RAMCON ENVIRONMENTAL CORPORATION

RAMCON BUILDING 223 SCOTT STREET MEMPHIS, TENNESSEE 38112 TELEPHONE 901 / 458-7000 800 / 458-4567

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
NORTH EAST HOT MIX COMPANY
DIV. OF JAMES JULIAN, INC.
BELAIR, MARYLAND
May 28, 1987

R. A. McGuirk
Ron McGuirk
North East Hot Mix Company

Sumner Buck
G. Sumner Buck, III
President

J. Cameron Mitchell
Team Leader

RAMCON ENVIRONMENTAL CORPORATION

RAMCON BUILDING 223 SCOTT STREET MEMPHIS, TENNESSEE 38112 TELEPHONE 901 / 458-7000 800 / 458-4567

June 3, 1987

Mr. Ron McGuirk
North East Hot Mix
Div. of James Julian, Inc.
P.O. Box 647
North East, MD 21901

Re: Particulate Emissions Test - Belair, Maryland

Dear Mr. McGuirk:

Enclosed are four copies of our report on the particulate emissions test we conducted at your plant. Based on our test results, your plant does not pass either EPA New Source Performance Standards or those set by the State of Maryland. The average grain loading of the three test runs was not in compliance with Federal or State Standards.

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

Mr. Craig Holdefer
Maryland Air Management
Div. of Environmental Affairs
P.O. Box 13387
Baltimore, MD 21203

We certainly have enjoyed working with you and look forward to serving you again in the future.

Sincerely,

G. Sumner Buck, III
President

GSBIII:kr

Enclosures

TABLE OF CONTENTS

I. INTRODUCTION

On May 28, 1987, personnel from RAMCON Environmental Corporation (REC) conducted a source emissions test for particulate emissions compliance at North East Hot Mix Company's CMI drum mix asphalt plant located in Belair, Maryland. RAMCON personnel conducting the test were Cameron Mitchell, Team Leader and John Bowden. Kim Rea was responsible for the final particulate 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. Mitchell and Ms. Rea.

The purpose of the test was to determine if the rate of particulate emissions from the plant's scrubber and the total contaminants by weight (grain loading) are below the limits set by EPA and the State of Maryland.

II. TEST RESULTS

Table I summarizes the test results. The grain loading limitation for EPA is .04 gr/DSCF and is specified in 39 FR 9314, March 8, 1974, 60.92 Standards for Particulate Matter (1), as amended. The allowable emissions for the State of Maryland is .03 gr/DSCF and is specified in C.O.M.A.R. 101806.03.

Mr. Craig Holdefer of Maryland's Office of Environmetnal Affairs observed the testing conducted by RAMCON.

TABLE I

SUMMARY OF TEST RESULTS
May 28, 1987

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	08:51 to 10:09	0.0594 gr/DSCF	96%	5.1 lbs/hr
2	11:42 to 13:00	0.0765 gr/DSCF	94%	7.7 lbs/hr
3	13:53 to 15:24	0.0597 gr/DSCF	101%	4.9 lbs/hr
	Average:	0.0652 gr/DSCF		5.9 lbs/hr

On the basis of these test results, the average grain loading of the three test runs was not below the .04 gr/DSCF emissions limitation set by US EPA or the .03 gr/DSCF limitation set by the State of Maryland. Therefore, the plant is not operating in compliance with State or Federal Standards.

III. TEST PROCEDURES

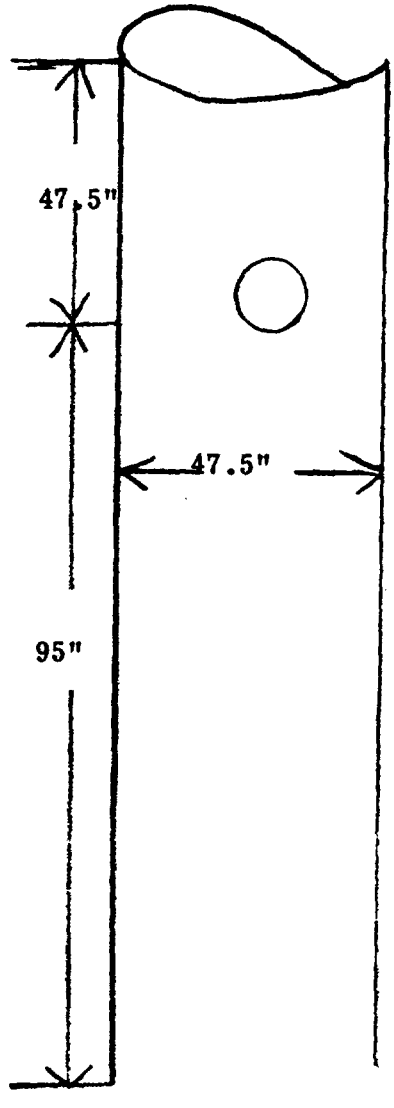
A. Method Used: The source sampling was conducted in accordance with Method 5 requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

B. Problems Encountered: The plant had problems with the automatic damper so the damper was manually operated. Because the flows were less than expected, the sample volume on test run one is less than the required 50 ft^3. For test run two the damper was opened slightly to increase the flow, but this caused problems with plant operations and the minimum of 50 ft^3 was barely attained. Therefore, the sampling time for test run three was increased to 3.5 minutes per point for a total testing time of 84 minutes to achieve the required minimum sample gas volume. Runs one and two were sampled for three minutes per point for a total testing time of 72 minutes. All three test runs were conducted in one day rather than the two day requirement due to a delay in starting the test because of plant operations.

C. Sampling Site: The emissions test was conducted after a scrubber on a round stack with a diameter of 47.5". The sampling ports were placed 47.5" down (1.0 diameters upstream) from the top of the stack and 95" up (2.0 diameters downstream) from the last flow disturbance. Twenty four points were sampled, twelve through each traverse for three minutes each.

Points on a Diameter	Probe Mark
1	*8.0"
2	10.2"
3	12.6"
4	15.4"
5	18.9"
6	23.9"
7	37.6"
8	42.6"
9	46.1"
10	48.9"
11	51.3"
12	53.5"

*Measurements include a 7.0" standoff.



IV. THE SOURCE

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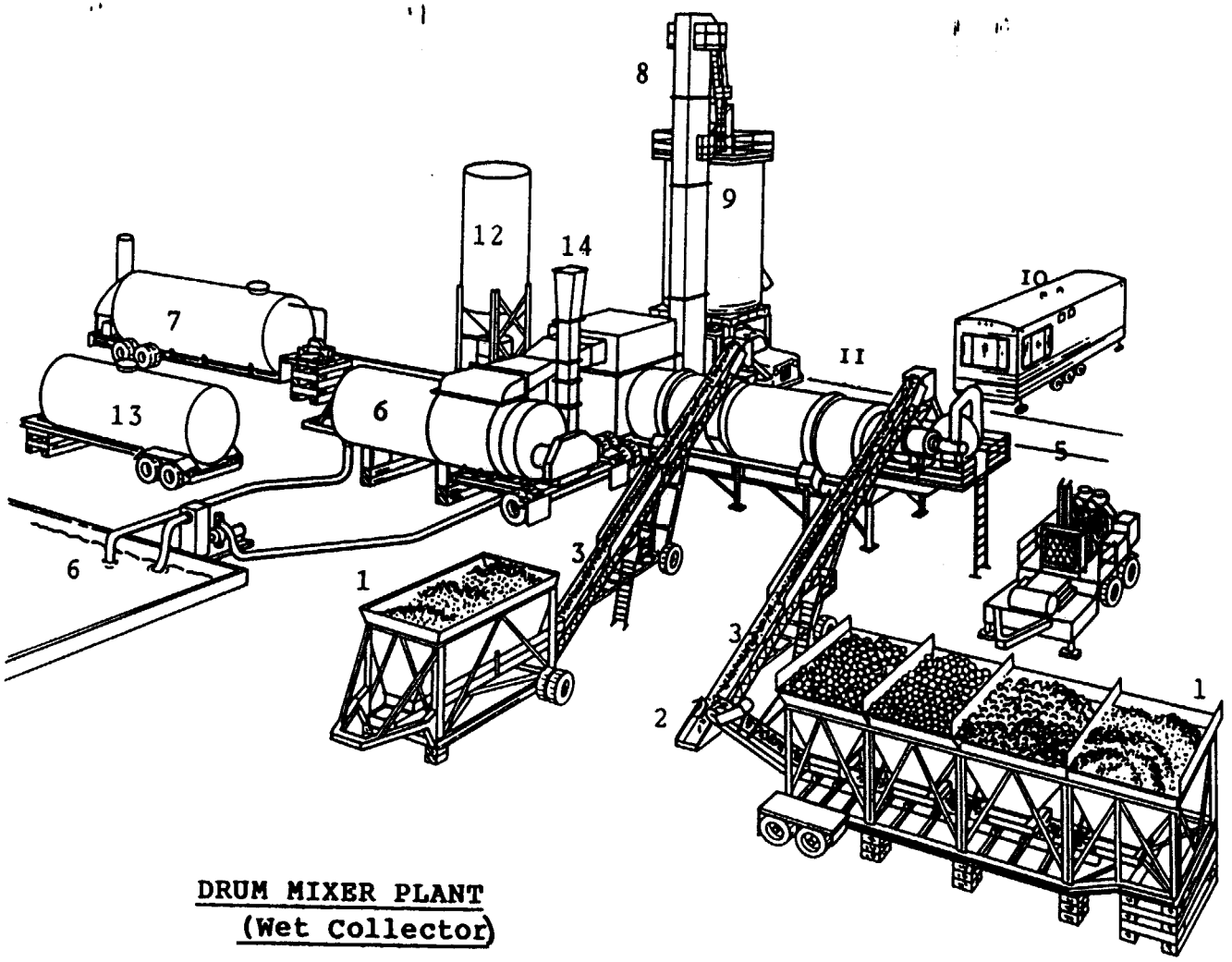
North East Hot Mix Company employs a CMI drum mix asphalt plant which is used to manufacture hot mix asphalt for road pavement. The process consists of blending prescribed portions of cold feed materials (sand, gravel, screenings, chips, etc.) uniformly and adding sufficient hot asphalt oil to bind the 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 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 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 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 fired with #2 fuel oil 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 burner and the mixing drum, the air passes through a high efficiency scrubber. The scrubber was manufactured by CMI. The exhaust gasses are drawn through the scrubber and discharged to the atmosphere through the stack. The design pressure drop across the venturi is in excess of 8 inches of water. The particulate matter, which is removed by the scrubber is fed into the scrubber pond where it drops out of suspension.



DRUM MIXER PLANT
(Wet Collector)

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. Wet scrubbing system: A system of cyclonic action, spray nozzles and a venturi removes 99% of particulates in the gas stream.

7. 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.

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

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

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

11. 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.

12. Mineral filler system (when used).

13. Burner fuel storage (when used).

14. Stack.

DATA SUMMARY

Plant

1. Manufacturer of plant CMI.
2. Designed maximum operating capacity 300 TPH @ 5 % moisture.
3. Actual operation rate 215 TPH @ 2.5 % moisture.
4. Startup date Sept. 1986.
5. Type of fuel used in dryer #2 FUEL OIL.
6. Quanity of fuel consumption 1.5 GAL per TON.

Aggregate

7. Name/type of mix MARYLAND S/N.
8. Percent asphalt in mix 5.9 %.
9. Temperature of asphalt 300°.
10. Sieve/Screening analysis: % Passing;

1"		3/8"	95	#16	33
3/4"	100	#4	62	#50	12
1/2"		#8	44	#200	3.2

Scrubber Control System

11. Manufacturer CMI.
12. Type; Venturi ✓; Wet Washer ; Spray Booth ; Other VERTICAL de-watering TANK
13. Water line pressure 85 psi.
14. Pressure drop across system ~~NOT AVAILABLE~~ psi.
15. Gallons per minute through system 200.
16. Water source 3 PONDS (i.e., lagoon, pond, etc.)
17. Number of spray nozzles 36.

COMPANY NAME North EAST HOT MIX Co. - Division of JAMES JULIAN INC.

COMPANY REPRESENTATIVE Ronald A. McGuirk

DATE 5/28/89

(8)

PLANT DATA

COMPANY NAME James Julian, Inc (North East Hot Mix)

COMPANY REP. [illegible] DATE 5/28/87 PHONE # 301-699-7194

DATA SOURCE Control Room computer

PLANT LOCATION Belair Maryland

PLANT MFG. C.M.I PLANT MODEL # _____ PLANT TYPE Drum Mix

MIX SPECIFICATION # SN OIL SPECIFICATION # 2 Fuel Oil

Time 24 Hour	#2 Fuel Oil __ Nat. Gas __ Propane __ Coal __ 9.1 per ton	Burner Setting % open	Aggregate TPH	N/A Recycle TPH	Liquid Asphalt TPH	Mix Temp. °F	✓ Venturi __ Baghouse Pressure Drop Inches Water
8:00-8:15		8%	180		11.3	300°	Not available
8:15-8:30		8%	199		12.5	285°	
8:30-8:45		7%	204		12.6	280°	
8:45-9:00		7%	201		12.6	280°	
9:00-9:15		6%	209		13.1	285°	
9:15-9:30		5%	212		13.2	280°	
9:30-9:45		5%	208		12.9	285°	
9:45-10:00		5%	209		12.9	285°	
10:00-10:15		5%	205		12.8	280°	
10:15-10:30		6%	203		12.7	280°	
10:30-10:45		5%	202		12.7	285°	
10:45-11:00		5%	204		12.8	280°	
11:00-11:15		5%	206		12.8	285°	
11:15-11:30		6%	205		12.8	285°	
11:30-11:45		6%	202		12.8	280°	
11:45-12:00		6%	204		12.7	285°	
12:00-12:15		6%	203		12.7	285°	
12:15-12:30		6%	203		12.7	280°	
12:30-12:45		6%	204		12.7	280°	
12:45-1:00		5%	204		12.5	280°	
1:00-1:15		7%	205		12.8	280°	
1:15-1:30		5%	203		12.7	285°	
1:30-1:45		5%	201		12.7	285°	
1:45-2:00		5%	201		12.6	285°	
2:00-2:15		5%	197		12.4	285°	

PLANT DATA

COMPANY NAME _____

COMPANY REP. _____ DATE _____ PHONE # _____

DATA SOURCE _____

PLANT LOCATION _____

PLANT MFG. _____ PLANT MODEL # _____ PLANT TYPE _____

MIX SPECIFICATION # _____ OIL SPECIFICATION # _____

Time 24 Hour	#2 Fuel Oil __ Nat. Gas __ Propane __ Coal __ = QAI PG76CU	Burner Setting % TON	Aggregate TPH	Recycle TPH N/A	Liquid Asphalt TPH	Mix Temp. °F	__ Venturi __ Baghouse Pressure Drop Inches Water
2:15-2:30		6%	197		12.3	285°	
2:30-2:45		5%	195		12.3	285°	
2:45-3:00		5%	196		12.4	285°	
3:00-3:15		5%	196		12.2	285°	
3:15-3:30		5%	199		12.5	285°	
3:30-3:45							

STOP #3

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 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.

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 "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 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 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. The balance is sensitive to even a hand on the table near the balance, so be careful and painstaking in every movement while weighing.

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.

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. The net weight is the same and no particulate is lost. This laboratory procedure is taught by EPA in the Quality Assurance for Source Emissions Workshop at Research Triangle Park and is approved by EPA.

Form REC#8 (14)

SAMPLE ANALYTICAL DATA FORM

Plant Location Northeast Hotmix Relative humidity in lab 45 %

Sample Location asphalt plant stack Density of Acetone (pa) .7853 mg/ml

Blank volume (V_a) 200 ml

Date/Time wt. blank 6-1-87 Gross wt. 98.9487 mg

Date/Time wt. blank 6-2-87 Gross wt. 98.9485 mg

Ave. Gross wt. 98.9486 mg

Tare wt. 98.9484 mg

Weight of blank (m_{ab}) .0002 mg

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

Weight of residue in acetone wash: $W_a = C_a V_{aw} p_a$ = ( )( )( ) = ( )

		Run # \	Run #	Run #
Acetone rinse volume (V_{aw})	ml	200	200	200
Date/Time of wt 6-1-87 Gross wt	g	130.7534	140.6141	139.9795
Date/Time of wt 6-2-87 Gross wt	g	130.7533	140.6138	139.9792
Average Gross wt	g	130.7534	140.6139	139.9794
Tare wt	g	130.7302	140.5506	139.9532
Less acetone blank wt (W_a)	g	.0002	.0002	.0002
Wt of particulate in acetone rinse (m_a)	g	.0230	.0631	.0260

Filter Numbers	#	SG-1939	SG-1940	SG-1837
Date/Time of wt 6-1-87 Gross wt	g	.6522	.6980	.6939
Date/Time of wt 6-2-87 Gross wt	g	.6520	.6980	.6935
Average Gross wt	g	.6521	.6980	.6937
Tare wt	g	.5059	.5094	.5185

Weight of particulate on filters(s) (m_f)	g	.1462	.1886	.1752
Weight of particulate in acetone rinse	g	.0230	.0631	.0260
Total weight of particulate (m_n)	g	.1692	.2517	.2012

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 Kim Pica Signature of reviewer S T Smith

COMPANY NAME NorthEast

Chloroform and Ethyl Ether Extraction for EPA Method 5 (back half)

Relative humidity in lab 48%

Density of chloroform and ethyl ether
1.4739/mL .7129/mL

		RUN 1	RUN 2	RUN 3
Chloroform and ethyl ether rinse volume	ml			
Date/time of wt 6-8-87 9:50 Am Gross wt.	g	100.0627	98.2010	99.8996
Date/time of wt 6-8-87 4:30 Gross wt.	g	100.0625	98.2007	99.8991
Avg. Gross wt.	g	100.0626	98.2009	99.8994
Tare wt.	g	100.0455	98.1765	99.8808
Wt. of particulate in chloroform ethyl ether rinse	g	.0171	.0244	.0186
Water evaporation	#	480	412	583
Date/time of wt. 6-8-87 9:45 Am Gross wt.	g	127.9114	163.0110	167.3107
Date/time of wt. 6-8-87 4:30 Gross wt.	g	127.9111	163.0109	167.3105
Avg. Gross wt.	g	127.9113	163.0110	167.3106
Tare wt.	g	127.9004	162.9933	167.2958
Less chloroform & ehtyl either blank wt.	g	.0001	.0001	.0001
Weight of particulate from water (m_f)	g	.0109	.0176	.0147
Wt. of particulate in chloroform ethyl ether rinse	g	.0171	.0244	.0186
Total weight of particulate (m_n)	g	.0280	.0420	.0333

Note: In no case should a blank residue 0.02 mg/g or 0.001% of the weight of chloroform ethyl ether used be subtracted from the sample weight.

Remarks _____

Signature of Analyst Kim Rea

Signature of Reviewer S. Buck

(16)

Probe Wash

ASH TEST

DATE 6/8/87

PLANT Northeast

BEFORE ASHING

RUN #	1	2	3
Gross Weight	130.7534	140.6139	139.9794
-tare weight	130.7302	140.5506	139.9532
Net Weight of Particulate	.0232	.0633	.0262

AFTER ASHING

RUN #	1	2	3
Gross wt. after ash	130.7449	140.6054	139.9727
-tare weight	130.7302	140.5506	139.9532
Weight of non-volatiles	.0147	.0548	.0195

CALCULATIONS NON-VOLATILES

RUN #	1	2	3
Weight of Non-volatiles	.0147	.0548	.0195
+ Net weight of Particulate =	.0232	.0633	.0262
X 100%	100%	100%	100%
Weight percent of non-volatiles	63.4	86.6	74.4

CALCULATIONS VOLATILES

RUN #	1	2	3
100%	100%	100%	100%
-Weight percent of non-volatiles	63.4	86.6	74.4
-Weight percent of volatiles	36.6	13.4	25.6

Analyst Kim Rea Checked S. Buck Approval

VII. CALCULATIONS

NAME: NORTH EAST HOT MIX

LOCATION: BELAIR, MARYLAND

			date	5/28/87	5/28/87	5/28/8
	SUMMARY OF TEST DATA			RUN # 1	RUN # 2	RUN #
	SAMPLING TRAIN DATA		start	08:51	11:42	13:53
			finish	10:09	13:00	15:24
1	Sampling time, minutes		θ	72	72	84
2	Sampling nozzle diameter, in.		Dn	.382	.382	.382
3	Sampling nozzle cross-sectional area, ft^2		An	.000796	.000796	.000796
4	Isokinetic variation		I	96	94	101
5	Sample gas volume - meter conditions, cf.		Vm	45.99	53.81	56.06
6	Average meter temperature, °R		Tm	559	567	576
7	Average orifice pressure drop, in.H_2O		ΔH	1.15	1.48	1.21
8	Total particulate collected mg.		Mn	169.2	251.7	201.2
	VELOCITY TRAVERSE DATA					
9	Stack area, ft^2		A	12.3	12.3	12.3
10	Absolute stack gas pressure, in. Hg.		Ps	30.46	30.46	30.46
11	Barometric pressure, in. Hg.		Pbar	30.46	30.46	30.46
12	Average absolute stack temperature, °R		Ts	613	623	628
13	Average $\bar{\sqrt{\text{velocity head}}}$, (Cp= .80)		$\bar{\sqrt{\Delta P}}$	.39	.43	.38
14	Average stack gas velocity ft. / sec.		Vs	24	26	23
	STACK MOISTURE CONTENT					
15	Total water collected by train, ml.		Vic	498.0	433.0	597.0
16	Moisture in stack gas, %		Bws	34.8	28.7	35.1
	EMISSIONS DATA:					
17	Stack gas flow rate, dscf/hr. (000's)		Qsd	595	700	569
18	Total particulate concentration, gr/dscf		Cs	.0594	.0765	.0597
19	Total particulate concentration, lbs/hr		E	5.1	7.7	4.9
20	Total particulate concentration, lbs/mbtu		E^1	.0000	.0000	.0000
	ORSAT DATA					
21	Percent CO2 by volume		CO2	11.0	12.1	11.5
22	Percent O2 by volume		O2	9.0	10.0	11.0
23	Percent CO by volume		CO	.0	.0	.0
24	Percent N2 by volume		N2	80.0	77.9	77.5

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 $V_{m(std)} = 17.64 \quad (.99)(45.99) \left[\frac{(30.46) + \frac{1.15}{13.6}}{559} \right] = 43.89$ dsc

Run # 2 $V_{m(std)} = 17.64 \quad (.99)(53.81) \left[\frac{(30.46) + \frac{1.48}{13.6}}{567} \right] = 50.66$ dsc

Run # 3 $V_{m(std)} = 17.64 \quad (.99)(56.06) \left[\frac{(30.46) + \frac{1.21}{13.6}}{576} \right] = 51.92$ dsc

Total contaminants by weight: 'GRAIN LOADING'

Particulate concentration C_s' gr./dscf.

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

Where:

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

M_n = Total amount of particulate matter collected, mg.

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

Run # 1: $C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{169.2}{43.89} \right] = .0594$ gr./dscf.

Run # 2: $C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{251.7}{50.66} \right] = .0765$ gr./dscf.

Run # 3: $C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{201.2}{51.92} \right] = .0597$ gr./dscf.

Dry molecular weight:

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

Where:

M_d = Dry molecular weight, lb./lb.-mole.

$\%CO_2$ = Percent carbon dioxide by volume (dry basis).

$\%O_2$ = Percent oxygen by volume (dry basis).

$\%N_2$ = Percent nitrogen by volume (dry basis).

%CO = Percent carbon monoxide by volume (dry basis).

0.264 = Ratio of O_2 to N_2 in air, v/v.

0.28 = Molecular weight of N_2 or CO, divided by 100.

0.32 = Molecular weight of O_2 divided by 100.

0.44 = Molecular weight of CO_2 divided by 100.

Run # 1: $M_d = 0.44(11.0\%) + 0.32(9.0\%) + 0.28(.0\% + 80.0\%) = 30.1$ lb./lb.-mole

Run # 2: $M_d = 0.44(12.1\%) + 0.32(10.0\%) + 0.28(.0\% + 77.9\%) = 30.3$ lb./lb.-mole

Run # 3: $M_d = 0.44(11.5\%) + 0.32(11.0\%) + 0.28(.0\% + 77.5\%) = 30.3$ lb./lb.-mole

Water vapor condensed :

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

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

Where:

0.04707 = Conversion factor ft^3/ml.

0.04715 = Conversion factor ft^3/g.

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

$V_{wsg_{std}}$ = Volume of water vapor collected in silica gel (standard 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 # 1:	$V_{wc(std)}$	= (0.04707) (480.0) =	22.6	cu.ft
	$V_{wsg(std)}$	= (0.04715) (18.0) =	.8	cu.ft
Run # 2:	$V_{wc(std)}$	= (0.04707) (412.0) =	19.4	cu.ft
	$V_{wsg(std)}$	= (0.04715) (21.0) =	1.0	cu.ft
Run # 3:	$V_{wc(std)}$	= (0.04707) (583.0) =	27.4	cu.ft
	$V_{wsg(std)}$	= (0.04715) (14.0) =	.7	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 stream.

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

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

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

Run # 1: $$B_{ws} = \frac{22.6 + .8}{22.6 + .8 + 43.89} \times 100 = 34.8\ \%$$

Run # 2: $$B_{ws} = \frac{19.4 + 1.0}{19.4 + 1.0 + 50.66} \times 100 = 28.7\ \%$$

Run # 3: $$B_{ws} = \frac{27.4 + .7}{27.4 + .7 + 51.92} \times 100 = 35.1\ \%$$

Molecular weight of stack gases: $M_s = M_d\ (1-B_{ws}) + 18\ (B_{ws})$.

Where:

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

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

Run # 1: $M_s = 30.1\ (1-\ .348\ ) + 18\ (\ .348\ ) = 25.9$ (lb./lb.-mole).

Run # 2: $M_s = 30.3\ (1-\ .287\ ) + 18\ (\ .287\ ) = 26.0$ (lb./lb.-mole).

Run # 3: $M_s = 30.3\ (1-\ .351\ ) + 18\ (\ .351\ ) = 26.0$ (lb./lb.-mole).

Stack gas velocity:

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

Where:

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

K_p = 85.49 ft/sec $\left[\text{(g/g-mole)-(mm Hg) / ($^\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 = Stack static pressure (in.Hg).

P_s = Absolute stack gas pressure, (in.Hg) = $P_{bar} + P_g$

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

t_s = Stack temperature, ($^\circ$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: $V = (85.49)\,(.80)\,(.39)\sqrt{\frac{613}{(30.46)(25.89)}} = 23.52$ ft/se

Run # 2: $V = (85.49)\,(.80)\,(.43)\sqrt{\frac{623}{(30.46)(26.77)}} = 25.71$ ft/se

Run # 3: $V = (85.49)\,(.80)\,(.38)\sqrt{\frac{628}{(30.46)(25.98)}} = 23.15$ 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, ($528^\circ R$).

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

P_g = Stack static pressure, (in.Hg.).

P_s = Absolute stack gas pressure, (in.Hg.); = $P_{bar} + P_g$

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

Run # 1:

$$Q_{sd} = 3600\ (1-.348)\ (\ 23.52)\ (\ \ 12.3) \left[\frac{528}{613}\right] \left[\frac{30.46}{29.92}\right] = 595435 \text{ dscf/}$$

Run # 2:

$$Q_{sd} = 3600\ (1-.287)\ (\ 25.71)\ (\ \ 12.3) \left[\frac{528}{623}\right] \left[\frac{30.46}{29.92}\right] = 700347 \text{ dscf/}$$

Run # 3:

$$Q_{sd} = 3600\ (1-.351)\ (\ 23.15)\ (\ \ 12.3) \left[\frac{528}{628}\right] \left[\frac{30.46}{29.92}\right] = 569437 \text{ dscf/}$$

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 matter in stack gas, dry basis, corrected to standard conditions (gr/dscf).

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

Run # 1: $E = \frac{(.0594)(595435)}{7000} = 5.1$ lb. / hr.

Run # 2: $E = \frac{(.0765)(700347)}{7000} = 7.7$ lb. / hr.

Run # 3: $E = \frac{(.0597)(569437)}{7000} = 4.9$ lb. / hr.

(26)

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

Where:

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

$$I = 100 \times 613 \left| \frac{(0.002669)(498.0) + \frac{46.0}{559}\left| 30.46 + \frac{1.15}{13.6} \right|}{60\ (\ 72\ )\ (\ 23.52\ )\ (30.46\ )\ (\ .000796\ )} \right| = 96\ \%$$

Run # 2:

$$I = 100 \times 623 \left| \frac{(0.002669)(433.0) + \frac{53.8}{567}\left| 30.46 + \frac{1.48}{13.6} \right|}{60\ (\ 72\ )\ (\ 25.71\ )\ (30.46\ )\ (\ .000796\ )} \right| = 94\ \%$$

Run # 3:

$$I = 100 \times 628 \left| \frac{(0.002669)(597.0) + \frac{56.1}{576}\left| 30.46 + \frac{1.21}{13.6} \right|}{60\ (\ 84\ )\ (\ 23.15\ )\ (30.46\ )\ (\ .000796\ )} \right| = 101\ \%$$

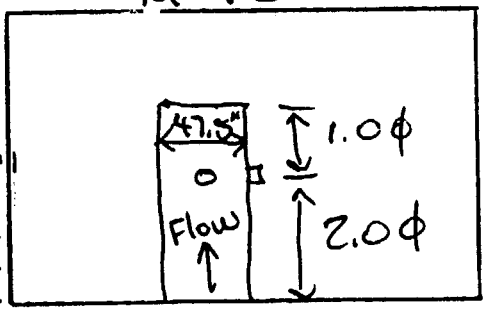
VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Northeast Hotmix

Location Bel Air, Md.
Operator C. Mitchell
Date 5-28-87
Run No. 1
Sample Box No. 2
Meter Box No. 689836
Meter H @ 1.37
C Factor 0.99
Pitot Tube Coefficient Cp 0.80

M=7.0



Ambient Temperature	72°F		
Barometric Pressure	30.46 / ~~30.50~~	FINAL	IMPINGER VOLUME, ml: 680
Assumed Moisture, %	35	INITIAL	200
Probe Length, m(ft)	5 ft	DIFFERENCE	480
Nozzle Identification No.	0.0007959		
Avg. Calibrated Nozzle Dia., (in.)	0.382 / 0.382 / 0.382		
Probe Heater Setting	6		
Leak Rate, m³/min. (cfm)	<0.02		
Probe Liner Material	316 Stainless		
Static Pressure, mm Hg (in.Hg)	+0.02 / 13.6		
Filter No.	SG-1939		

	SILICA GEL WEIGHT, g
	510
	495
	15

Schematic of Stack Cross Section

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	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A) 1	8:51 / 8:54	4	150	0.12	0.84	402.89 / 405.23	80	80	270	55
2	8:57	6	150	0.19	1.3	407.22	90	80	265	55
3	9:00	4	150	0.11	0.80	408.93	100	80	250	55
4	9:03	2	155	0.05	0.35	409.84	100	80	250	55
5	9:06	2	155	0.03	0.21	410.80	110	80	250	55
6	9:09	5	155	0.14	0.98	412.80	110	80	240	55
7	9:12	10	155	0.25	1.75	415.15	110	80	255	55
8	9:15	9	150	0.20	1.40	417.20	110	80	255	55
9	9:18	8	150	0.18	1.26	419.12	115	85	260	55
10	9:21	7	150	0.14	0.98	421.11	115	85	270	55
11	9:24	7	150	0.12	0.84	422.60	120	85	260	60
12	9:27	7	150	0.13	0.91	424.10	120	85	260	60
B) 1	9:33 / 9:36	7	150	0.16	1.1	426.74	115	90	265	60

M_A = 11.0% M = 9.0%

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 5-28-87 LOCATION Bel Air, Md TEST NO. 1

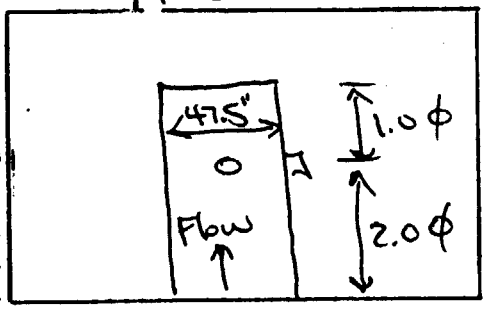
TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_g (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME Vm (ft^3)	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							# in	out		
2	9:39	10	150	0.19	1.33	429.30	115	90	265	55
3	9:42	10	155	0.16	1.12	430.80	120	90	240	55
4	9:45	10	155	0.15	1.05	433.65	120	90	250	55
5	9:48	6	155	0.07	0.49	434.03	120	90	250	55
6	9:51	6	155	0.07	0.49	436.29	120	90	265	60
7	9:54	8	155	0.26	1.82	439.00	120	90	265	60
8	9:57	8	155	0.35	2.45	440.22	120	90	240	60
9	10:00	8	155	0.26	1.82	443.30	110	95	240	60
10	10:03	8	155	0.23	1.61	444.78	110	95	260	60
11	10:06	8	155	0.19	1.33	447.01	110	95	265	60
12	10:09	8	155	0.18	1.26	448.88	110	95	260	65

RAMCON ENVIRONMENTAL CORPORATION

Plant Northeast Hotmix

Location Bel Air Md
Operator C. Mitchell
Date 5-28-87
Run No. 2
Sample Box No. 3
Meter Box No. 689836
Meter H @ 1.37
C Factor 0.99
Pitot Tube Coefficient Cp 0.80

M=8.0



		IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
Ambient Temperature	81°F		
Barometric Pressure	30.46 FINAL	612	511
Assumed Moisture, %	30 INITIAL	200	490
Probe Length, m(ft)	5 ft DIFFERENCE	412	21
Nozzle Identification No.	0.0007959		
Avg. Calibrated Nozzle Dia., (in.)	0.382/0.382/0.382		
Probe Heater Setting	6		
Leak Rate, m^3/min. (cfm)	<0.02		
Probe Liner Material	316 Stainless		
Static Pressure, mm Hg (in. Hg)	+0.02/13.6		
Filter No.	SG-1940		

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 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	11:42 30 / 11:45 30	4	155	0.11	0.88	449.43 / 451.87	95	90	230	55
2	11:48 30	5	155	0.14	1.12	454.50	110	90	245	55
3	11:51 30	7	160	0.18	1.44	456.45	115	90	265	55
4	11:54 30	8	160	0.31	2.48	459.22	120	90	255	55
5	11:57 30	8	160	0.20	1.6	461.35	115	90	255	55
6	12:00 30	8	165	0.21	1.7	463.62	120	90	240	55
7	12:03 30	7	165	0.18	1.44	466.23	120	90	245	55
8	12:06 30	7	160	0.21	1.7	468.50	120	95	255	60
9	12:09 30	8	165	0.25	2.0	471.57	120	95	250	60
10	12:12 30	6	165	0.20	1.6	473.56	120	95	240	60
11	12:15 30	6	165	0.20	1.6	475.94	120	95	255	60
12	12:18 30	6	165	0.20	1.6	477.65	120	95	255	60
1	12:24 / 12:27	6	155	0.15	1.2	480.40	110	100	250	60

$\Delta H = 12.1\%$ $\Delta_- = 10\%$

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 5-28-87 LOCATION Bel Air, 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 V_m (ft^3)	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
2	12:30	7	160	0.17	1.36	482.81	120	100	255	55
3	12:33	7	165	0.14	1.12	484.61	120	100	240	55
4	12:36	6	165	0.15	1.20	486.65	120	100	255	55
5	12:39	8	165	0.19	1.52	488.62	120	100	260	60
6	12:42	8	165	0.18	1.44	491.00	120	100	250	60
7	12:45	7	165	0.16	1.28	493.25	120	100	255	60
8	12:48	7	165	0.14	1.12	495.24	120	100	255	60
9	12:51	8	165	0.20	1.60	497.25	120	100	255	60
10	12:54	8	165	0.20	1.60	499.34	120	100	245	60
11	12:57	7	165	0.18	1.44	501.50	120	100	245	65
12	13:00	7	160	0.17	1.36	503.24	120	100	240	65

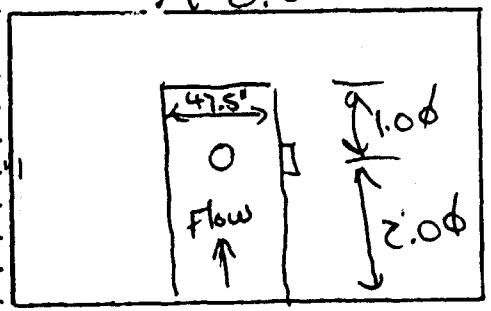
- 30 -

RAMCON ENVIRONMENTAL CORPORATION

Plant Northeast Hotmix

Location Bel Air Md
Operator C. Mitchell
Date 5-28-87
Run No. 3
Sample Box No. 2
Meter Box No. 689836
Meter H @ 1.37
C Factor 0.99
Pitot Tube Coefficient Cp 0.80

M=8.0



		IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
Ambient Temperature 85°F			
Barometric Pressure 30.46	FINAL	783	484
Assumed Moisture, % 25	INITIAL	200	470
Probe Length, m(ft) 5 ft	DIFFERENCE	583	14

Nozzle Identification No. 0.000795 9
Avg. Calibrated Nozzle Dia., (in.) 0.382/0.382/0.38
Probe Heater Setting 6
Leak Rate, m^3/min. (cfm) <0.02
Probe Liner Material 316 Stainless
Static Pressure, mm Hg (in. Hg) +0.02/13.6
Filter No. SG-1837

Schematic of Stack Cross Section

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	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A) 1	13:53 30 / 13:57	2	160	0.07	0.56	505.61 / 505.64	105	100	225	55
2	14:00 30	3	165	0.09	0.72	507.51	120	100	220	55
3	14:04	4	165	0.13	1.04	509.91	125	100	230	55
4	14:07 30	4	165	0.15	1.20	512.22	130	100	245	55
5	14:11	4	165	0.14	1.12	514.74	130	100	240	55
6	14:14 30	4	165	0.15	1.20	516.90	130	100	255	55
7	14:18	4	165	0.08	0.64	518.92	130	100	260	55
8	14:21 30	7	170	0.21	1.68	521.67	130	100	260	55
9	14:25	9	170	0.25	2.0	525.24	130	105	255	60
10	14:28 30	9	170	0.22	1.76	527.25	130	105	245	60
11	14:32	8	170	0.19	1.52	530.22	130	105	250	65
12	14:36 30	8	170	0.15	1.20	531.66	130	105	250	65
B) 1	14:42 30 / 14:46	7	165	0.12	0.96	534.80	120	110	240	55

$\Delta n = 11.5\%$ $\eta = 110\%$

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 5-28-87 LOCATION Bel Air, 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	14:49 30	10	165	0.18	1.44	537.32	130	110	240	55
3	14:53	10	165	0.18	1.44	539.70	130	110	245	55
4	14:56 30	10	170	0.21	1.68	542.25	130	110	250	60
5	15:00	9	170	0.14	1.12	544.71	125	110	255	60
6	15:03 30	6	170	0.07	0.56	546.53	125	110	260	60
7	15:07	7	170	0.11	0.88	548.43	130	110	240	60
8	15:10 30	10	170	0.23	1.84	551.42	135	110	230	60
9	15:14	8	170	0.15	1.20	553.14	130	110	250	55
10	15:17 39	8	170	0.13	1.04	555.55	125	110	255	55
11	15:21	8	170	0.14	1.12	557.70	125	110	230	60
12	15:24 40	8	165	0.14	1.12	559.67	125	110	235	60

IX. CALIBRATIONS

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 6/3/87 Meter box number 689836

Barometric pressure, P_b = 30.11 in. Hg Calibrated by S. Greenwood

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
0.5	5	826.00 / 831.16	80°	110° / 125°	85° / 95°	104°	11.17*	1.01	1.39
1.0	5	831.40 / 836.61	80°	115° / 125°	90° / 95°	106°	8.02	1.003	1.41
1.5	10	837.00 / 847.38	80°	115° / 124	90° / 93	10	13.29	1.009	1.48
2.0	10								
3.0	10								
4.0	10								
							Avg	1.006	1.43

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t + 460)}$	$\Delta H@_i = \frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\ \theta}{V_w}\right]^2$
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.

Quality Assurance Handbook M4-2.3A (front side)

Form #REC-02

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number _____ Date 4-30-87 Meter box number 3 Plant McMahon

Barometric pressure, P_b = 29.91 in. Hg Dry gas meter number 668836 Pretest Y .99

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter Inlet (t_{d_i}), °F	Dry gas meter Outlet (t_{d_o}), °F	Dry gas meter Average[a] (t_d), °F				
	10	10.2	76	76	100	88	15.5	5	.999	1.34
	10	10.2	76	79	100	90	15.2	5	1.003	1.44
	10	10.2	76	80	100	90	15.3	5	.999	1.36
									Y = .99	

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

where

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

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

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

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

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

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

ΔH = Pressure differential across orifice, in. H_2O.

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

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

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

RAMCON

Lear Siegler Stack Sampler

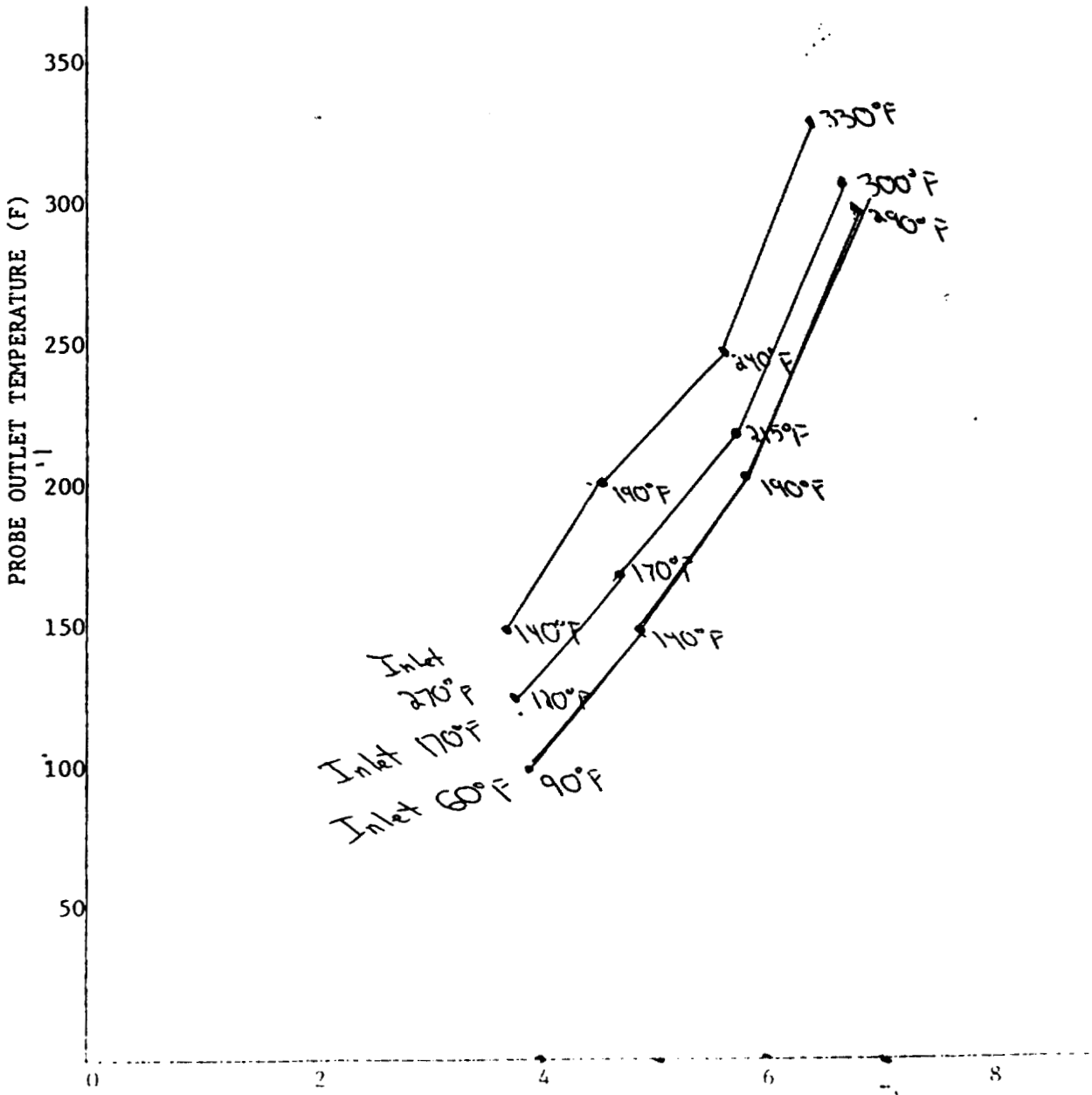
Heating Probe Calibration

Probe No. 52 Probe Length 5ft

Date of Calibration 1/10/97 Signature Shawn Greenwood

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



STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 11/08/87 Thermocouple number 52

Ambient temperature 60°F °C Barometric pressure 30.34 in. Hg

Calibrator Shawn Shearwood 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	33°F	.03%
B	Boiling Water	212°F	213°F	.003%
C	0:1	410°F	412°F	.005%
D	Ambient	60°F	61°F	.02%
	5-26-87	72°F	72°F	0%

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

[b] Type of calibration system used.

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

PITOT TUBE CALIBRATION DATA

Calibration pitot tube: type S size (OD) 3/8 ID number 52

Type S pitot tube ID number 52 $C_{p(std)}$ = 1

Calibration: date 1-7-87 performed by [illegible]

A-Side Calibration

Δp_{std}, cm (in.) H_2O	Δp_s, cm (in.) H_2O	$C_{p(S)}$ [a]	DEV. [b]
.82	1.3	.79	.01
.74	1.15	.80	.00
.92	1.45	.80	.00
Average		.80	

B-Side Calibration

Δp_{std}, cm (in.) H_2O	Δp_s, cm (in.) H_2O	$C_{p(S)}$ [a]	DEV. [b]
.82	1.3	.79	.01
.74	1.15	.80	.00
.92	1.45	.80	.00
Average		.80	

[a] $C_{p(S)} = C_{p(std)} \sqrt{\frac{\Delta p_{std}}{\Delta p_s}}$ = _____

[b] $DEV = C_{p(S)} - \bar{C}_p$, (must be ≤ 0.01)

$\bar{C}_p(A) - \bar{C}_p(B)$ = _____ (must be ≤ 0.01).

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 6-17-86 Thermocouple number inlet / outlet

Ambient temperature 24 °C Barometric pressure 29.96 in. Hg ✓

Calibrator Turner Reference: mercury-in-glass _____

other _____

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	inlet ambient	24°C	24 °C	0
B	outlet ambient	24 °C	24 °C	0
C	Ambient 5-2867	72°F	72°F	0

[a] Type of calibration system used.

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

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 6-17-86 Thermocouple number Hot box

Ambient temperature 24 °C Barometric pressure 29.95 in. Hg

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

other _____

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	Boiling water	100 °C	100 °C	0
B	Ambient	24 °C	23.9	< .1 %
C	ambient			
	5.2 m	72 °F	72 °F	0 %

[a] Type of calibration system used.

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

X. RAMCON PERSONNEL

RAMCON Environmental Stack Test Team

Sumner Buck - President

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 44 years old and a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis.

J. Cameron Mitchell - Team Leader

Cameron Mitchell has been employed by RAMCON for several years. He has undergone extensive training in Methods 1 through 9. He is qualified as a team leader and has personally sampled over 250 stacks including over 200 asphalt plants. He is currently certified as a V.E. reader. He recently graduated from Memphis State University with a Bachelors Degree in Civil Engineering and a minor in Mathematics.