (lb./lb.-mole).

Moisture content of stack gases: $$B_{ws} = \frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{wc_{std}} + V_{wsg_{std}} + V_{m_{std}}} \times 100$$

Where:

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

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

$V_{wc_{std}}$ = Volume of water vapor condenced corrected to stanndard conditions (scf).

$V_{wsg_{std}}$ = Volume of water vapor collected in silica gel corcted to standard conditions (scf).

Run # 4 : $$B_{ws} = \frac{14.5 + .9}{14.5 + .9 + 55.90} \times 100 = 21.6\ \%$$

Run # : $$B_{ws} = \frac{.0 + .0}{.0 + .0 + .00} \times 100 = .0\ \%$$

Run # : $$B_{ws} = \frac{.0 + .0}{.0 + .0 + .00} \times 100 = .0\ \%$$

Molecular weight of stack gases: $M_s = M_d\ (1-B_{ws}) + (B_{ws})$.

Where:

M_s = Molecular weight of stack gas, wet basis, (lb.1le).

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

Run # 4 : $M_s = 29.6\ (1- .216\ ) + 18\ (\ .216\ ) = 27.1$ (lb./lb.-mole).

Run # : $M_s = .0\ (1- .000\ ) + 18\ (\ .000\ ) = .0$ (lb./lb.-mole).

Run # : $M_s = .0\ (1- .000\ ) + 18\ (\ .000\ ) = .0$ (lb./lb.-mole).

Stack gas velocity:

$$V_s = K_p\, C_p \left[\overline{\sqrt{\overline{\Delta P}}}\right]_{avg.} \sqrt{\frac{T_{s(avg.)}}{P_s\ M_s}}$$

Where:

V_s = Avarage velocity of gas stream in stack, ft./sec.

K_p = 85.49 ft/sec $\left[\overline{(g/g\text{-}mole)\text{-}(mm\ Hg)\ /\ (^{\circ}K)(\ mm\ H_2O}\right]^{1/2}$

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 = Satck 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, ($^{\circ}$f).

T_s = Absolute stack temperature, ($^{\circ}$R). = 460 + t_s.

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

Run # 1: $V = (85.48)\ (\ .79)\ (\ .91)\ \sqrt{\frac{737}{(29.45)(26.85)}} = 59.33$ ft/sec

Run # 2: $V = (85.48)\ (\ .79)\ (\ .89)\ \sqrt{\frac{730}{(29.45)(27.08)}} = 57.50$ ft/sec

Run # 3: $V = (85.48)\ (\ .79)\ (\ .91)\ \sqrt{\frac{727}{(29.45)(27.22)}} = 58.52$ ft/sec

-Stack gas velocity:

$$V_s = K_p\, C_p \left| \sqrt{\overline{\Delta P}} \right|_{avg.} \sqrt{\frac{T_{s(avg.)}}{P_s\ M_s}}$$

Where:

V_s = Avarage velocity of gas stream in stack, ft./sec.

K_p = 85.49 ft/sec $\left| \overline{(g/g\text{-}mole)\text{-}(mm\ Hg) \,/\, (^{\circ}K)(\ mm\ H_2O} \right|^{1/2}$

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 = Satck 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, ($^{\circ}$f).

T_s = Absolute stack temperature, ($^{\circ}$R). = 460 + t_s.

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

Run # 4 : $V = (85.48)\ (\ .79)\ (\ .98) \sqrt{\frac{733}{(29.50)(27.09)}} = 63.38$ ft/se

Run # : $V = (85.48)\ (\ .00)\ (\ .00) \sqrt{\frac{0}{(\ .00)(\ .00)}} = .00$ ft/se

Run # 6: $V = (85.48)\ (\ .00)\ (\ .00) \sqrt{\frac{0}{(\ .00)(\ .00)}} = .00$ ft/se

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_s = Stack temperature ($^\circ$f).
T_s = Absolute stack temperature, ($^\circ$R).
T_{std} = Standard absolute temperature, (528°R).
P_{bar} = Barometric pressure at measurement site, (in.Hg.).
P_g = Satck 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:

$$Q_{sd} = 3600\ (1-.237)\ (\ 59.33)\ (\ \ 11.3) \left[\frac{528}{737}\right] \left[\frac{29.45}{29.92}\right] = 1298584 \text{ dscf/hr}$$

Run # 2:

$$Q_{sd} = 3600\ (1-.217)\ (\ 57.50)\ (\ \ 11.3) \left[\frac{528}{730}\right] \left[\frac{29.45}{29.92}\right] = 1303903 \text{ dscf/hr}$$

Run # 3:

$$Q_{sd} = 3600\ (1-.205)\ (\ 58.52)\ (\ \ 11.3) \left[\frac{528}{727}\right] \left[\frac{29.45}{29.92}\right] = 1352931 \text{ dscf/hr}$$

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_s = Stack temperature ($^\circ$f).

T_s = Absolute stack temperature, ($^\circ$R).

T_{std} = Standard absolute temperature, (528°R).

P_{bar} = Barometric pressure at measurement site, (in.Hg.).

P_g = Satck 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 # 4:

$$Q_{sd} = 3600\ (1-.216)\ (\ 63.38)\ (\ \ 11.3) \left[\frac{528}{733}\right] \left[\frac{29.50}{29.92}\right] = 1435620 \text{ dscf/h}$$

Run # :

$$Q_{sd} = 3600\ (1-.000)\ (\ \ .00)\ (\ \ .0) \left[\frac{528}{0}\right] \left[\frac{.00}{29.92}\right] = 0 \text{ dscf/h}$$

Run # :

$$Q_{sd} = 3600\ (1-.000)\ (\ \ .00)\ (\ \ .0) \left[\frac{528}{0}\right] \left[\frac{.00}{29.92}\right] = 0 \text{ dscf/h}$$

Emissions rate from stack:

$$E = \frac{(C_s)(Q_{sd})}{7000 \text{ gr./lb.}} = \text{lb. / hr.}$$

Where:

E = Emissions rate, lb./hr.

C = concentration of particulate mater in stack gas, dry basis, corrected to standard conditions (g/dsf).

Q = Dry volumetric stack gas flow rate corrected to standard conditions, (dscf/hr).

Run # 1: $E = \frac{(.0262)(1298584)}{7000} = 4.9$ lb. / hr.

Run # 2: $E = \frac{(.0137)(1303903)}{7000} = 2.6$ lb. / hr.

Run # 3: $E = \frac{(.0107)(1352931)}{7000} = 2.1$ lb. / hr.

Emissions rate from stack:

$$E = \frac{(C_s)(Q_{sd})}{7000 \text{ gr./lb.}} = \text{lb. / hr.}$$

Where:

E = Emissions rate, lb./hr.

C = concentration of particulate mater in stack gas, dry basis, corrected to standard conditions (g/dsf).

Q = Dry volumetric stack gas flow rate corrected to standard conditions, (dscf/hr).

Run # 4 : $E = \frac{(.0183)(1435620)}{7000} = 3.8$ lb. / hr.

Run # : $E = \frac{(.0000)(0)}{7000} = .0$ lb. / hr.

Run # : $E = \frac{(.0000)(0)}{7000} = .0$ lb. / hr.

$$\text{Isokinetic variation : } I = 100\ T_s \left| \frac{0.002669\ V_{ic} + (V_m/T_m)(P_{bar} + \Delta H/13.6)}{60\ \ \theta\ \ V_s\ \ P_s\ \ A_n} \right|$$

Where:

I	=	Precent isokinetic sampling.
100	=	conversion to percent.
T_s	=	Absolute average stack gas temperature, $^\circ R$.
0.002669	=	conversion factor, Hg - ft^3/ml - $^\circ R$.
V_{ic}	=	Total volume of liquid collected in impingers and silica gel, m
T_m	=	Absolute average dry gas meter temperature, $^\circ R$.
P_{bar}	=	Barometric pressure at sampling site, (inHg).
ΔH	=	Average pressure differential across the oriface 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, ft^2.

Run # 1:

$$I = 100 \times 737 \left| \frac{(0.002669)(322.0) + \frac{52.7}{556}\left| 29.40 + \frac{1.29}{13.6} \right|}{60\ (\ 72\ )\ (\ 59.33\ )\ (29.45\ )\ (\ .000383\ )} \right| = 93\ \%$$

Run # 2:

$$I = 100 \times 730 \left| \frac{(0.002669)(292.0) + \frac{54.4}{567}\left| 29.40 + \frac{1.34}{13.6} \right|}{60\ (\ 72\ )\ (\ 57.50\ )\ (29.45\ )\ (\ .000383\ )} \right| = 94\ \%$$

Run # 3:

$$I = 100 \times 727 \left| \frac{(0.002669)(267.0) + \frac{53.9}{568}\left| 29.40 + \frac{1.38}{13.6} \right|}{60\ (\ 72\ )\ (\ 58.52\ )\ (29.45\ )\ (\ .000383\ )} \right| = 89\ \%$$

Isokinetic variation : $I = 100\ T_s \left| \dfrac{0.002669\ V_{ic} + (V_m/T_m)(P_{bar} + \Delta H/13.6)}{60\ \ \theta\ \ V_s\ \ P_s\ \ A_n} \right|$

Where:

I	=	Precent isokinetic sampling.
100	=	conversion to percent.
T_s	=	Absolute average stack gas temperature, $^\circ R$.
0.002669	=	conversion factor, Hg - $ft^3/ml - {}^\circ R$.
V_{ic}	=	Total volume of liquid collected in impingers and silica gel, ml
T_m	=	Absolute average dry gas meter temperature, $^\circ R$.
P_{bar}	=	Barometric pressure at sampling site, (inHg).
ΔH	=	Average pressure differential across the oriface 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, ft^2.

Run # 4:

$$I = 100 \times 733 \left| \frac{(0.002669)(327.0) + \frac{60.0}{554}\left| 29.45 + \frac{1.62}{13.6} \right|}{60\ (\ 72\ )\ (\ 63.38\ )\ (29.50\ )\ (\ .000383\ )} \right| = 97\ \%$$

Run # :

$$I = 100 \times 0 \left| \frac{(0.002669)(\ .0) + \frac{.0}{0}\left| .00 + \frac{.00}{13.6} \right|}{60\ (\ 0\ )\ (\ .00\ )\ (\ .00\ )\ (\ .000000\ )} \right| = 0\ \%$$

Run # ,:

$$I = 100 \times 0 \left| \frac{(0.002669)(\ .0) + \frac{.0}{0}\left| .00 + \frac{.00}{13.6} \right|}{60\ (\ 0\ )\ (\ .00\ )\ (\ .00\ )\ (\ .000000\ )} \right| = 0\ \%$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Mattingly Const. PP 1.4

Location Easton Md

Operator Sam Thomas

Date 6-25-84

Run No. One

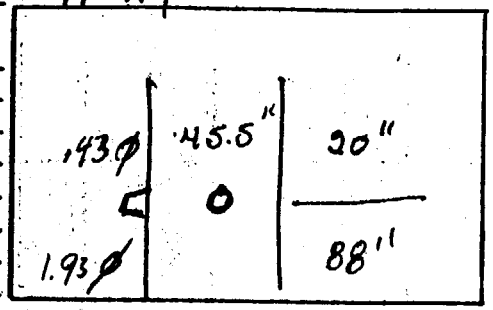
Sample Box No. One

Meter Box No. 700205

Meter H @ 1.26

C Factor .99

Pitot Tube Coefficient Cp .79



Schematic of Stack Cross Section

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	505	515
INITIAL	200	498
DIFFERENCE	305	17

Ambient Temperature 85

Barometric Pressure 29.40

Assumed Moisture, % 32 %

Probe Length, m(ft) 5

Nozzle Identification No. .000383

Avg. Calibrated Nozzle Dia., (in.) .265/.263/.26

Probe Heater Setting 5

Leak Rate, m^3/min. (cfm) -.02

Probe Liner Material Stainless Steal 316

Static Pressure, mm Hg (in.Hg) +.05

Filter No. RU 52

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)		FILTER HOLDER TEMP (°F)	GAS TEMP LVG CONDENSER OR LAST IMPINGER (°F)
							Inlet	Outlet		
A) 1	7:29 / 7:32	7	280	1.30	1.75	656.67 / 660	85	75	250	60
2	7:34 / 7:37	7	280	2.0	2.7	662.80	90	80	250	60
3	7:40	7	280	2.1	2.8	666.20	95	80	250	60
4	7:43	7	280	1.9	2.5	669.50	95	80	250	60
5	7:46	7	280	1.9	2.5	672.60	100	80	250	60
6	7:49	5	280	1.0	1.3	675.30	105	80	250	60
7	7:52	2	275	.30	.40	676.70	105	80	250	60
8	7:55	2	275	.30	.40	678.0	105	85	255	60
9	7:58	2	275	.30	.40	679.50	105	85	255	60
10	8:01	2	275	.30	.40	680.60	105	85	255	60
11	8:04	2	275	.30	.40	681.90	105	85	255	60
12	8:07	2	275	.30	.40	683.27	110	85	255	60
B) 1	8:33 / 8:36	2	275	.30	.40	684.60	95	90	255	60

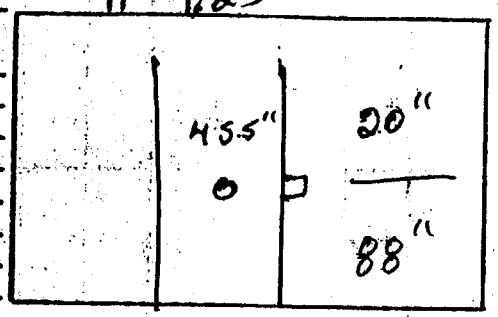
RAMCON emissions test log sheet, cont. DATE 6-25-84 LOCATION Easton Md. TEST NO. 1

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 V_m (ft^3)	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
2	8:39	2	275	.30	.40	685.90	105	90	250	55
3	8:42	2	275	.30	.40	687.10	110	90	250	55
4	8:45	2	275	.30	.40	688.58	110	90	250	55
5	8:48	2	275	.35	.47	690.30	110	90	250	55
6	8:51	2	275	.50	.66	691.90	110	90	250	55
7	8:54	5	275	1.0	1.35	693.90	110	90	250	55
8	8:57	5	280	1.4	1.90	696.80	115	90	250	45
9	9:00	5	280	1.7	2.3	699.90	120	95	250	55
10	9:03	6	280	1.8	2.4	703.20	120	95	255	55
11	9:06	6	280	1.8	2.4	706.40	120	95	255	55
12	9:09	6	280	1.4	1.9	709.38	120	95	255	55

RAMCON ENVIRONMENTAL CORPORATION

Plant Mattingly Const

Location Easton Md
Operator Sam Turco
Date 6-25-84
Run No. Two
Sample Box No. Two
Meter Box No. 700205
Meter H @ 1.26
C Factor .99
Pitot Tube Coefficient Cp .79



Schematic of Stack Cross Section

	Impinger Volume, ml	Silica Gel Weight, g
Final	475	522
Initial	200	505
Difference	275	17

Ambient Temperature 85
Barometric Pressure 29.40
Assumed Moisture, % 23.0
Probe Length, m(ft) 5
Nozzle Identification No. .000383
Avg. Calibrated Nozzle Dia., (in.) .265/.266/.26
Probe Heater Setting 5
Leak Rate, m^3/min. (cfm) -.02
Probe Liner Material Stainless Steel 316
Static Pressure, mm Hg (in. Hg) -.05
Filter No. RU 43

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	GAS SAMPLE TEMP. AT DRY GAS METER (°F) Outlet	FILTER HOLDER TEMP (°F)	GAS TEMP LVG CONDENSER OR LAST IMPINGER (°F)
A) 1	9:52 / 9:55	4	275	1.2	1.8	709.60 / 712.50	105	95	250	60
2	9:58	5	275	1.8	2.7	715.80	105	95	250	60
3	10:01	5	275	1.8	2.7	719.40	115	95	250	60
4	10:04	5	275	1.8	2.7	722.40	115	95	250	60
5	10:07	5	270	1.45	2.0	725.50	115	95	250	60
6	10:10	4	270	.90	1.35	728.20	120	95	250	60
7	10:13	2	270	.30	.45	729.60	120	95	265	60
8	10:16	2	270	.30	.45	730.90	120	95	265	60
9	10:19	2	270	.30	.45	732.10	120	95	265	60
10	10:22	2	270	.30	.45	733.80	120	95	265	60
11	10:25	2	265	.30	.45	735.00	120	95	265	60
12	10:28	2	265	.30	.45	736.52	120	95	265	60
A) 1	10:40 / 10:43	2	265	.30	.45	737.90	105	95	265	60

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RAMCON emissions test log sheet, cont. DATE 6-25-87 LOCATION Easton md 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)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
2	10:46	2	265	.30	.45	739.50	115	95	260	60
3	10:49	2	265	.35	.52	740.70	115	95	260	60
4	10:52	2	270	.40	.60	742.30	115	95	260	60
5	10:55	2	270	.40	.60	743.98	120	95	260	60
6	10:58	2	270	.56	.84	745.98	120	95	260	60
7	11:01	6	270	.96	1.4	748.20	120	100	260	60
8	11:04	7	270	1.4	2.1	751.10	120	100	260	60
9	11:07	7	270	1.6	2.4	754.40	120	100	255	60
10	11:10	7	270	1.7	2.5	757.80	120	100	255	55
11	11:13	7	270	1.7	2.5	761.00	120	100	255	55
12	11:16	7	270	1.3	1.95	764.023	125	100	255	55

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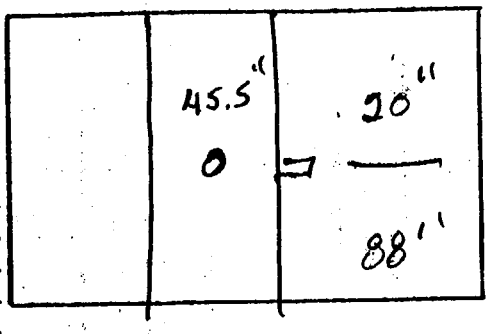
RAMCON ENVIRONMENTAL CORPORATION

Plant Mattingly Const
Location Easton, Md
Operator Jon Clumm
Date 6-25-84
Run No. Three
Sample Box No. Three
Meter Box No. 700205
Meter H @ 1.26
C Factor .99
Pitot Tube Coefficient Cp .79



Schematic of Stack Cross Section

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	455	520
INITIAL	200	508
DIFFERENCE	255	12

Ambient Temperature 85
Barometric Pressure 29.40
Assumed Moisture, % 21
Probe Length, m(ft) 5
Nozzle Identification No. .000383
Avg. Calibrated Nozzle Dia., (in.) .265/.266/.26
Probe Heater Setting 5
Leak Rate, m^3/min. (cfm) -.02
Probe Liner Material Stainless Steel 316
Static Pressure, mm Hg (in. Hg) +.05
Filter No. RU46

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM (in. Hg)	STACK TEMP (Ts) (°F)	VELOCITY HEAD (Ps) (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)
A) 1	11:58:25 / 12:01	7	270	1.8	2.6	764.50 / 768.00	110	100	240	60
2	12:04	7	270	1.8	2.6	771.80 / 770.90	120	100	240	60
3	12:07	7	270	1.8	2.6	774.10	120	100	240	60
4	12:10	7	270	1.8	2.6	777.50	120	100	250	60
5	12:13	7	270	1.8	2.6	780.90	120	100	250	60
6	12:16	2	270	.4	.6	783.10	120	100	260	60
7	12:19	2	270	.35	.45 / .52	784.50	120	100	260	60
8	12:22	2	270	.3	.45	785.80	120	100	260	60
9	12:25	2	270	.3	.45	787.10	120	100	250	60
10	12:28	2	270	.3	.45	788.20	120	100	240	60
11	12:31	2	270	.3	.45	788.90	110	100	250	60
12	13:17 / 13:20	2	270	.3	.45	790.00	120	100	240	60
B) 1	13:30 / 13:38	2	270	.3	.45	790.50	120	100	240	60

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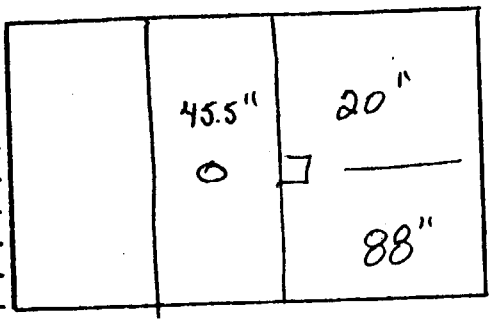
RAMCON emissions test log sheet, cont. DATE 6-25-84 LOCATION Easton Md. TEST NO. 3

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)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
2	13:37	2	270	.3	.45	792.50	105	100	260	60
3	13:39 ~~13:39~~	2	270	.3	.45	794.30	115	100	260	60
4	~~M:49~~ ~~14:52~~	3	260	.42	.62	796.40	100	100	255	60
5	14:55	3	260	.50	.72	798.10	110	100	255	60
6	14:58	4	260	.60	.88	799.70	115	100	255	60
7	15:01	6	260	1.1	1.6	802.40	120	100	255	60
8	15:04	7	265	1.4	2.1	805.20	120	100	255	60
9	15:07	8	265	1.7	2.5	808.70	120	100	255	60
10	15:10	8	265	1.7	2.5	811.80	120	100	260	60
11	15:13	8	265	1.6	2.4	815.50	120	100	260	60
12	15:16	8	265	1.4	2.1	818.358	120	100	260	60

RAMCON ENVIRONMENTAL CORPORATION

Plant Mathis Ly Const
Location Easton Md
Operator Sam Turner
Date 6-26-84
Run No. Four
Sample Box No. One
Meter Box No. 700205
Meter H @ 1.26
C Factor .99
Pitot Tube Coefficient Cp .79



Schematic of Stack Cross Section

Ambient Temperature 80
Barometric Pressure 29.95
Assumed Moisture, % 14
Probe Length, m(ft) 5'
Nozzle Identification No. .000 383
Avg. Calibrated Nozzle Dia., (in.) .266 / .265 / .26
Probe Heater Setting 5
Leak Rate, m³/min. (cfm)
Probe Liner Material Stainless Steel
Static Pressure, mm Hg (in. Hg) ±.05
Filter No. RV-31

	IMPINGER VOLUME ml	SILICA GEL WEIGHT g
FINAL	507	495
INITIAL	200	475
DIFFERENCE	307	20

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM (in. Hg)	STACK TEMP (Ts) (°F)	VELOCITY HEAD (Ps) (in) H2O	PRESSURE DIFF. ORF. MTR (in H2O)	GAS SAMPLE VOLUME (ft³)	GAS SAMPLE TEMP. AT DRY GAS METER (°F) Inlet	Outlet	FILTER HOLDER TEMP (°F)	GAS TEMP LVG CONDENSER OR LAST IMPINGER (°F)
A) 1	7:26 / 7:29	4	280	1.5	2.2	818.62 / 820.10	80	(ST) 80 70	250	60
2	7:32	5	280	1.9	2.8	825.30	90	70	255	60
3	7:35	5	280	1.9	2.8	828.60	95	70	255	60
4	7.38	5	280	1.9	2.8	832.00	100	75	255	60
5	7:41	5	280	1.7	2.5	836.00	100	75	255	60
6	7:44	5	280	1.3	1.9	838.20	105	80	260	60
7	7:47	(ST) 82	280	.45 ~~.50~~ 60	.72	840.20	105	80	260	55
8	7:50	2	275	.30	.48	841.55	105	80	260	55
9	7:53	2	270	.30	.48	842.90	105	80	260	55
10	7:56	2	270	.37	.56	844.50	105	80	260	55
11	7:59	2	270	.37	.56	846.00	105	80	260	55
12	8:02	2	270	.30	.48	847.46	105	80	260	55
A) 1	8:14 / 8:17	2	270	.15	.72	849.20	100	85	260	55

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RAMCON emissions test log sheet, cont. DATE 6-26-84 LOCATION Easton Md TEST NO. 4

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)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
2	8:20	3	270	.50	.80	851.20	105	85	255	60
3	8:23	3	270	.50	.80	852.90	110	85	255	60
4	8:26	3	270	.56	.85	854.80	110	85	255	60
5	8:29	3	270	.56	.85	856.70	110	90	250	60
6	8:32	3	270	.56	.85	858.50	110	90	250	60
7	8:35	5	270	1.5	2.2	861.70	110	90	250	60
8	8:38	6	270	1.7	2.5	864.90	115	90	245	55
9	8:41	6	270	1.8	2.7	868.40	115	90	245	55
10	8:44	7	270	2.0	3.0	871.70	115	90	245	55
11	8:47	7	270	2.0	3.0	875.30	115	90	245	55
12	8:50	6	270	1.6	2.4	878.587	115	90	245	60

IX. CALIBRATIONS

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number 1 Date 5-25-84 Meter box number C-282 Plant Douglas

Barometric pressure, P_b = 30.3 in. Hg Dry gas meter number 700205 Pretest Y 1.00

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	10	10.68	76	132	101	116.5	18.80	5	1.00	1.64
1	10	10.70	76	134	102	118.0	18.81	5	1.00	1.64
1	10	10.72	76	135	103	119	18.82	5	1.00	1.64
									Y = 1.00	

[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 ±0.05Y.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number 1 Date 6-29-89 Meter box number C-28Z Plant Mattingly

Barometric pressure, P_b = 29.65 in. Hg Dry gas meter number 700805 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	$\frac{Y_i \cdot V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
2	10	44.95 → 55.25	78	106	82	94	10.75	5	1.27	0.99
2	10	55.25 → 65.60	78	109	83	95.5	10.65	5	1.26	0.99
2	10	65.60 → 75.95	78	107	84	95.5	10.71	5	1.27	0.99
									Y =	

[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 ±0.05Y.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 8-25-83 Thermocouple number INLET/OUTLET

Ambient temperature 99 °F Barometric pressure 29.92 in. Hg

Calibrator S. Buck Reference: mercury-in-glass 100 °F

other _____

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
100	INLET AMBIENT	100 °F	100 °F	0 %
100	OUTLET AMBIENT	100 °F	100 °F	0 %
	AMBIENT 6-25-84	85 °F	85 °F	0 %

[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 ≤ 1.5%.

RAMCON

Lear Siegler Stack Sampler

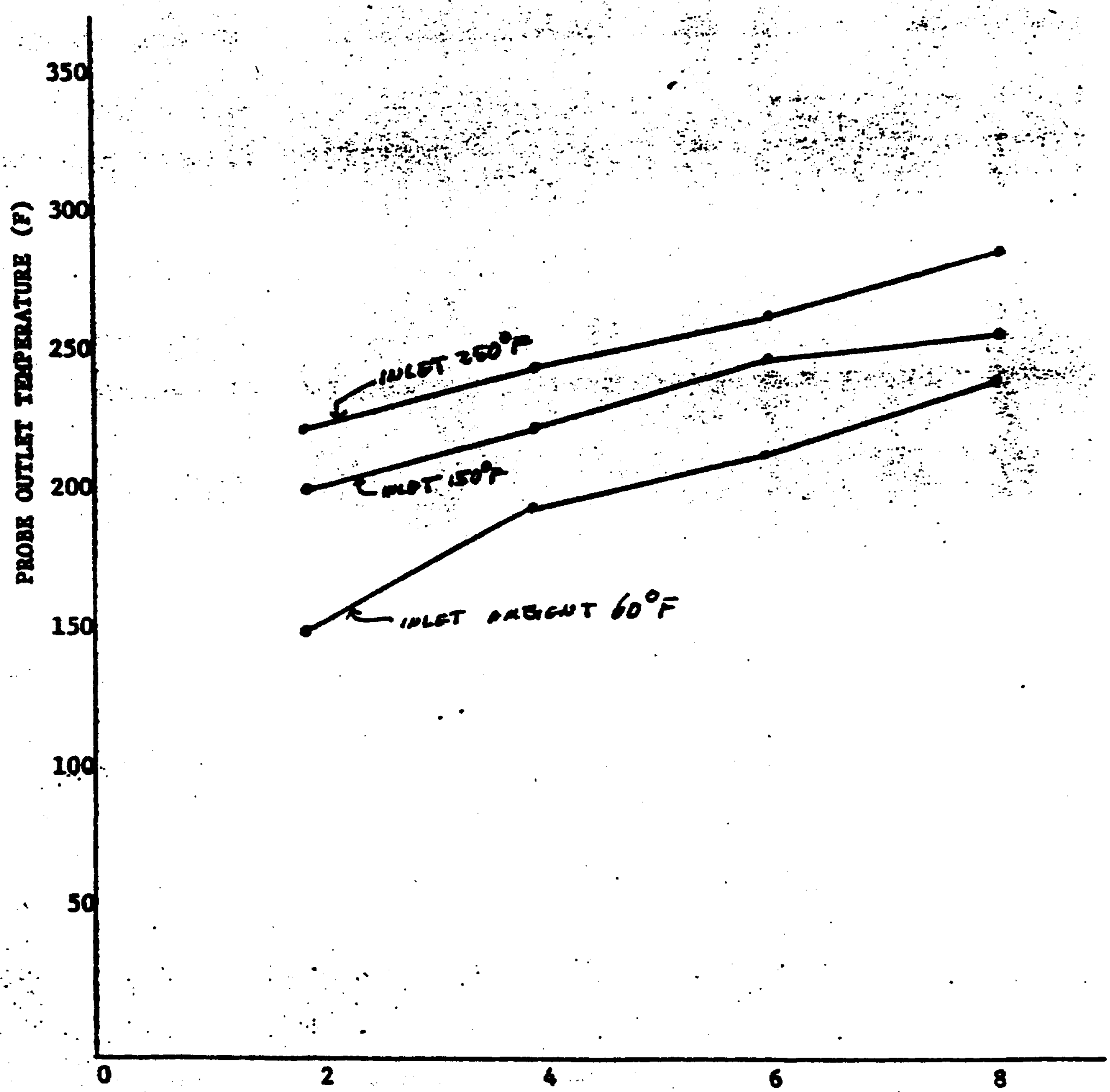
Heating Probe Calibration

Probe No. 2 Probe Length 5'

Date of Calibration 3/11/77 Signature W.C Lehinger

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



RAMCON ENVIRONMENTAL CORPORATION

Date 1/20/81 Thermocouple number 5'

Ambient temperature 76 °C Barometric pressure _____ in. Hg

Calibrator Lee Reference: mercury-in-glass ✓

other _____

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
76° F	Ambient	were 75.5°	76°F	99.3% accur
32° F 0° C	ice bath	32° F 0° C	32°F	100% accur
	AMBIENT 6-25-84	85°F	85°F	0%

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.

RAMCON ENVIRONMENTAL CORPORATION

Lear Siegler Stack Sampler

Nozzle Diameter Calibration

Date _____ Signature _____

Nozzle No.	Average Diameter	Nozzle No.	Average Diameter
1	.310/.310/.310/=.310 mm = .122"	7	.700/.701/.701/=.701 mm = .276
2	.400/.400/.395/=.398 mm = .157"	8	
3	.455/.450/.460/=.455 mm = .179"	9	
4	.460/.460/.460/=.460 mm = .181	10	
5	.600/.600/.610/=.607 mm = .239"	11	
6	.600/.600/.610/=.603 mm = .240"	12	

Pitot Tube Calibration (S Type)

Pitot Tube Identification No. 5' Date 7/15/81

Calibrated by: JoKee

"A" SIDE CALIBRATION Green (impact)

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	.44	.71	.787	
2	.58	.94	.785	
3	.74	1.20	.785	
		$\bar{C}_p$ (SIDE A)	.786	

7-13-81 SB

"B" SIDE CALIBRATION Red (static)

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	.46	.74	.788	
2	.61	.82	.788	
3	.71	1.14	.789	
		$\bar{C}_p$ (SIDE B)	.788	

7-13-81 SB

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_1^3 |C_p(s)-\bar{C}_p(\text{A OR B})|}{3} \leftarrow \text{MUST BE} \leq 0.01$$

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

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

RAMCON ENVIRONMENTAL CORPORATION

Date 8/20/81 Thermocouple number Hottest

Ambient temperature 76 °C Barometric pressure _____ in. Hg

Calibrator Lee Reference: mercury-in-glass ✓

other _____

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
100°C	boiling H_2O	100°C	100°C	100%
76°F	ambient	mercury 75.5F	75°C	99.3%
	AMBIENT 6-25-84	85°F	85°F	0%

[a] Every 30°C (50°F) for each reference point.

[b] Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.

X. RAMCON PERSONNEL

RAMCON Environmental Stack Test Team

Sumner Buck - President & Field Supervisor

Sumner Buck is the President of RAMCON Environmental. He is a graduate of the EPA 450 "Source Sampling for Particulate Pollutants" course and the 474 "Continuous Emissions Monitoring" course all given at RTP. Mr. Buck is a qualified V.E. reader with current certification. Mr. Buck has personally sampled over 300 stacks including over 100 asphalt plants. He is 40 years old and a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis.

Sam Turner - Team Leader

Sam Turner has three years experience in the Air Division and is qualified as a team leader. He has sampled over twenty large boiler stacks and approximately 75 asphalt plants. He is a graduate of State Technical Institute of Memphis, and holds an Associate Degree in Environmental Engineering. He also has another year's experience in the wet chemistry lab.