5/2-3/89

DTE-249-89

DSE FILE 40766

COMMONWEALTH of VIRGINIA

Department of Air Pollution Control

ROOM 801, NINTH STREET OFFICE BUILDING
POST OFFICE BOX 10089
RICHMOND, VIRGINIA 23240
(804) 786-2378

RICHARD L. COOK
EXECUTIVE DIRECTOR

May 30, 1989

Mr. Bernard E. Turlinski
Chief, Air Enforcement Branch
U. S. Environmental Protection Agency
Region III
841 Chestnut Street
Philadelphia, PA 19107

Dear Mr. Turlinski:

Please find enclosed a copy of the in-stack [redacted] conducted for [redacted] at Piney River, Virginia. This source, subject to NSPS, was tested to verify operational compliance with the on-site drum mix asphalt plant.

Sincerely,

Greg L. Clayton
Director, Division of Technical Evaluation

GLC/HTCjr/edb
SE-26

Enclosure

cc: Assistant Executive Director, Technical Services

Copy: Director, DTE 5/18/89

[redacted]N CORPORATION DSE FILE Reg # 40766

Post Office Box 27404 Richmond, Virginia 23261

(804) 262-1233

FAX (804) 262-0925

R)

MAY 89

Reg. III

May 16, 1989

Commonwealth of Virginia
State Air Pollution Control Board
7701-03 Timberlake Road
Lynchburg, Virginia 24502

Attention: Mr. Thomas Henderson, Director Region III

RE: Location - Piney River
Registration No: 40766
County-Plant No: 2080-0019

Dear Mr. Henderson:

Enclosed are two (2) copies of the results of the [redacted] Environmental Corporation as required by our permit.

If you have any further questions or if I may be of any further service in this matter please free to contact me at our office.

Cordially,

BLAKEMORE CONSTRUCTION CORPORATION

L. V. Dawson
Assistant Vice President

LVD:cg

Enclosures: 2 copies RAMCON Reports

DSE FILE 40766

RAMCON

ENVIRONMENTAL CORPORATION

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
BLAKEMORE CONSTRUCTION COMPANY
PINEY RIVER, VIRGINIA
MAY 2 & 3, 1989

Steve Runion
Blakemore Construction

G. Sumner Buck, III
President

Dave Armstrong
Team Leader

RAMCON BUILDING, 223 SCOTT STREET, MEMPHIS, TENNESSEE 38112

RAMCON

ENVIRONMENTAL CORPORATION

May 10, 1989

Mr. Steve Runion
[redacted]
P.O. Box 27404
Richmond, VA 23261

Re: Particulate Emissions Test: [redacted]

Dear Mr. Runion:

Enclosed you will find four copies of our report on the [redacted] test we conducted on your plant. Based on our test results, the average grain loading of the three test runs does pass N.S.P.S. emissions limitations set by US EPA and the State of Virginia. Therefore, the plant is operating in compliance with Federal and State Standards.

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

Mr. Thomas Henderson
Virginia Air Quality
7701-03 Timberlake
Lynchburg, VA 24502

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

Sincerely,

G. Sumner Buck, III
President

GSBIII:kr

Enclosures

TABLE OF CONTENTS

I. INTRODUCTION

[redacted] personnel from RAMCON Environmental Corporation conducted a source emissions test for particulate emissions compliance at Blakemore Construction Company's CMI [redacted] located in Piney River, Virginia. RAMCON personnel conducting the test were Dave Armstrong, Team Leader, and Dave Bailey. Sam Turner 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. Armstrong.

The purpose of the test was to determine if the rate of particulate emissions from this plant [redacted] is below or equal to the allowable [redacted] missions limit set by US EPA and the State of Virginia.

II. 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 Virginia are the same as those set by EPA.

Mr. Ward Butler of Commonwealth of Virginia's State Air Pollution Control Board observed the testing conducted by RAMCON.

TABLE I

SUMMARY OF TEST RESULTS

May 2 & 3, 1989

Test [redacted]	Time	Grain Loading	[redacted] Variation	Actual Emissions
1	14:15 to 16:39	0.0134 gr/DSCF	106.5%	2.0 lbs/hr
2	08:43 to 09:48	0.0156 gr/DSCF	99.0%	2.0 lbs/hr
3	10:47 to 11:51	0.0167 gr/DSCF	98.7%	2.1 lbs/hr
	Average:	[redacted]		[redacted]

On the basis of these test results, the average grain loading of the three test runs was below the [redacted] emissions limitation set by EPA and the State of Virginia. Therefore, the plant is operating in compliance with State and Federal Standards.

III. TEST PROCEDURES

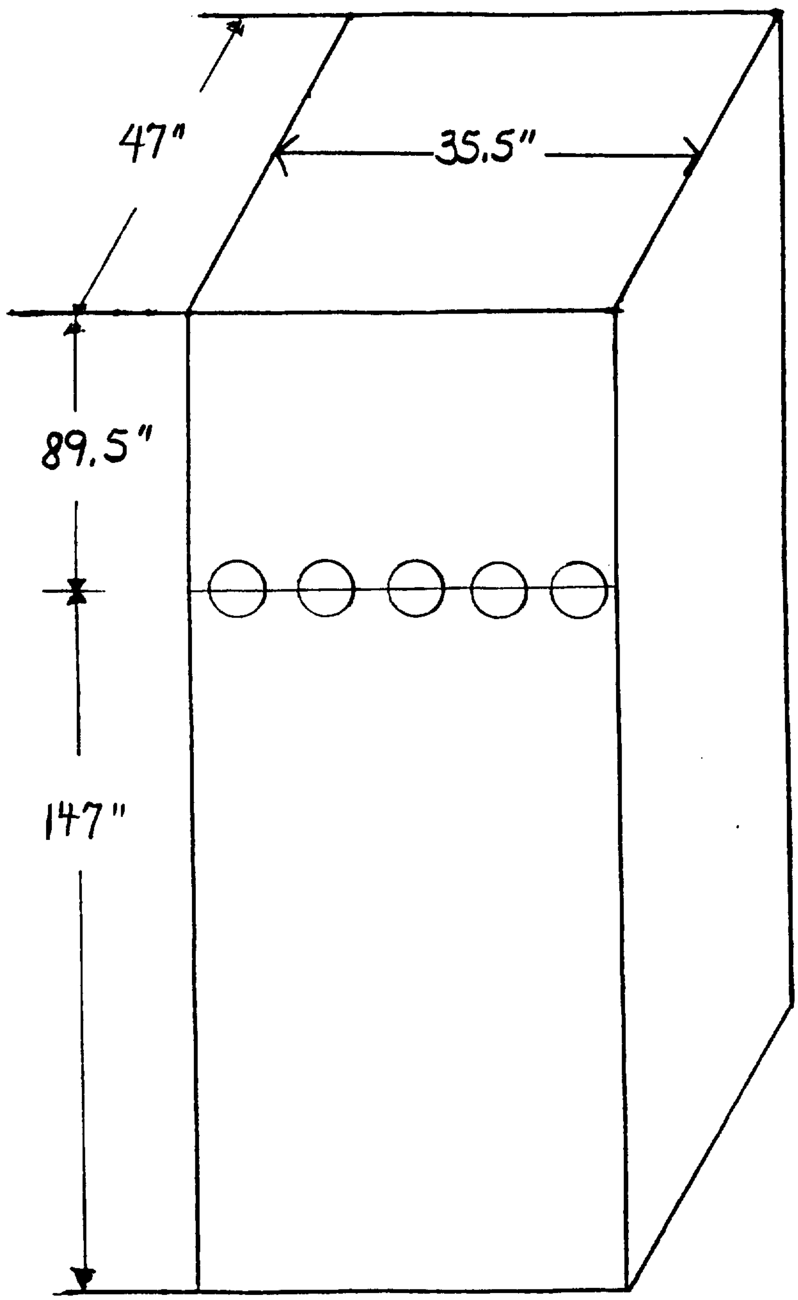
A. Method Used: [redacted] source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

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 35.5" x 47" with an equivalent diameter of 40.5". Five sampling ports were placed 89.5" down (1.9 diameters upstream) from the top of the stack and 147" up (3.1 diameters downstream) from the last flow disturbance. The ports were evenly spaced on 7.1" centers. The two outside ports are 3.5" from the side walls of the stack. Thirty points were sampled, six through each port for two minutes each.

Points on a Diameter	Probe Mark
1	*7.9"
2	15.8"
3	23.6"
4	31.4"
5	39.3"
6	47.1"

Measurements include a 4" standoff.



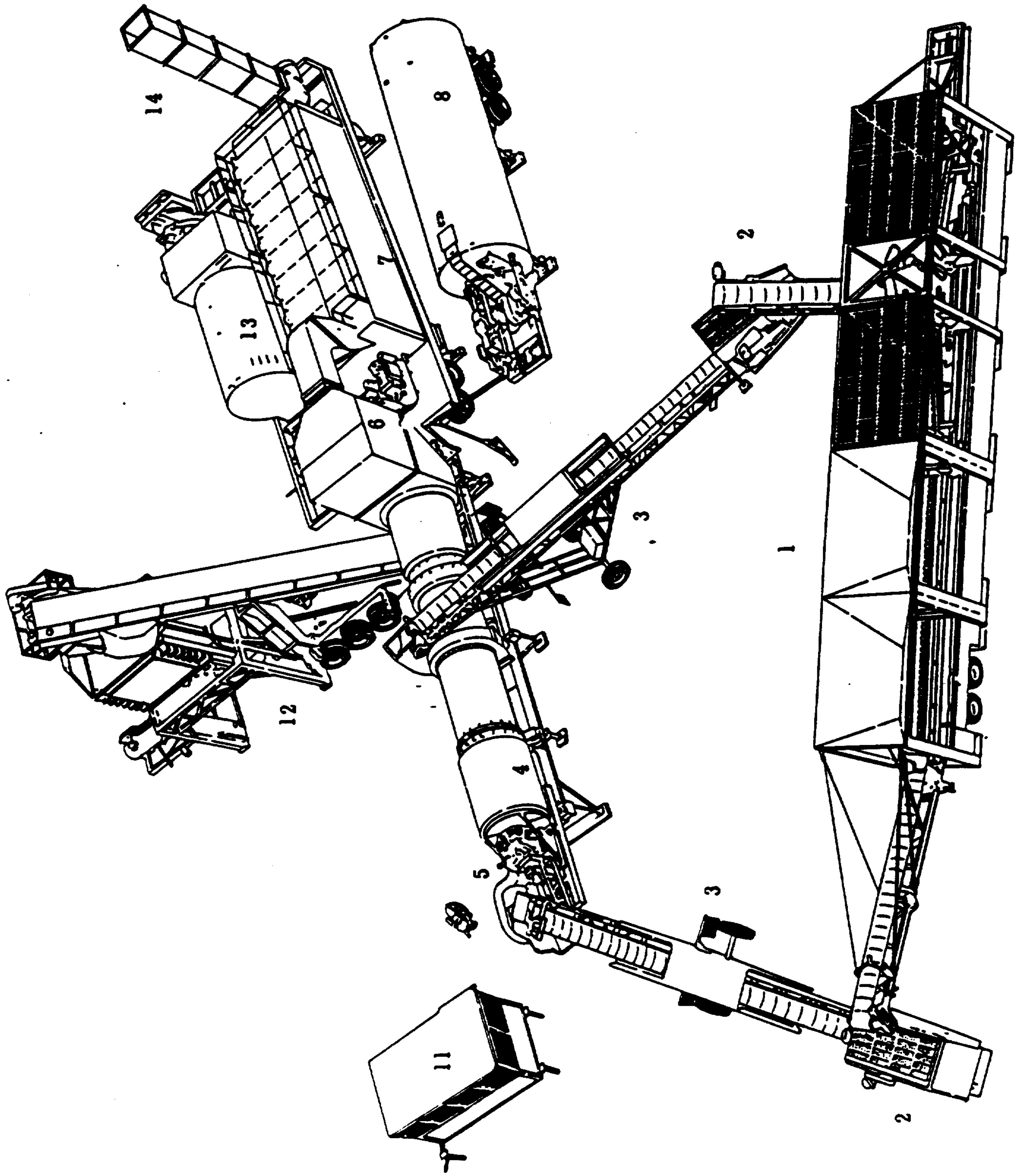
IV. THE SOURCE

IV. THE SOURCE

Blakemore Construction Company employs a CMI 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 to 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 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. 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 used a burner fired with #2 fuel oil to heat air to dry the aggregate, and the motion of the rotating drum to blend the aggregate. The hot asphalt oil is blended into the aggregate in the coater. 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 Aeropulse. 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 2-6 inches of water. The particulate matter, which is removed by the baghouse, is reinjected into the drum mixer.



CMI drum mixer plant (baghouse)

1. Aggregate bins: Virgin aggregate is fed individually into each of four bins by type. It is metered onto a conveyor belt running under the bins to a shaker screen. The proporation 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 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 provide the flame which drys the aggregate.

6. Knock off baffleing: A baffeling 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 project.

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

13. Fuel Storage

DATA SUMMARY

Plant

1. Manufacturer of plant CMI.
2. Designed maximum operating [redacted] @ 5 % moisture.
3. Actual [redacted] @ 5 % moisture.
4. Startup date 11-3-88.
5. Type of [redacted] DIESEL.
6. Quanity of fuel consumption 256.8 GAL.

Aggregate

7. Name/[redacted].
8. Percent asphalt in mix 4.95 %.
9. Temperature of asphalt 280.
10. Sieve/Screening analysis: % Passing;

1"	100	3/8"	65.7	#30	17.3
3/4"	100	#4	43.8	#50	11.[illegible]
				#100	7.5
1/2"	100	#8	32.[illegible]	#200	5.6

Baghouse

11. Manufacturer AERO PULSE INC.
12. No. of bags 684. Type of [redacted].
13. Air to [redacted]. Designed [redacted].
14. Square feet of bags 8200.
15. Type of [redacted] YES, reverse air ____, plenum pulse ____, other ____.
16. Cleaning cycle time 2 SEC.
17. Interval between cleaning cycle 3 SEC.
18. Pressure [redacted]
19. Pulse pressure on cleaning cycle 100 PSI psi.

COMPANY NAME B[illegible] CONST. CORP. DATE 5-3-8[illegible]

COMPANY REPRESENTATIVE [illegible]

PLANT DATA
(8)

COMPANY NAME Blakemore Const. Co.

COMPANY REP. Larry Dawson DATE 5-2, 3-1989 PHONE # 271 5041 Area Code (804

DATA SOURCE

PLANT LOCATION Piney River, Virginia

PLANT MFG. PLANT MODEL # PLANT TYPE Drum

MIX SPECIFICATION # S-10 OIL SPECIFICATION # 2

Time 24 Hour	✓ Fuel Oil ✓ Nat. Gas __ Propane __ Coal __	Burner Setting	Aggregate TPH	Recycle TPH	Liquid Asphalt TPH	Mix Temp. °F	__ Venturi __ Baghouse Pressure Drop Inches Water
5-2-89							
2:15		40%	208		115	284	3.5
2:30		40%	204		114	284	3.2
2:45		40%	203		[illegible]	[illegible]	3.5
4:15		40%	203		114	[illegible]	4.0
4:30		40%	[illegible]		113	280	4.1
5-3-89							
[illegible]		40%	[illegible]		[illegible]	[illegible]	[illegible]
9:00		35%	185		106	283	[illegible]
9:15		35%	[illegible]		[illegible]	256	4.75
9:30		35%	195		103	270	4.5
9:45		35%	[illegible]		103	[illegible]	4.5
11:00		35%	[illegible]		101	282	3.6
11:15		33%	181		102	290	4.0
11:30		35%	[illegible]		[illegible]	270	4.0
11:45		35%	[illegible]		[illegible]	[illegible]	[illegible]
			$\frac{2669}{14}$ = 191		$\frac{1501}{14}$ = 107		

V. EQUIPMENT USED

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 nex page.

B. An Airguide Instruments Model 211-B (uncorrected) aneroid barometer was used to check the barometric pressure.

C. Weston dial thermometers are used to check meter temperatures. An Analogic Model 2572 Digital Thermocouple is used for stack temperatures.

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

E. Filters are mady by Schleicher and Schuell and are type 1-HV with a porosity of .03 microns.

F. The acetone is reagent grade or ACS grade with a residue of $\leq$ .001.

VI. LABORATORY PROCEDURES & RESULTS

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 desiccator to dry for at least 24 hours. Clean plastic petri dishes, also numbered, top and bottom, are placed in the desiccator with the filters. After desiccation, 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 books. 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 at 175°C for two hours. The open jars are removed and placed in a desiccator until cool for two hours and then tightly sealed. The jars are then numbered and weighed on the triple beam balance to the closest tenth of a gram. 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 petri dishes. In the lab, the dishes are opened and placed into a desiccator for at least 24 hours. Then the filters are weighed continuously every six hours until a constant weight is achieved. All data is recorded on the laboratory forms that will be bound in the test report.

B. SILICA GEL: The silica gel used in the stack test is returned to the appropriate mason jar and sealed for transport to the laboratory where it is reweighed to a constant weight on a triple beam balance to the nearest tenth of a gram.

C. PROBE RINSINGS: In all tests where a probe washout analysis is necessary, this is accomplished in accordance with procedures specified in "EPA Reference Method 5". These samples are returned to the lab in sealed mason jars for analysis. The front half of the filter holder is washed in accordance with the same procedures and included with the probe wash. Reagent or ACS grade acetone is used as the solvent. The backhalf of the filter holder is washed with deionized water into the impinger catch for appropriate analysis.

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

E. ACETONE: A blank analysis of acetone is conducted from the one gallon glass container used in the field preparation. This acetone was used in the field for rinsing the probe, nozzle, and top half of the filter holder. A blank analysis is performed prior to testing on all new containers of acetone received from the manufacturer to insure that the quality of the acetone used will be exceed the .001% residual purity standard.

SPECIAL NOTE

When sampling sources high in moisture content, (such as asphalt plants) the filter paper sometimes sticks to the filter holder. When removing the filter, it may tear. In order to maintain control of any small pieces of filter paper which may be easily lost, they are washed with acetone into the probe washing. This makes the filter weight light (sometimes negative) and the probe wash correspondingly heavier. this laboratory procedure is taught by EPA in the "Quality Assurance for Source Emissions Workshop" at Research Triangle Park and is approved by EPA.

WEIGHING PROCEDURE - SARTORIUS ANALYTICAL BALANCE

The Sartorius balance is accurate to 0.1 mg and has a maximum capacity of 200 grams. The balance precision (standard deviation) is 0.05 mg. 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 the "zero" position. The beam arrest lever (on the lower left hand side toward the rear of the balance) is then slowly pressed downward to the full release position. The lighted vernier scale on the front of the cabinet should align with 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 the 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 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 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 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. The balance is sensitive to even a hand on the table near the balance, so be careful and painstaking in every movement while weighing.

Form REC#8

(13)

SAMPLE ANALYTICAL DATA FORM

Plant Location Blue[illegible] | Relative humidity in lab 57 %

Sample Location hot mix asphalt plant | Density of Acetone (p_a) .7853 mg/ml

Blank volume (V_a) 100 ml

Date/Time wt. blank 5-8-89 | Gross wt. 136.4459 mg

Date/Time wt. blank 5-9-89 | Gross wt. 136.4459 mg

Ave. Gross wt. 136.4459 mg

Tare wt. 136.4459 mg

Weight of blank (m_{ab}) 0.000 mg

Acetone blank residue concentration (C_a) $(C_a) = (M_{ab}) / (V_a)(p_a)$ = (0 mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} P_a$ = (0)(200)(.7853) = (0)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	450	425	425
Date/Time of wt 5-8-89 8:30 Gross wt	g	136.8676	143.4042	134.6541
Date/Time of wt 5-9-89 8:30 Gross wt	g	136.8678	143.4043	134.6541
Average Gross wt	g	136.8677	143.4043	134.6541
Tare wt	g	136.8383	143.3814	134.6318
Less acetone blank wt (W_a)	g	0	0	0
Wt of particulate in acetone rinse (m_a)	g	0.0294	0.0229	0.0223

Filter Numbers	#	FK-3315	FK-3317	FK 3316
Date/Time of wt 5-8-89 8:30 Gross wt	g	0.5331	0.5418	0.5481
Date/Time of wt 5-9-89 8:30 Gross wt	g	0.5333	0.5419	0.5480
Average Gross wt	g	0.5332	0.5418	0.5481
Tare wt	g	0.5278	0.5243	0.5302

Weight of particulate on filters(s) (m_f)	g	0.0054	0.0175	0.0179
Weight of particulate in acetone rinse	g	0.0294	0.0229	0.0223
Total weight of particulate (m_n)	g	0.0348	0.0404	0.0402

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 Sam Turner

Signature of reviewer [illegible]

Blakemore

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: 14.84 = 20.9 - [1.3465 x 4.5]

RUN #2: 15.24 = 20.9 - [1.3465 x 4.2]

RUN #3 15.78 = 20.9 - [1.3465 x 3.8]

RUN 1:	$CO_{2\%}$	4.5	$CO_{2\%}$	4.5	$CO_{2\%}$	4.5	AVG.	4.5
	$O_{2\%}$	14.84	$O_{2\%}$	14.84	$O_{2\%}$	14.84	AVG.	14.84
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.66
RUN 2:	$CO_{2\%}$	4.0	$CO_{2\%}$	4.0	$CO_{2\%}$	4.5	AVG.	4.2
	$O_{2\%}$	15	$O_{2\%}$		$O_{2\%}$		AVG.	15.24
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.56
RUN 3:	$CO_{2\%}$	4.0	$CO_{2\%}$	3.5	$CO_{2\%}$	4.0	AVG.	3.8
	$O_{2\%}$		$O_{2\%}$		$O_{2\%}$		AVG.	15.78
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.42

VII. CALCULATIONS

BLAKEMORE CONSTRUCTION CORPORATION
PINEY RIVER, VIRGINIA

SUMMARY OF TEST DATA

		5-2-89	5-3-89	5-3-89
		RUN #1	RUN #2	RUN #3
SAMPLING TRAIN DATA				
	start	14:15	08:43	10:47
	finish	16:39	09:48	11:51
1. Sampling time, minutes	θ	60.0	60.0	60.0
2. Sampling nozzle diameter, in.	D_n	.2530	.2530	.2530
3. Sampling nozzle cross-sect. area, ft^2	A_n	.000349	.000349	.000349
4. Isokinetic variation	I	106.5	99.0	98.7
5. Sample gas volume - meter cond., cf.	V_m	42.394	41.181	38.585
6. Average meter temperature, ^oR	T_m	548	539	544
7. Avg. oriface pressure drop, in. H_2O	dH	1.55	1.49	1.29
8. Total particulate collected, mg.	M_n	34.80	40.40	40.20
VELOCITY TRAVERSE DATA				
9. Stack area, ft^2	A	11.60	11.60	11.60
10. Absolute stack gas pressure, in. Hg.	P_s	29.50	29.78	29.78
11. Barometric pressure, in. Hg.	P_{bar}	29.50	29.78	29.78
12. Avg. absolute stack temperature, R^o	[redacted]	709	707	710
13. Average $-\sqrt{\text{vel. head}}$, (C_p= .82)	$-\sqrt{dP}$	0.81	0.83	0.78
14. Average stack gas velocity, ft./sec.	V_s	54.06	54.67	51.60
STACK MOISTURE CONTENT				
15. Total water collected by train, ml.	V_{ic}	278.00	226.00	220.00
16. Moisture in stack gas, %	B_{ws}	24.67	21.15	21.94
EMISSIONS DATA				
17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	1248	1338	1245
18. Stack gas flow rate, cfm	[redacted]	37626	38050	35914
19. Particulate concentration, [redacted]	[redacted]	0.0134	0.0156	0.0167
20. Particulate concentration, [redacted]	[redacted]	2.39	2.98	2.97
21. Particulate concentration, [redacted]	[redacted]	0.00000	0.00000	0.00000
ORSAT DATA				
22. Percent CO_2 by volume	CO_2	4.50	4.20	3.80
23. Percent O_2 by volume	O_2	14.84	15.24	15.78
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	80.66	80.56	80.42

Format: summryR3

Dry Gas Volume

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

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 ^{o}R.

T_{std} = Standard absolute temperature ($528^{o}R$).

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

Y = Dry gas meter calibration factor.

13.6 = Inches water per inches Hg.

RUN 1:

$$V_{m(std)} = (17.64)(\ .990)(\ 42.394)\left[\frac{(29.50) + \frac{1.55}{13.6}}{548}\right] = 40.009\ \text{dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(\ .990)(\ 41.181)\left[\frac{(29.78) + \frac{1.49}{13.6}}{539}\right] = 39.881\ \text{dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(\ .990)(\ 38.585)\left[\frac{(29.78) + \frac{1.29}{13.6}}{544}\right] = 37.005\ \text{dscf}$$

Isokinetic Variation

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

Where:

I	=	Percent isokinetic sampling.
100	=	Conversion to percent.
T_s	=	Absolute average stack gas temperature, ^oR.
0.002669	=	Conversion factor, Hg - ft^3/ml - ^oR.
V_{ic}	=	Ttl vol of liquid collected in impingers and silica gel, ml.
T_m	=	Absolute average dry gas meter temperature, ^oR.
P_{bar}	=	Barometric pressure at sampling site, (in. Hg).
dH	=	Av 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:

$$I = (100)(\;709\;) \left[\frac{(0.002669)(278.00) + \frac{42.394}{548} \left[29.50 + \frac{1.55}{13.6} \right]}{60 \; (\;60.0\;)\;(\;54.06\;)\;(\;29.50\;)\;(\;.000349\;)} \right] = 106.5\%$$

Run 2:

$$I = (100)(\;707\;) \left[\frac{(0.002669)(226.00) + \frac{41.181}{539} \left[29.78 + \frac{1.49}{13.6} \right]}{60 \; (\;60.0\;)\;(\;54.67\;)\;(\;29.78\;)\;(\;.000349\;)} \right] = 99.0\%$$

Run 3:

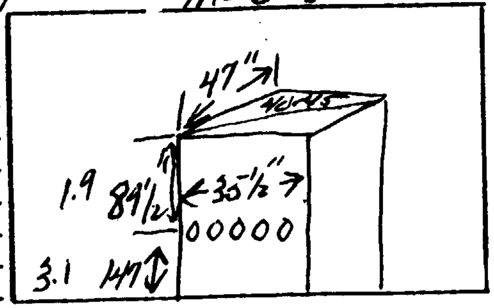
$$I = (100)(\;710\;) \left[\frac{(0.002669)(220.00) + \frac{38.585}{544} \left[29.78 + \frac{1.29}{13.6} \right]}{60 \; (\;60.0\;)\;(\;51.60\;)\;(\;29.78\;)\;(\;.000349\;)} \right] = 98.7\%$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Blakemore Const. (CMI)   m=2.3

Location Piney River, Va.
Operator Dave Armstrong
Date 5-2-89
Run No. 1
Sample Box No. 1
Meter Box No. 670725 / C-182
Meter H @ 1.94
C Factor .987
Pitot Tube Coefficient Cp .818



Schematic of Stack Cross Section

Ambient Temperature 72°F
Barometric Pressure 29.50
Assumed Moisture, % 22
Probe Length, m(ft) 8 Ft.
Nozzle Identification No. .0003491
Avg. Calibrated Nozzle Dia., (in.) .253/.253/.253
Probe Heater Setting 5
Leak Rate, m³/min. (cfm) +.002 @ 6"
Probe Liner Material Stainless Steel
Static Pressure, mm Hg (in.Hg) +.05"
Filter No. 1 K 3315

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	474	528.0
INITIAL	200	524.0
DIFFERENCE	274	4

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
A 1	2:15 / 2:17	4	252	.70	1.6	115.750 / 117.18	86	84	275	60
2	2:19	4	254	.72	1.7	118.66	88	84	275	60
3	2:21	4.5	255	.78	1.8	120.17	92	82	275	60
4	2:23	5	256	.95	2.2	121.81	92	80	275	60
5	2:25	5.5	256	.96	2.2	123.45	94	80	275	60
6	2:27	5.5	248	1.0	2.3	125.15	96	80	275	60
B 1	2:28 / 2:30	4	246	.68	1.6	126.61	94	80	275	60
2	2:32	4	252	.64	1.5	128.02	96	80	275	60
3	2:34	4	256	.65	1.5	129.42	96	80	275	60
4	2:36	4.5	258	.75	1.7	130.89	100	80	275	60
5	2:38	5	258	.92	2.1	132.50	100	80	275	60
6	2:40	6	252	1.1	2.5	134.24	100	80	275	60
C 1	2:41 / 2:43	4	244	.63	1.4	135.62	98	80	275	60

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 5-2-89 LOCATION Piney River, VA. 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) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	2:45	4	248	.55	1.3	136.46	100	80	275	60
plant 3	2:47	4	254	.58	1.3	138.27	100	80	275	60
Down 4	2:49	4	256	.61	1.4	139.61	102	80	275	60
4:08 / 4:10 5	~~4:08~~ ~~2:51~~	4	232	.60	1.4	140.97	92	80	275	60
4:12 6	~~4:10~~ ~~2:53~~	3.5	234	.48	1.1	142.26	92	80	275	60
D 1	4:13 / 4:15	5	234	.84	1.9	143.81	92	80	275	60
2	4:17	4.5	236	.64	1.5	145.23	94	80	275	60
3	4:19	4	242	.51	1.2	146.54	94	80	275	60
4	4:21	3	246	.42	.97	147.68	96	80	275	60
5	4:23	3.5	248	.48	1.1	148.90	96	78	275	60
6	4:25	4	248	.58	1.3	150.23	96	78	275	60
E 1	4:27 / 4:29	4	248	.64	1.5	151.65	92	78	275	60
2	4:31	4.5	248	.60	1.4	153.03	94	78	275	60
3	4:33	4	248	.50	1.2	154.29	96	78	275	60
4	4:35	4	250	.48	1.1	155.54	98	78	275	60
5	4:37	4	250	.50	1.2	156.86	98	78	275	60
6	4:39	4	250	.60	1.4	158.144	100	78	275	60

RAMCON ENVIRONMENTAL CORPORATION

lant Blakemore Const.
ocation Piney River, Va.
perator Wade Armstrong
ate 5-3-89
un No. 2
ample Box No. 2
eter Box No. 620775
eter H @ 1.94
Factor .987
itot Tube Coefficient Cp .818

m = 2.07 (2.3 struck out)

Schematic of Stack Cross Section

Ambient Temperature 54°F
Barometric Pressure 29.78
Assumed Moisture, % 22
Probe Length, m(ft) 4 Ft.
Nozzle Identification No. .0003491
Avg. Calibrated Nozzle Dia., (in.) .253/.253/.253
Probe Heater Setting 5
Leak Rate, m^3/min. (cfm) +.000 @ 15"
Probe Liner Material STAINLESS STEEL
Static Pressure, mm Hg (in. Hg) +.05"
Filter No. FK 3317

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	416	542.0
INITIAL	200	532.0
DIFFERENCE	216	10

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	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A	1	8:43 / 8:45	3	232	1.4	3.2	172.300 / 174.11	62	60	275	55
	2	8:47	2	230	.98	2.3	175.81	74	60	275	55
	3	8:49	1.5	236	.68	1.6	177.25	78	60	275	55
	4	8:51	1	238	.52	1.2	178.50	80	60	275	55
	5	8:53	1	244	.45	1.0	179.60	82	60	275	55
	6	8:55	1	248	.55	1.1	180.83	84	60	275	55
B	1	8:56 / 8:58	1.5	250	.79	1.6	182.25	82	64	275	55
	2	9:00	1.5	250	.64	1.3	183.66	86	64	275	55
	3	9:02	1	252	.60	1.2	184.77	88	66	275	55
	4	9:04	1	252	.48	.99	185.90	90	66	275	55
	5	9:06	1	254	.44	.91	187.00	90	68	275	55
	6	9:08	1	254	.53	1.1	188.22	92	68	275	55
C	1	9:09 / 9:11	1.5	254	.73	1.5	189.58	90	68	275	55

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 5-3-89 LOCATION Piney River, Va 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 V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	9:13	1.5	254	.58	1.2	190.91	94	70	275	55
3	9:15	1	252	.50	1.0	192.03	94	70	275	55
4	9:17	1	252	.52	1.1	193.26	96	70	275	55
5	9:19	1	250	.58	1.2	194.49	96	70	275	55
6	9:21	1.5	250	.72	1.5	195.90	96	72	275	55
D 1	9:23 / 9:25	1.5	242	.72	1.5	197.31	94	72	275	55
2	9:27	1.5	246	.63	1.3	198.67	96	72	275	55
3	9:29	1	244	.56	1.2	199.93	96	74	275	55
4	9:31	1.5	242	.68	1.4	201.27	96	74	275	55
5	9:33	2	242	.88	1.8	202.79	96	74	275	55
6	9:35	2	246	.90	1.9	204.38	96	74	275	55
E 1	9:36 / 9:38	1.5	242	.67	1.4	205.74	92	74	275	55
2	9:40	1.5	248	.67	1.4	207.11	94	74	275	55
3	9:42	2	250	.71	1.5	208.52	96	74	275	55
4	9:44	2	248	.88	1.8	210.05	96	74	275	55
5	9:46	2.5	248	1.1	2.3	211.73	98	74	275	55
6	9:48	2	248	1.0	2.1	213.381	98	74	275	55

RAMCON ENVIRONMENTAL CORPORATION

Plant Blakemore Const. (CMI)

M = 2.07

Location Piney River, Va.
Operator Paul Armstrong
Date 5-3-89
Run No. 3
Sample Box No. 2
Meter Box No. 670775 / C-185
Meter H @ 1.94
C Factor .987
Pitot Tube Coefficient Cp .818

Ambient Temperature 56°F
Barometric Pressure 29.78
Assumed Moisture, % 22
Probe Length, m(ft) 4 ft.
Nozzle Identification No. .000.3491
Avg. Calibrated Nozzle Dia., (in.) .253/.253/.253
Probe Heater Setting 5
Leak Rate, m^3/min. (cfm) .007 @ 5"
Probe Liner Material Stainless Steel
Static Pressure, mm Hg (in. Hg) .05"
Filter No. 1-K 3316

	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g
FINAL	410	541.0
INITIAL	200	531.0
DIFFERENCE	210	10

Schematic of Stack Cross Section

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 H_20	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	10:47 / 10:49	3	240	1.6	3.3	213.600 / 215.59	80	80	275	50
2	10:51	2	240	.86	1.8	217.20	86	80	275	50
3	10:53	1.5	242	.62	1.3	218.46	88	78	275	50
4	10:55	1	248	.54	1.1	219.70	90	76	275	50
5	10:57	1	250	.52	1.1	220.84	92	76	275	50
6	10:59	1	252	.55	1.1	221.97	92	76	275	50
B 1	11:00 / 11:02	2	244	.88	1.8	223.48	88	76	275	50
2	11:04	1.5	250	.67	1.4	224.92	92	74	275	50
3	11:06	1.5	250	.67	1.4	226.26	92	74	275	50
4	11:08	1	252	.58	1.2	227.46	92	74	275	50
5	11:10	1	254	.44	.91	228.56	94	74	275	50
6	11:12	1	254	.67	1.4	229.92	94	74	275	50
C 1	11:13 / 11:15	2	246	.75	1.6	231.36	92	74	275	50

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 5-3-89 LOCATION Piney River, Va. 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)
2	11:17	1.5	254	.62	1.3	232.69	94	74	275	50
3	11:19	1	256	.48	.99	233.82	94	74	275	50
4	11:21	1	256	.44	.91	234.94	94	74	275	50
5	11:23	1	256	.48	.99	236.08	94	74	275	50
6	11:25	1	256	.48	.99	237.24	94	74	275	50
D 1	11:26 / 11:28	2	244	.82	1.7	238.75	92	74	275	50
2	11:30	2	248	.68	1.4	240.21	94	74	275	50
3	11:32	1	248	.48	.99	241.32	94	74	275	50
4	11:34	1	248	.45	.93	242.41	96	74	275	50
5	11:36	1	248	.40	.83	243.46	96	74	275	50
6	11:38	1	248	.45	.93	244.56	96	74	275	50
E 1	11:39 / 11:41	2	244	.81	1.7	246.04	94	74	275	50
2	11:43	2	252	.78	1.6	247.47	98	76	275	50
3	11:45	1.5	254	.60	1.2	248.77	100	76	275	50
4	11:47	1.5	254	.48	.99	249.93	100	78	275	50
5	11:49	1	252	.45	.93	251.03	102	78	275	50
6	11:51	1	250	.48	~~.93~~ .99	252.185	102	78	275	50

IX. CALIBRATIONS

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 5-5-89 Meter box number 670775/C-185

Barometric pressure, P_b = 29.86 in. Hg Calibrated by D. Armstrong

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: Avg[a] (t_d), °F	Time (Θ), min	Y_i	$\Delta H@_i$ in. H_2O	CFM
0.5	5									
1.0	5									
1.5	10	303.90 / 314.20	75	96 / 98	84 / 84	90.5	15.28	.996	1.93	.674
2.0	10	316.15 / 326.62	75	100 / 100	82 / 82	91	13.21	.980	1.92	.793
3.0	10	328.35 / 338.456	75	100 / 100	82 / 80	90.5	10.75	.976	1.91	.975
4.0	10									
							Avg	.984	1.92	

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$	$\Delta H@_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\Theta}{V_w}\right]^2$
0.5	0.0368		
1.0	0.0737		
1.5	0.110		
2.0	0.147		
3.0	0.221		
4.0	0.294		

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

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date *14 March 89* Meter box number *C-185/670775*

Barometric pressure, P_b = *29.76* in. Hg Calibrated by *D. Armstrong*

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: Avg[a] (t_d), °F	Time (θ), min	Y_i	$ΔH@_i$ in. H_2O	C-s-m
0.5	5	913.189 / 908.160	72	96 / 82	70 / 68	79	12.43	.994	1.84	.397
1.0	5	907.926 / 902.802	72	96 / 82	68 / 68	78.5	9.13	.987	1.86	.561
1.5	10	902.385 / 892.150	72	96 / 82	68 / 68	78.5	15.33	.989	1.97	.668
2.0	10	891.535 / 881.406	72	96 / 84	68 / 68	79	13.28	.994	1.97	.764
3.0	10	881.135 / 870.950	72	100 / 80	68 / 68	79	10.87	.987	1.98	.937
4.0	10	870.444 / 860.552	72	100 / 80	68 / 68	79	9.48	.973	2.01	1.09
							Avg	.987	1.94	.736

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$	$\Delta H@_i = \frac{0.0317\ \Delta H}{P_b\ (t_d + 460)} \left[\frac{(t_w + 460)\ \theta}{V_w}\right]^2$
0.5	0.0368	.994	1.84
1.0	0.0737	.987	1.86
1.5	0.110	.989	1.97
2.0	0.147	.994	1.97
3.0	0.221	.987	1.98
4.0	0.294	.973	2.01

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

Form #REC-02

RAMCON ENVIRONMENTAL CORPORATION

Date 2-10-88 Thermocouple number Outlet

Ambient temperature 55°F °C Barometric pressure 29.96 in. Hg

Calibrator S. Greenwood Reference: mercury-in-glass ✓

other ______

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
A	ICE BATH	33° F	32° F	.03%
B	OVEN	152° F	150° F	.01%
C	OVEN	175° F	175° F	0 %
D	Ambient	55° F	55° F	0%
	5-29-89	72°F	72°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

Date 2-10-88 Thermocouple number Inlet

Ambient temperature 55°F °C Barometric pressure 29.96 in. Hg

Calibrator S. Greenwood Reference: mercury-in-glass ✓

other ______

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, ~~°C~~	Thermocouple Potentiometer Temperature, ~~°C~~	Temperature Difference,[c] %
A	ICE BATH	33°F	33°F	0%
B	OVEN	150°F	151°F	.007%
C	OVEN	175°F	173°F	.01%
D	AMBIENT	55°F	54°F	.02%
	5-27-89	72°F	72°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		7	
2		8	
3		9	
4		10	
5		11	
6		12	

Pitot Tube Calibration (S Type)

Pitot Tube Identification No. 41 Date 2-3-88

Calibrated by: Sam T. Turner

"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	0.90	1.37	.811	< .01
2	0.60	.91	.812	< .01
3	0.41	.62	.806	< .01
		$\bar{C}_p$ (SIDE A)	.810	

"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	0.90	1.38	.808	< .01
2	0.60	.92	.808	< .01
3	0.41	.62	.807	< .01
		$\bar{C}_p$ (SIDE B)	.808	

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

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

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

Form No. EED-17-1

RAMCON

Lear Siegler Stack Sampler

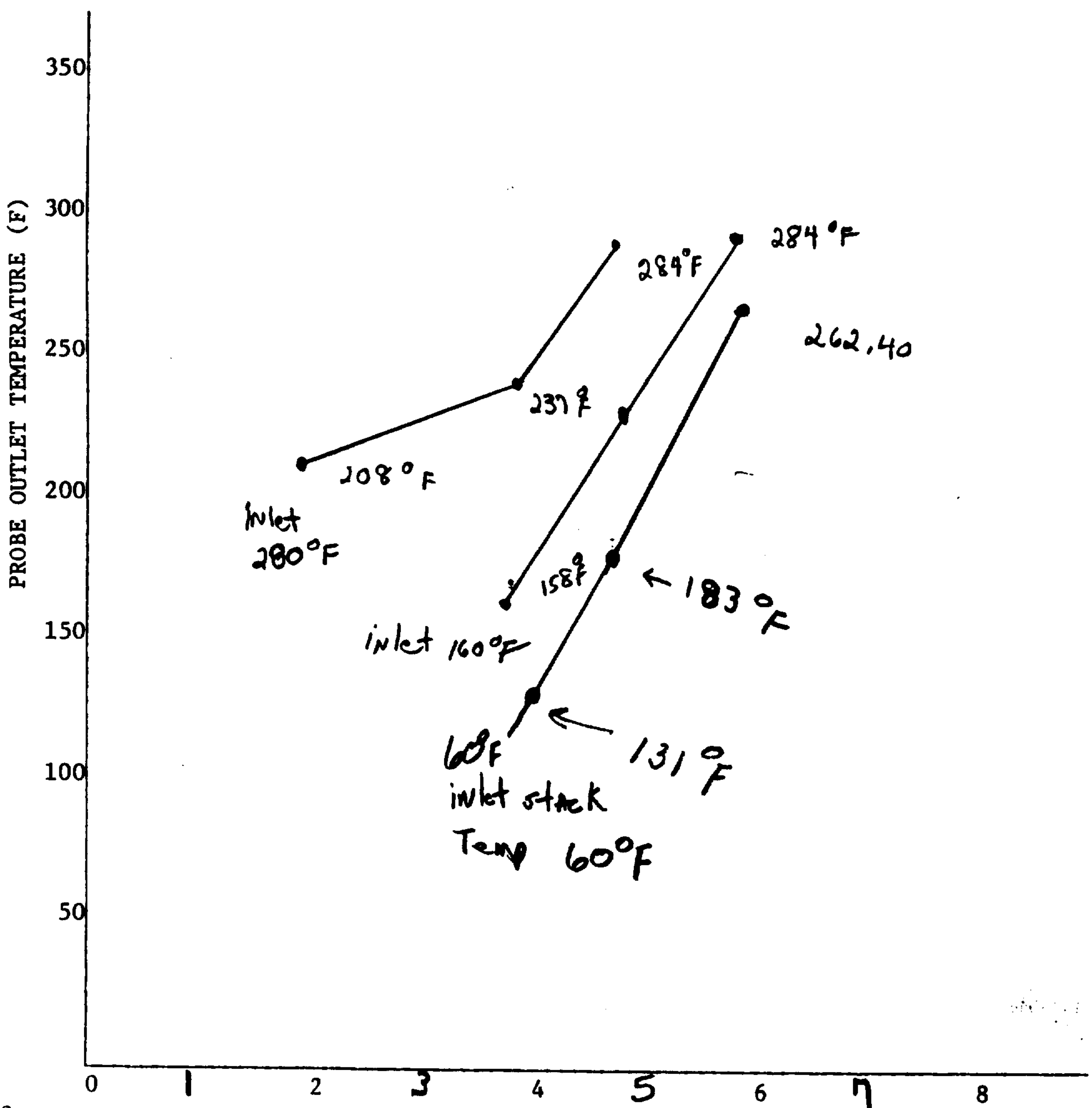
<u>Heating Probe Calibration</u>

Probe No. 41 Probe Length 4'

Date of Calibration 1-21-88 Signature Sam T. 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



PROBE HEAT SETTING (%)

Date 2-9-88 Thermocouple number 41

Ambient temperature 54 °C Barometric pressure 29.95 in. Hg

Calibrator S. Greenwood Reference: mercury-in-glass ✓

other ________

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
A	Ice Water	32° F	31°F	.03%
B	Boiling Water	212°F	211°F	.005%
C	Oil	380°F	377°F	.008%
D	Ambient	54°F	53°F	.02%
E	Ambient	72°F 5-2-89	72°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

Sumner Buck is the President of RAMCON Environmental Corporation. He is a graduate of the EPA 450 "Source Sampling for Particulate Pollutant's" course and the 474 "Continuous Emissions Monitoring" course all given at RTP. Mr. Buck is a certified V.E. reader with current certification. Mr. Buck has personally sampled over 400 stacks including over 300 asphalt plants. He is 47 years old and a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis.

Dave Armstrong - Team Leader

Dave Armstrong has been with RAMCON Environmental for two years. He was promoted to Team Leader in 1988 and altogether has sampled almost 200 stacks of all types. Dave is a current V.E. reader and has extensive training in EPA Methods 1 - 9.

VI. LABORATORY PROCEDURES & RESULTS

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 desiccator to dry for at least 24 hours. Clean plastic petri dishes, also numbered, top and bottom, are placed in the desiccator with the filters. After desiccation, 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 books. 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 at 175°C for two hours. The open jars are removed and placed in a desiccator until cool for two hours and then tightly sealed. The jars are then numbered and weighed on the triple beam balance to the closest tenth of a gram. 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 petri dishes. In the lab, the dishes are opened and placed into a desiccator for at least 24 hours. Then the filters are weighed continuously every six hours until a constant weight is achieved. All data is recorded on the laboratory forms that will be bound in the test report.

B. SILICA GEL: The silica gel used in the stack test is returned to the appropriate mason jar and sealed for transport to the laboratory where it is reweighed to a constant weight on a triple beam balance to the nearest tenth of a gram.

C. PROBE RINSINGS: In all tests where a probe washout analysis is necessary, this is accomplished in accordance with procedures specified in "EPA Reference Method 5". These samples are returned to the lab in sealed mason jars for analysis. The front half of the filter holder is washed in accordance with the same procedures and included with the probe wash. Reagent or ACS grade acetone is used as the solvent. The backhalf of the filter holder is washed with deionized water into the impinger catch for appropriate analysis.

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

E. ACETONE: A blank analysis of acetone is conducted from the one gallon glass container used in the field preparation. This acetone was used in the field for rinsing the probe, nozzle, and top half of the filter holder. A blank analysis is performed prior to testing on all new containers of acetone received from the manufacturer to insure that the quality of the acetone used will be exceed the .001% residual purity standard.

SPECIAL NOTE

When sampling sources high in moisture content, (such as asphalt plants) the filter paper sometimes sticks to the filter holder. When removing the filter, it may tear. In order to maintain control of any small pieces of filter paper which may be easily lost, they are washed with acetone into the probe washing. This makes the filter weight light (sometimes negative) and the probe wash correspondingly heavier. this laboratory procedure is taught by EPA in the "Quality Assurance for Source Emissions Workshop" at Research Triangle Park and is approved by EPA.

WEIGHING PROCEDURE - SARTORIUS ANALYTICAL BALANCE

The Sartorius balance is accurate to 0.1 mg and has a maximum capacity of 200 grams. The balance precision (standard deviation) is 0.05 mg. 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 the "zero" position. The beam arrest lever (on the lower left hand side toward the rear of the balance) is then slowly pressed downward to the full release position. The lighted vernier scale on the front of the cabinet should align with 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 the 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 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 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 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. The balance is sensitive to even a hand on the table near the balance, so be careful and painstaking in every movement while weighing.

Form REC#8

SAMPLE ANALYTICAL DATA FORM

Plant Location Baltimore — Relative humidity in lab 57 %

Sample Location hot mix asphalt plant — Density of Acetone (pa) .7853 mg/ml

Blank volume (V_a) 100 ml

Date/Time wt. blank 5-8-89 — Gross wt. 136.4459 mg

Date/Time wt. blank 5-9-89 — Gross wt. 136.4459 mg

Ave. Gross wt. 136.4459 mg

Tare wt. 136.4459 mg

Weight of blank (m_{ab}) 0.000 mg

Acetone blank residue concentration (C_a) $(C_a) = (M_{ab}) / (V_a) (p_a)$ = (0 mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} P_a$ = (0)(200)(.7853) = (0)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	450	425	425
Date/Time of wt 5-8-89 8:30 Gross wt	g	136.8676	143.4042	134.6541
Date/Time of wt 5-9-89 8:30 Gross wt	g	136.8678	143.4043	134.6541
Average Gross wt	g	136.8677	143.4043	134.6541
Tare wt	g	136.8383	143.3814	134.6318
Less acetone blank wt (W_a)	g	0	0	0
Wt of particulate in acetone rinse (m_a)	g	0.0294	0.0229	0.0223

Filter Numbers	#	FK-3315	FK-3317	FK 3316
Date/Time of wt 5-8-89 8:30 Gross wt	g	0.5331	0.5418	0.5481
Date/Time of wt 5-9-89 8:30 Gross wt	g	0.5333	0.5418	0.5480
Average Gross wt	g	0.5332	0.5418	0.5481
Tare wt	g	0.5278	0.5243	0.5302

Weight of particulate on filters(s) (m_f)	g	0.0054	0.0175	0.0179
Weight of particulate in acetone rinse	g	0.0294	0.0229	0.0223
Total weight of particulate (m_n)	g	0.0348	0.0404	0.0402

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 Sam Turner — Signature of reviewer [signature]

Blakemore

(14)

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: 14.44 = 20.9 - [1.3465 x 4.5]

RUN #2: 15.24 = 20.9 - [1.3465 x 4.2]

RUN #3 15.78 = 20.9 - [1.3465 x 3.8]

RUN 1:	$CO_{2\%}$	4.5	$CO_{2\%}$	4.5	$CO_{2\%}$	4.5	AVG.	4.5
	$O_{2\%}$	14.44	$O_{2\%}$	14.84	$O_{2\%}$	14.84	AVG.	14.84
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.66
RUN 2:	$CO_{2\%}$	4.0	$CO_{2\%}$	4.0	$CO_{2\%}$	4.5	AVG.	4.2
	$O_{2\%}$	15	$O_{2\%}$		$O_{2\%}$		AVG.	15.24
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.56
RUN 3:	$CO_{2\%}$	4.0	$CO_{2\%}$	3.5	$CO_{2\%}$	4.0	AVG.	3.8
	$O_{2\%}$		$O_{2\%}$		$O_{2\%}$		AVG.	15.78
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.42

VII. CALCULATIONS

BLAKEMORE CONSTRUCTION CORPORATION
PINEY RIVER, VIRGINIA

SUMMARY OF TEST DATA

		5-2-89 RUN #1	5-3-89 RUN #2	5-3-89 RUN #3
SAMPLING TRAIN DATA				
	start	14:15	08:43	10:47
	finish	16:39	09:48	11:51
1. Sampling time, minutes	θ	60.0	60.0	60.0
2. Sampling nozzle diameter, in.	D_n	.2530	.2530	.2530
3. Sampling nozzle cross-sect. area, ft^2	A_n	.000349	.000349	.000349
4. Isokinetic variation	I	106.5	99.0	98.7
5. Sample gas volume - meter cond., cf.	V_m	42.394	41.181	38.585
6. Average meter temperature, ^oR	T_m	548	539	544
7. Avg. oriface pressure drop, in. H_2O	dH	1.55	1.49	1.29
8. Total particulate collected, mg.	M_n	34.80	40.40	40.20
VELOCITY TRAVERSE DATA				
9. Stack area, ft^2	A	11.60	11.60	11.60
10. Absolute stack gas pressure, in. Hg.	P_s	29.50	29.78	29.78
11. Barometric pressure, in. Hg.	P_{bar}	29.50	29.78	29.78
12. Avg. absolute stack temperature, R^o	[redacted]	709	707	710
13. Average $-\sqrt{\text{vel. head}}$, (C_p = .82)	$-\sqrt{dP}$	0.81	0.83	0.78
14. Average stack gas velocity, ft./sec.	V_s	54.06	54.67	51.60
STACK MOISTURE CONTENT				
15. Total water collected by train, ml.	V_{ic}	278.00	226.00	220.00
16. Moisture in stack gas, %	B_{ws}	24.67	21.15	21.94
EMISSIONS DATA				
17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	1248	1338	1245
18. Stack gas flow rate, cfm	[redacted]	37626	38050	35914
19. Particulate concentration, [redacted]	[redacted]	0.0134	0.0156	0.0167
20. Particulate concentration, [redacted]	[redacted]	2.39	2.98	2.97
21. Particulate concentration, [redacted]	[redacted]	0.00000	0.00000	0.00000
ORSAT DATA				
22. Percent CO_2 by volume	CO_2	4.50	4.20	3.80
23. Percent O_2 by volume	O_2	14.84	15.24	15.78
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	80.66	80.56	80.42

Format: summryR3