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ADMINISTRATION

RAMCON ENVIRONMENTAL CORPORATION

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

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
JAMES JULIAN, INC.
NORTH EAST, MARYLAND
August 6 & 7, 1984

James Julian

James Julian
James Julian, Inc.

Sumner Buck

G. Sumner Buck, III
President

Cameron Mitchell

Cameron Mitchell
Team Leader

RAMCON **ENVIRONMENTAL CORPORATION**

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

August 13, 1984

Mr. Joseph R. Julian
James Julian, Inc.
P.O. Box 2538
Wilmington, DE 19805

Subject: Particulate Emissions Test - North East, Maryland Plant

Dear Mr. Julian:

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

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

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

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

Sincerely,

G. Sumner Buck, III
President

GSBIII:kr

Enclosures

TABLE OF CONTENTS

I. INTRODUCTION

On August 6 & 7, 1984, personnel from RAMCON Environmental Corporation (REC) conducted a source emissions test for particulate emissions compliance at James Julian, Inc.'s Boeing drum mix asphalt plant located in North East, Maryland. RAMCON personnel conducting the test were Cameron Mitchell, team leader and Ken Allmendinger. Cameron Mitchell 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 were limited to Mr. Mitchell and Mr. Allmendinger.

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

II. TEST RESULTS

Table I summarizes the test results. The grain loading limitation 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 are stated in C.O.M.A.R. 101811.03. Mr. Lee Haskins and Ms. Kathy Gunkel of the Maryland Department of Environmental Programs observed the testing conducted by RAMCON.

TABLE I

SUMMARY OF TEST RESULTS
August 6 & 7, 1984

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	12:17 to 13:25	0.0300 gr/SCF	109%	6.4 lbs/hr
2	09:52 to 11:12	0.0342 gr/SCF	101%	7.8 lbs/hr
*3	14:52 to 08:23	0.0323 gr/SCF	109%	6.7 lbs/hr
Average		0.0322 gr/SCF		7.0 lbs/hr

* Test run three began 8-7-84, and was completed 8-8-84.

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

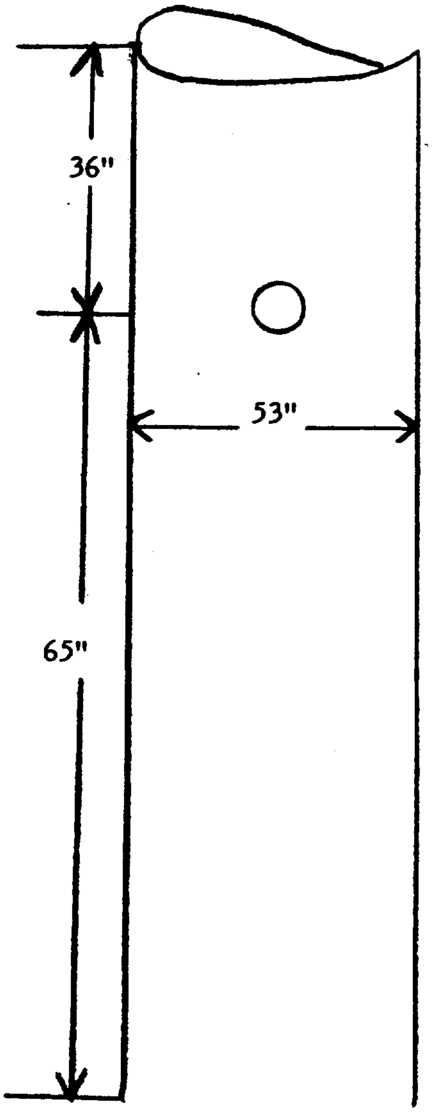
III. TEST PROCEDURES

A. Method Used: The source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended. All three test runs were sampled at two minutes each.

B. Problems Encountered: No problems were encountered.

C. Sampling Site: The emissions test was conducted after a scrubber on a round stack with a diameter of 53". The sampling ports were placed 36" down (0.68 diameters upstream) from the top of the stack and 65" up (1.22 diameters downstream) from the last flow disturbance. Twenty four points were sampled, twelve through each traverse for three minutes each.

Points on a Diameter	Plus 6" Standoff	Probe Mark
1		7.6"
2		10.6"
3		12.3"
4		15.4"
5		19.3"
6		24.8"
7		40.2"
8		45.8"
9		49.6"
10		52.7"
11		55.4"
12		57.9"



IV. THE SOURCE

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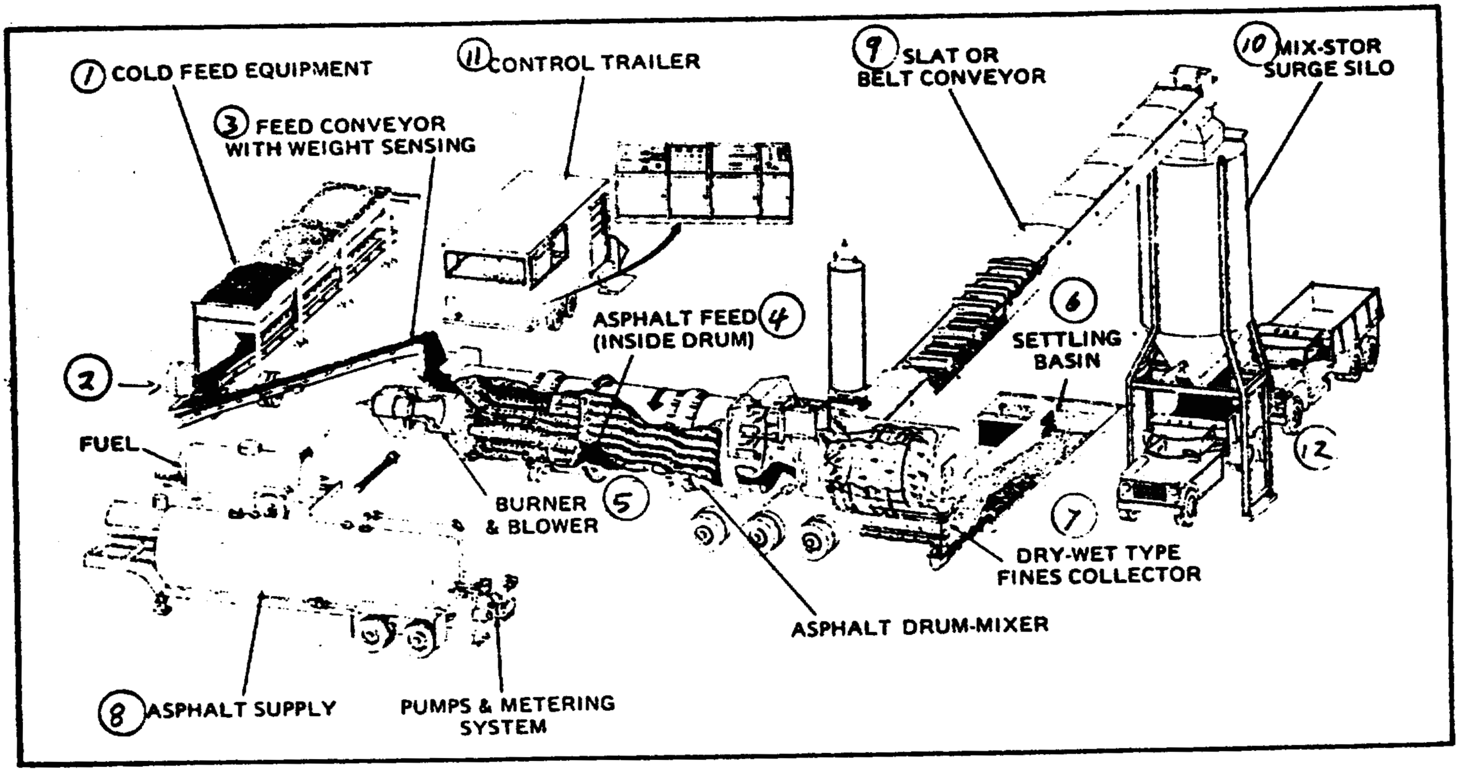
James Julian, Inc. employs a Boeing drum mix asphalt concrete plant which is used to manufacture asphalt concrete for road pavement. The process consists of blending prescribed portions of cold feed materials (sand, gravel, screenings, chips, etc.) uniformly and adding sufficient hot asphalt oil to bind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

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

The drum mixer uses a burner to heat air to dry the aggregate, and the motion of the rotating drum to blend the aggregate and hot asphalt oil thoroughly. The air is drawn into the system via an exhaust fan. After passing through the gas burner and the mixing drum, the air passes through a high efficiency scrubber. The scrubber is manufactured by Boeing. 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 15 inches of water. The particulate matter, which is removed by the scrubber is fed into a scrubber pond where it drops out of suspension.

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



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 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. Stack

DATA SUMMARY

Plant

1. Manufacturer of plant BOEING.
2. Designed maximum operating capacity 600 TPH @ 0 % moisture.
3. Actual operation rate 350 TPH @ 0-7 % moisture.
4. Startup date April 84.
5. Type of fuel used in dryer Dieselect.
6. Quanity of fuel consumption 1.2 GAL per TON.

Aggregate

7. Name/type of mix SURFACE S/N 6.2 A.
8. Percent asphalt in mix 6.2 %.
9. Temperature of asphalt 285.
10. Sieve/Screening analysis: % Passing:

1"		3/8"	98	#30	32
3/4"		#4	77	#100	11
1/2"		#16	43	#200	6.4

Scrubber Control System

11. Manufacturer BOEING.
12. Type; Venturi ✓; Wet Washer ____; Spray Booth ____; Other ____.
13. Water line pressure 84 psi.
14. Pressure drop across system 13-14 psi.
15. Gallons per minute through system 205.
16. Water source SEDIMENT POND (i.e., lagoon, pond, etc.)
17. Number of spray nozzles 36.

COMPANY NAME JAMES Julian INC.

COMPANY REPRESENTATIVE Ronald A. McGuirk

DATE 8/8/84

PLANT DATA

COMPANY NAME JAMES Julian INC.
COMPANY REP. Ron McGuirk DATE 8/8/84 Phone # 301-287-9170
DATA SOURCE
PLANT LOCATION Maryland Materials, North EAST, MD.
PLANT MANUFACTURER Boeing PLANT MODEL NO. 600 PLANT TYPE Drum Mix
MIX SPECIFICATION NO. OIL SPECIFICATION NO.

TIME: START STOP A.T. 90 °F R.H. 80 %

TIME 24 HOUR	FUEL OIL ☑ NATURAL GAS ☐ PROPANE ☐	BURNER SETTING	AGGREGATE TPH	RECYCLE TPH	ASPHALT	MIX TEMPERATURE °F	VENTURI ☑ Baghouse ☐ DIFFERENTIAL
	560 gal. per hr	MANUAL	350	0	6.2	285	12-14

REMARKS:

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 next page.

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

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

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

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.

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.

WEIGHING PROCEDURE — SARTORIUS ANALYTICAL BALANCE

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

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

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

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

SAMPLE ANALYTICAL DATA FORM

Plant Location North East, Maryland
Sample Location James Julian Const. Co.
Relative humidity in lab 70%
Density of acetone (ρ_a) .7899 g/ml

		RUN 1	RUN 2	RUN 3
Acetone rinse container number	#	PW1	PW2	PW3
Acetone rinse volume (V_{aw})	ml	325	200	250
Acetone blank residue concentration (C_a)	mg/g	0	0	0
$W_a = C_a V_{aw} \rho_a$ = (0)(200)(.7899) = 0	g	0	0	0
Date/time of wt ________ Gross wt	g	143.4856	131.9938	134.4980
Date/time of wt ________ Gross wt	g	143.4859	131.9946	134.4998
Average Gross wt	g	143.4857	131.9942	134.4989
Tare wt	g	143.4239	131.9309	134.4389
Less acetone blank wt (W_a)	g	0	0	0
Wt of particulate in acetone rinse (m_a)	g	0.0618	0.0633	0.0600
Filter numbers	#	U-0062	U-0063	U-0064
Date/time of wt ________ Gross wt	g	0.6977	0.7210	0.7105
Date/time of wt ________ Gross wt	g	0.6976	0.7205	0.7100
Average Gross wt	g	0.6976	0.7207	0.7102
Tare wt	g	0.6750	0.6767	0.6708
Weight of particulate on filters(s) (m_f)	g	0.0226	0.0440	0.0394
Weight of particulate in acetone rinse	g	0.0618	0.0633	0.0600
Total weight of particulate (m_n)	g	0.0844	0.1073	0.0994

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

Remarks ________________________________

Signature of analyst Cameron Mitchell
Signature of reviewer

VII. CALCULATIONS

NAME: JAMES JULIAN CONSTRUCTION CO.

	LOCATION: NORTHEAST MARYLAND	date	8/06/84	8/07/84	8/07/8
	SUMMARY OF TEST DATA		RUN # 1	RUN # 2	RUN #
	SAMPLING TRAIN DATA	start	12:17	09:52	14:52
		finish	13:25	11:12	08:2
1	Sampling time, minutes	θ	64	72	72
2	Sampling nozzle diameter, in.	Dn	.265	.265	.265
3	Sampling nozzle cross-sectional area, ft^2.	An	.000383	.000383	.000383
4	Isokinetit variation	I	109	101	109
5	Sample gas volume - meter conditions, cf.	Vm	47.25	51.96	50.40
6	Average meter temperature, °R	Tm	580	572	564
7	Average oriface pressure drop, in.H_2O	ΔH	1.72	1.69	1.38
8	Total particulate collected mg.	Mn	84.4	107.3	99.4
	VELOCITY TRAVERSE DATA				
9	Stack area, ft^2.	A	15.3	15.3	15.3
10	Absolute stack gas pressure, in Hg.	Ps	30.00	30.00	30.00
11	Barometric pressure, in. Hg.	Pbar	30.00	30.00	30.00
12	Average absolute stack temperature, °R	Ts	611	619	621
13	Average $\sqrt{\text{velocity head}}$, (Cp= .84)	$\sqrt{\Delta P}$	.71	.75	.68
14	Average stack gas velocity ft./ sec.	Vs	45	48	43
	STACK MOISTURE CONTENT				
15	Total water collected by train, ml.	Vic	398.0	419.0	405.0
16	Moisture in stack gas, %	Bws	30.2	29.1	28.7
	EMISSIONS DATA:				
17	Stack gas flow rate, dscf/hr. (000's)	Qsd	1,492	1,587	1,443
18	Total particulate concentration, gr/dscf	Cs	.0300	.0342	.0323
19	Total particulate concentration, lbs/hr	E	6.4	7.8	6.7
20	Total particulate concentration, lbs/mbtu	E'	.0	.0	.0
	ORSAT DATA				
21	Percent CO2 by volume	CO2	10.0	10.0	10.0
22	Percent O2 by volume	O2	11.0	11.0	11.0
23	Percent CO by volume	CO	.0	.0	.0
24	Percent N2 by volume	N2	79.0	79.0	79.0

Buzzycalc

Dry Gas Volume :

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

Where:

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

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

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

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

T_m = Absolute temperature at meter °R

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

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

Y = Dry gas meter calibration factor

13.6 = inches water per inches Hg.

Run # 1 $$V_{m(std)} = 17.64 \quad (1.00)(47.25) \left[\frac{(30.00) + \frac{1.72}{13.6}}{580} \right] = 43.29 \text{ ds}$$

Run # 2 $$V_{m(std)} = 17.64 \quad (1.00)(51.96) \left[\frac{(30.00) + \frac{1.69}{13.6}}{572} \right] = 48.27 \text{ ds}$$

Run # 3 $$V_{m(std)} = 17.64 \quad (1.00)(50.40) \left[\frac{(30.00) + \frac{1.38}{13.6}}{564} \right] = 47.45 \text{ ds}$$

Total contamints by weight: 'GRAIN LOADING'

Particulate concentration $C_s^{'}$ gr./dscf.

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

Where:

$C_s^{'}$ = concentration of particulate mater in stack gas, dry basis, corrected to standard conditions, g/dsf

M_n = Total amount of particulate mater colected, mg.

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

Run # 1: $C_s^{'} = \left[0.0154 \ \frac{gr}{mg} \right] \left[\frac{84.4}{43.29} \right] = .0300$ gr./dscf.

Run # 2: $C_s^{'} = \left[0.0154 \ \frac{gr}{mg} \right] \left[\frac{107.3}{48.27} \right] = .0342$ gr./dscf.

Run # 3: $C_s^{'} = \left[0.0154 \ \frac{gr}{mg} \right] \left[\frac{99.4}{47.45} \right] = .0323$ gr./dscf.

Water vapor condenced :

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

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

Where:

0.04707 = Conversion factor ft.^{3}/ml.

0.04715 = Conversion factor ft.^{3}/g.

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

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

V_f = Final volume of impinger contents, mi.

V_i = Initial volume of impinger contents

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

R = Ideal gas constant, 21.85 (in.Hg.)(cu.ft./lb.-mole)(°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) (378.0) = 17.8 cu.ft
$V_{wsg(std)}$ = (0.04715) (20.0) = .9 cu.ft

Run # 2:
$V_{wc(std)}$ = (0.04707) (392.0) = 18.5 cu.ft
$V_{wsg(std)}$ = (0.04715) (27.0) = 1.3 cu.ft

Run # 3:
$V_{wsg(std)}$ = (0.04707) (390.0) = 18.4 cu.ft
$V_{wc(std)}$ = (0.04715) (15.0) = .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 ream.

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

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

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

Run # 1: $$B_{ws} = \frac{17.8 + .9}{17.8 + .9 + 43.29} \text{ X } 100 = 30.2\ \%$$

Run # 2: $$B_{ws} = \frac{18.5 + 1.3}{18.5 + 1.3 + 48.27} \text{ X } 100 = 29.1\ \%$$

Run # 3: $$B_{ws} = \frac{18.4 + .7}{18.4 + .7 + 47.45} \text{ X } 100 = 28.7\ \%$$

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

Where:

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

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

Run # 1: M_s = 30.0 (1- .302) + 18 (.302) = 26.4 (lb./lb.-mole).

Run # 2: M_s = 30.0 (1- .291) + 18 (.291) = 26.5 (lb./lb.-mole).

Run # 3: M_s = 30.0 (1- .287) + 18 (.287) = 26.6 (lb./lb.-mole).

Stack gas velocity:

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

Where:

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

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

C_p = Pitot tube coefficient,(dimensionless).

ΔP = Velocity head of stack gas, in. H_2O.

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

P_g = Satck static pressure (in.Hg).

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

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

t_s = Stack temperature, (°f).

T_s = Absolute stack temperature, (°R). = $460 + t_s$.

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

Run # 1: $V = (85.48)(\ .84)(\ .71)\sqrt{\dfrac{611}{(30.00)(26.38)}} = 44.79$ ft/s

Run # 2: $V = (85.48)(\ .84)(\ .75)\sqrt{\dfrac{619}{(30.00)(26.51)}} = 47.51$ ft/s

Run # 3: $V = (85.48)(\ .84)(\ .68)\sqrt{\dfrac{621}{(30.00)(26.56)}} = 43.10$ ft/s

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 (°f).
T_s = Absolute stack temperature, (°R).
T_{std} = Standard absolute temperature, (528°R).
P_{bar} = Barometric pressure at measurement site, (in.Hg.).
P_g = Satck static pressure, (in.Hg.).
P_s = Absolute stack gas pressure, (in.Hg.); = $P_{bar} + P_g$
P_{std} = Standard absolute pressure, (29.92 in.Hg).

Run # 1:

$$Q_{sd} = 3600\ (1-.302)\ (\ 44.79)\ (\ \ 15.3) \left[\frac{528}{611} \right] \left[\frac{30.00}{29.92} \right] = \quad 1492048 \text{ dscf/}$$

Run # 2:

$$Q_{sd} = 3600\ (1-.291)\ (\ 47.51)\ (\ \ 15.3) \left[\frac{528}{619} \right] \left[\frac{30.00}{29.92} \right] = \quad 1586822 \text{ dscf/}$$

Run # 3:

$$Q_{sd} = 3600\ (1-.287)\ (\ 43.10)\ (\ \ 15.3) \left[\frac{528}{621} \right] \left[\frac{30.00}{29.92} \right] = \quad 1442988 \text{ dscf/}$$

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 mater in stack gas, dry basis, corrected to standard conditions (g/dsf).

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

Run # 1: $$E = \frac{(.0300)\ (1492048)}{7000} = 6.4 \text{ lb. / hr.}$$

Run # 2: $$E = \frac{(.0342)\ (1586822)}{7000} = 7.8 \text{ lb. / hr.}$$

Run # 3: $$E = \frac{(.0323)\ (1442988)}{7000} = 6.7 \text{ lb. / hr.}$$

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

Where:

I = Precent 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,

T_m = Absolute average dry gas meter temperature, °R.

P_{bar} = Barometric pressure at sampling site, (inHg).

ΔH = Average pressure differential across the oriface meter, (in.H_2

13.6 = Specific gravity of mercury.

60 = conversion seconds to minutes

Q = 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:

$$I = 100 \quad X \quad 611 \left[\frac{(0.002669)(398.0) + \frac{47.2}{580}\left[30.00 + \frac{1.72}{13.6}\right]}{60\ (\ 64\ )\ (\ 44.79\ )\ (30.00\ )\ (\ .000383\ )} \right] = 109\ \%$$

Run # 2:

$$I = 100 \quad X \quad 619 \left[\frac{(0.002669)(419.0) + \frac{52.0}{572}\left[30.00 + \frac{1.69}{13.6}\right]}{60\ (\ 72\ )\ (\ 47.51\ )\ (30.00\ )\ (\ .000383\ )} \right] = 101$$

Run # 3:

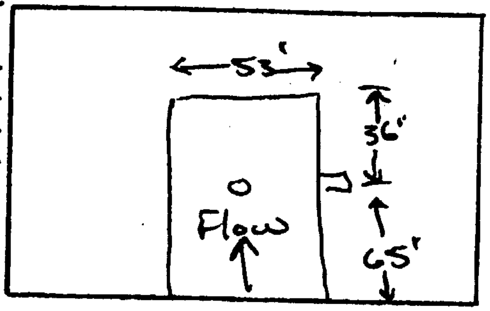
$$I = 100 \quad X \quad 621 \left[\frac{(0.002669)(405.0) + \frac{50.4}{564}\left[30.00 + \frac{1.38}{13.6}\right]}{60\ (\ 72\ )\ (\ 43.10\ )\ (30.00\ )\ (\ .000383\ )} \right] = 109$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant James Julian
Location Northeast My.
Operator C. Mitchell
Date 8-6-84
Run No. 1
Sample Box No. 1
Meter Box No. 185
Meter H @ 1.86
C Factor 60028
Pitot Tube Coefficient Cp 0.84

M=3.34



Schematic of Stack Cross Section

Ambient Temperature 85°F
Barometric Pressure 29.9 "Hg
Assumed Moisture, % 24%
Probe Length, m(ft) 5'
Nozzle Identification No. 0.000383
Avg. Calibrated Nozzle Dia., (in.) 0.265
Probe Heater Setting 5
Leak Rate, m3/min. (cfm) <0.02
Probe Liner Material 316 Stainless
Static Pressure, mm Hg (in.Hg) +0.02
Filter No. U-0062

	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g
FINAL	578	586
INITIAL	200	566
DIFFERENCE	378	20

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)		FILTER HOLDER TEMP (°F)	GAS TEMP LVG CONDENSER OR LAST IMPINGER (°F)
							Inlet	Outlet		
A 1	12:17 12:19	2	145	0.4	1.47	706.77 708.50	110	110	250	55
2	12:21	2	150	0.4	1.47	709.92	120	105	250	55
3	12:23	1	150	0.3	1.00	710.92	125	105	250	55
4	12:25	1	150	0.3	1.00	712.05	125	105	250	55
5	12:27	1	145	0.3	1.00	713.15	125	105	250	55
6	12:29	2	145	0.3	1.00	714.36	125	105	250	55
7	12:31	2	150	0.3	1.00	715.42	130	105	250	55
8	12:33	1	150	0.2	0.67	716.40	130	105	250	55
9	12:35	2	150	0.3	1.00	718.40	130	105	250	55
10	12:37	3	150	0.5	1.67	720.02	135	105	250	55
11	12:39	3	155	0.6	2.00	722.03	135	105	250	55
12	12:41	4	150	0.7	2.33	722.88	135	105	250	55
13	12:43	4	155	0.7	2.33	725.04	135	105	250	55

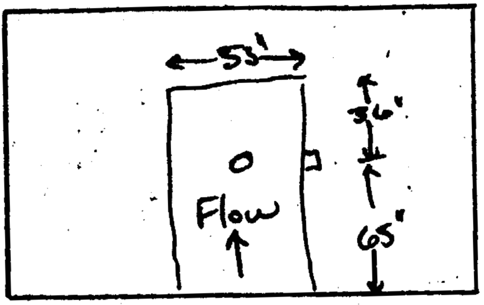
RAMCON emissions test log sheet, cont. DATE 8-6-84 LOCATION James Julian TEST NO. 1

TRAVERSE POINT	SAMPLING TIME θ (min)	~~P~~ Vacuum (in. ~~H2O~~ 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		
14	12:45	4	155	0.7	2.33	726.25	135	105	255	55
15	12:47	4	150	0.7	2.33	728.40	135	105	255	55
16	12:49	4	150	0.6	2.00	729.18	135	105	255	55
B) 1	~~12:53~~ 12:55	3	150	0.5	1.67	731.39	120	110	255	60
2	12:57	3	150	0.6	2.00	732.58	135	110	255	60
3	12:59	3	150	0.6	2.00	734.28	135	110	255	60
4	13:01	3	150	0.5	1.67	735.60	135	110	255	60
5	13:03	3	155	0.5	1.67	737.06	135	110	255	60
6	13:05	3	150	0.5	1.67	738.57	135	110	260	60
7	13:07	3	150	0.5	1.67	740.25	135	110	260	60
8	13:09	2	150	0.3	1.00	741.30	135	110	260	60
9	13:11	3	150	0.4	1.34	742.71	135	110	260	60
10	13:13	3	150	0.5	1.67	744.10	140	110	260	60
11	13:15	3	155	0.6	2.00	745.90	140	110	260	60
12	13:17	4	150	0.7	2.33	747.40	140	110	260	60
13	13:19	4	155	0.7	2.33	749.30	140	110	260	60
14	13:21	5	155	0.8	2.67	751.00	140	110	260	60
15	13:23	5	155	0.8	2.67	753.04	140	110	260	60
16	13:25	4	155	0.6	2.00	754.02	140	110	260	60

H = 2.95

RAMCON ENVIRONMENTAL CORPORATION

Plant James Julian
Location Northeast, Md.
Operator C. Mitchell
Date 8-7-84
Run No. 2
Sample Box No. 2
Meter Box No. 185
Meter H @ 1.86
C Factor 1.0028
Pitot Tube Coefficient Cp 0.84



Schematic of Stack Cross Section

Ambient Temperature 95°F
Barometric Pressure 29.94" Hg
Assumed Moisture, % 29
Probe Length, m(ft) 5'
Nozzle Identification No. 0.000393
Avg. Calibrated Nozzle Dia., (in.) 0.265
Probe Heater Setting 5
Leak Rate, m3/min.(cfm) <0.02
Probe Liner Material 316 stainless
Static Pressure, mm Hg (in.Hg) +0.03
Filter No. U-0063

	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g
FINAL	592	565
INITIAL	200	538
DIFFERENCE	392	27

TRAV. PT NO.	SAMPLING TIME (θ)min.	VACUUM (in. Hg)	STACK TEMP (Ts) (°F)	VELOCITY HEAD (Ps) (in)H20	PRESSURE DIFF. ORF. MTR (in H2O)	GAS SAMPLE VOLUME 7529 (ft3)	GAS SAMPLE TEMP. AT DRY GAS METER (°F) Inlet	Outlet	FILTER HOLDER TEMP (°F)	GAS TEMP LVG CONDENSER OR LAST IMPINGER (°F)
A) 1	ck 9:45 9:52/9:55	1	160	0.3	0.89	ck 754.56/756.84	95	90	250	55
2	9:58	2	155	0.4	1.18	758.65	105	90	250	55
3	10:01	3	160	0.5	1.47	760.45	110	90	250	55
4	10:04	3	155	0.5	1.47	762.50	115	90	250	55
5	10:07	3	155	0.4	1.18	764.23	120	90	250	55
6	10:10	3	160	0.4	1.18	766.17	120	95	250	55
7	10:13	3	160	0.4	1.18	767.93	125	95	250	55
8	10:16	3	155	0.5	1.47	770.13	125	95	250	55
9	10:19	4	160	0.6	1.77	772.20	125	95	250	55
10	10:22	4	160	0.6	1.77	774.47	130	100	255	55
11	10:25	4	160	0.6	1.77	777.01	130	100	255	55
12	10:28	6	160	0.8	2.36	779.90	130	100	255	55
B) 1	10:36/10:39	4	160	0.7	2.[illegible]	782.40	120	100	255	55

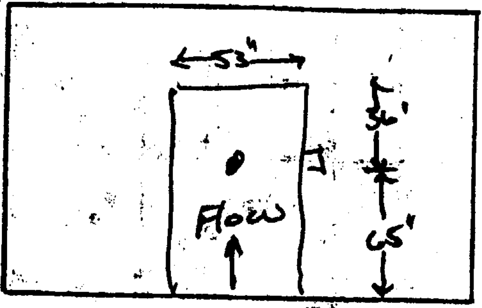
RAMCON emissions test log sheet, cont. DATE 8-7-84 LOCATION James Julian TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	P_s (in. H_2O)	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	10:42	4	160	0.6	1.77	784.00	130	100	250	60
3	10:45	4	160	0.6	1.77	786.50	130	100	250	60
4	10:48	5	160	0.7	2.1	788.74	130	100	250	60
5	10:51	4	160	0.6	1.77	791.29	135	105	255	55
6	10:54	4	160	0.5	~~1.5~~ 1.47	793.23	135	105	255	55
7	10:57	3	155	0.4	1.18	795.05	135	105	255	55
8	11:00	4	165	0.6	1.77	797.35	135	105	255	55
9	11:03	5	155	0.8	2.36	799.75	135	105	255	55
10	11:06	5	160	0.8	2.36	802.47	135	105	255	55
11	11:09	4	160	0.6	1.77	804.90	135	105	255	55
12	11:12	5	155	0.8	2.36	806.84	135	105	255	55

RAMCON ENVIRONMENTAL CORPORATION

Plant James Julian
Location Northeast May.
Operator C. Mitchell
Date 8-7-84
Run No. 3
Sample Box No. 3
Meter Box No. 185
Meter H @ 1.86
C Factor 1.0028
Pitot Tube Coefficient Cp 0.84

M=2.95



Schematic of Stack Cross Section

Ambient Temperature 90°F
Barometric Pressure 29.9" Hg
Assumed Moisture, % 25
Probe Length, m(ft) 5
Nozzle Identification No. 0.000383
Avg. Calibrated Nozzle Dia., (in.) 0.265
Probe Heater Setting 5
Leak Rate, m³/min. (cfm) <0.02
Probe Liner Material 316 Stainless
Static Pressure, mm Hg (in.Hg) +0.03
Filter No. U-0064

	IMPINGER VOLUME ml	SILICA GEL WEIGHT, g
FINAL	590	534
INITIAL	200	519
DIFFERENCE	390	15

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 (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	14:52 / 14:55	1	165	0.4	1.18	807.09 / 809.33	110	105	255	55
2	14:58	2	165	0.4	1.18	811.10	120	105	255	55
3	15:01	2	165	0.4	1.18	812.92	125	105	255	55
4	15:04	2	165	0.4	1.18	814.80	125	105	255	55
5	15:07	2	165	0.4	1.18	816.68	130	100	255	55
6	15:10	1	165	0.3	0.88	818.25	130	100	255	55
7	15:13	1	165	0.3	0.88	820.00	130	100	255	60
8	15:16	3	165	0.5	1.48	822.21	130	100	255	60
9	15:19	3	160	0.6	1.77	824.30	130	100	255	60
10	15:22	4	160	0.7	2.1	826.78	130	100	255	60
11	15:25	4	155	0.7	2.[illegible]	829.50	130	100	255	60
12	15:28	3	155	0.6	1.77	830.93	130	100	255	60
B) 1	7:47	2	155	0.4	1.18	833.20	75	75	255	60

7/3/94 7:50

RAMCON emissions test log sheet, cont. DATE 8-7-84 LOCATION James Julian TEST NO. 3

TRAVERSE POINT	SAMPLING TIME θ (min)	P_s (in. H_2O)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME Vm (ft^3)	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
2	7:53	3	155	0.5	1.48	834.90	90	70	255	55
3	7:56	4	165	0.5	1.48	836.90	95	75	255	55
4	7:59	4	160	0.5	1.48	839.10	100	75	255	55
5	8:02	4	165	0.4	1.18	840.74	105	75	255	55
6	8:05	4	160	0.4	1.18	842.72	110	80	255	60
7	8:08	2	160	0.3	0.88	844.20	110	80	255	60
8	8:11	2	160	0.3	0.88	846.00	115	85	255	60
9	8:14	3	160	0.5	1.48	848.40	115	85	255	60
10	8:17	3	165	0.5	1.48	851.55	120	85	255	60
11	8:20	3	160	0.6	1.77	854.43	120	90	255	60
12	8:23	3	160	0.6	1.77	857.49	120	90	255	60

IX. CALIBRATIONS

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number ________ Date 8-13-84 Meter box number 185 Plant James Julian

Barometric pressure, P_b = 29.755 in. Hg Dry gas meter number 689836 Pretest Y ________

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter						$\dfrac{V_w P_b (t_d + 460)}{V_d \left(P_b + \dfrac{\Delta H}{13.6}\right)\left(t_w + 460\right)}$
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Average[a] (t_d), °F				
3.0	cm ~~10~~ 13	995.81 9.28	74	118	88	103.0	13.67	5	1.01	
3.0	10	16.38 26.67	74	119	88	103.5	10.48	4	1.01	
3.0	10	26.67 36.97	74	119	88	103.5	10.47	4	1.01	
									Y =	1.01

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

where

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

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

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

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

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

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

ΔH = Pressure differential across orifice, in. H_2O.

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

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

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

(30)

POSTTEST DRY GAS METER CALIBRATION DATA FORM
EPA CALIBRATED ORIFICE

Calibration Date 8-13-84
Device Number 1
Device K' 2.525 x 10^{-4}
Meter Box No. 185
D.G.M. No. 689836
P_{bar} 755.8 mmHg

Sampling Time (Θ) min.	Vacuum (in. Hg)	Pressure Diff. Orf. Mtr (H_2O)	Gas Sample Volume (ft^3)	Gas Sample Temp. At Dry Gas Meter (°F) Inlet	Outlet
		ΔH avg.	V_m / $V_m$std	°F / °R	°C / °K
15.0	19"	0.5	891.4 / 897.365	107 / 110	94 / 94
RUN 1	19"	0.5	5.965	101.25 / 561.25	38.47 / 311.47
15.0	19"	0.5	897.365 / 903.35	105 / 109	94 / 94
RUN 2	19"	0.5	5.995	100.5 / 560.5	38.05 / 311.05
15.0	19"	0.5	881.855 / 887.785	105 / 109	92 / 93
RUN 3	19"	0.5	5.95	100 / 560	37.8 / 310.8

$V_m std = V_s$

$V_s = \frac{K' P_o \Theta}{\sqrt{T_o}}$

Where;

$V_m std$ = Dry gas volume through meter at standard conditions, cu.ft. (Determine using Method 5 formulas and procedures.)
V_s = Dry gas volume through calibrated orifice at standard conditions.
K' = Calibrated orifice constant (Determined by EPA).
P_o = Pressure at entry to orifice mm Hg.
T_o = Temperature at entry to orifice °K.

$$V_s = \frac{(2.525\times10^{-4})\ (755.8)\ (15)}{(17.65)} = (0.162)(35.3145) = 5.72$$

$$Y = \frac{V_s}{V_m std} = \frac{5.72}{5.58} = 1.02$$

$$V_m std = 17.64\ (5.965) \left[\frac{(29.755) + \frac{(0.5)}{13.6}}{(561.25)}\right] = 5.58$$

$$V_s = \frac{(2.525\times10^{-4})\ (755.8)\ (15)}{(17.64)} = (0.162)(35.3145) = 5.72$$

$$Y = \frac{V_s}{V_m std} = \frac{5.72}{5.61} = 1.02$$

$$V_m std = 17.64\ (5.995) \left[\frac{(29.755) + \frac{(0.5)}{13.6}}{(560.5)}\right] = 5.61$$

$$V_s = \frac{(2.525\times10^{-4})\ (755.8)\ (15)}{(17.63)} = (0.162)(35.3145) = 5.72$$

$$Y = \frac{V_s}{V_m std} = \frac{5.72}{5.58} = 1.02$$

$$V_m std = 17.64\ (5.95) \left[\frac{(29.755) + \frac{(0.5)}{13.6}}{(560)}\right] = 5.58$$

POSTTEST DRY GAS METER CALIBRATION DATA FORM
EPA CALIBRATED ORIFICE

S. Bush

Calibration Date 8-2-84
Device Number 2
Device K' 2.498 x 10^{-4}
Meter Box No. C-185
D.G.M. No. 689936
P_{bar} 29.39 mmHg

Sampling Time (0) min.	Vacuum (in. Hg)	Pressure Diff. Orf. Mtr (H_2O)	Gas Sample Volume (ft³)	Gas Sample Temp. At Dry Gas Meter (°F) Inlet	Outlet
Start Stop		Δ H avg.	V_m $V_m$std	°F °R	°C °K
0 15	19"	.50	687.50 693.458	76 86	74 73
RUN 1	19"	—	5.958 5.76	79 537	25 298
0 15	19"	.50	693.58 699.446	84 86	73 72
RUN 2	19"	—	5.946 5.73	79 539	26 299
0 15	19"	.50	699.60 705.541	88 86	73 72
RUN 3	19"	—	5.941	80 540	27 300

$V_m std = V_s$

$$V_s = \frac{K' P_o \Theta}{\sqrt{T_o}}$$

Where;

$V_m std$ = Dry gas volume through meter at standard conditions, cu.ft. (Determine using Method 5 formulas and procedures.)
V_s = Dry gas volume through calibrated orifice at standard conditions.
K' = Calibrated orifice constant (Determined by EPA).
P_o = Pressure at entry to orifice mm Hg.
T_o = Temperature at entry to orifice °K.

$$V_s = \frac{(.0002498)\ (746.5)\ (15)}{(17.31)}$$

$$V_m std = \frac{17.64\ (5.958)\left[(29.39) + \frac{(.5)}{13.6}\right]}{(537)} \qquad Y = \frac{V_s}{V_m std} = \frac{5.71}{5.76}\ .991$$

$$V_s = \frac{(.0002498)\ (746.5)\ (15)}{(17.3)}$$

$$V_m std = \frac{17.64\ (5.946)\left[(29.39) + \frac{(.5)}{13.6}\right]}{(\quad)} \qquad Y = \frac{V_s}{V_m std} = \frac{5.71}{5.73}\ .997$$

$$V_s = \frac{(.0002498)\ (746.5)\ (15)}{(17.31)}$$

$$V_m std = \frac{17.64\ (5.941)\left[(29.39) + \frac{(.5)}{13.6}\right]}{(540)} \qquad Y = \frac{V_s}{V_m std} = \frac{5.71}{5.71} = 1.00$$

Date 7-13- 84 Thermocouple number INlet/outlet

Ambient temperature 77 °F Barometric pressure 29.34 in. Hg

Calibrator S Turney Reference: mercury-in-glass 77 °F

other

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
77	Inlet Ambient	77 °F	77 °F	100%
77°F	Outlet Ambient	77 °F	77 °F	100%
85°F	6-885	85 °F	85 °F	100%

[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.

Date 7-12-84 Thermocouple number Hotbox

Ambient temperature 25 °C Barometric pressure 29.34 in. Hg

Calibrator Turned Reference: mercury-in-glass ✓

other ________

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
100°C	boiling H2O	100°C	100°C	100%
76°F	Ambient	Mercury 75.8 F	75°C	99.9%
85°F	6-6-85	85°F	85°F	100%

[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 8·2·84 Thermocouple number 5'

Ambient temperature 74 °C Barometric pressure 29.39 in. Hg

Calibrator Sam Turner Reference: mercury-in-glass ✓

other

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
74°F	ambient	Merc. 74°F	74 F	100 %
32°F	ice bath	32°F	32°F	100 %
85°F	6-8-84	85°F	85°F	100%

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

[b] Type of calibration system used.

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

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. 5′ Date 8·2·84

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	.43	.72	.773	-.01
2	.57	.95	.775	-.01
3	.74	1.20	.785	-.01
		$\bar{C}_p$ (SIDE A)	.778	

"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	.45	.75	.775	-.01
2	.50	.81	.786	-.01
3	.71	1.16	.782	-.01
		$\bar{C}_p$ (SIDE B)	.781	

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

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

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

Form No. EED-17-1

RAMCON

Lear Siegler Stack Sampler

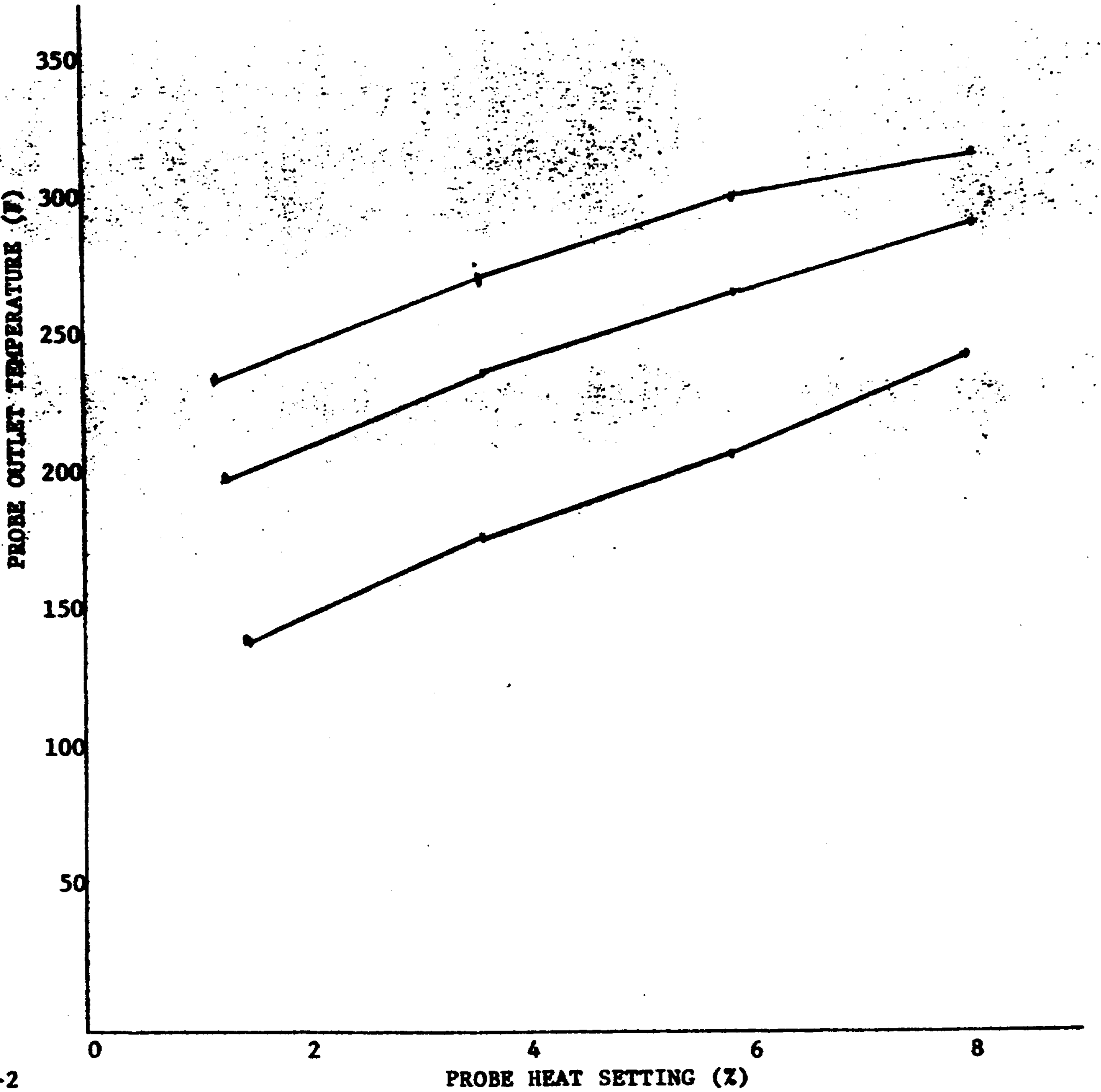
Heating Probe Calibration

Probe No. 2 Probe Length 5'

Date of Calibration 8-2-84 Signature Sam T Turn

Name of Company to be tested

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



Form No. EED-17-2

X. RAMCON PERSONNEL

RAMCON Environmental Stack Test Team

Sumner Buck - President & Field Supervisor

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

J. Cameron Mitchell - Team Leader

Cameron Mitchell has been employed by RAMCON for several years. He has undergone extensive traning in Methods 1 through 8. He is qualified as a team leader and has personally sampled over 100 stacks including 40 asphalt plants. He is currently enrolled in Memphis State University with a major in Civil Engineering.

XI. VISIBLE EMISSIONS

MARYLAND STATE DEPARTMENT OF HEALTH AND MENTAL HYGIENE
OFFICE OF ENVIRONMENTAL PROGRAMS
Air Management Administration
O'Conor Building
201 W. Preston Street
Baltimore, Maryland 21201

REPORT OF OBSERVATION OF VISIBLE EMISSIONS

Date 8/16/84

Time At Start Of Observation 12:22

Premise Name James Julian, Inc

Address [illegible]

County Cecil

Type of Installation [illegible]

Color of Plume

Point of Discharge [illegible] ~~[illegible]~~ Scrubber

Point of Observation S-SE of stack

Steam Plume ☐ None ☒ Attached ☐ Detached

Sky Conditions [illegible] blue sky [illegible]

Ambient Temperature 85-90 F

Wind Direction NW

Wind Speed 0-5mph very [illegible]

Sec / Min	0	15	30	45	Sec / Min	0	15	30	45	Sec / Min	0	15	30	[illegible]
0 1222	0	0	0	0	20					40				
1	0	0	0	0	21					41				
2	0	0	0	0	22					42				
3	0	0	0	0	23					43				
4	0	0	0	0	24					44				
5	0	0	0	0	25					45				
6	0	0	0	0	26					46				
7	0	0	0	0	27					47				
8	0	0	0	0	28					48				
9	0	0	0	0	29					49				
10	0	0	0	0	30					50				
11	0	0	0	0	31					51				
12	0	0	0	0	32					52				
13					33					53				
14					34					54				
15 27					35					55				
16					36					56				
17					37					57				
18 40					38					58				
19					39					59				

Remarks: 32% DH, 27.7-3.3, 28.8-0.9, 37.7-2.3, 6.2% AC, RSCF mix

Name of Observer

DHMH 1841
AMA-19 Revised 10-1-81

(39)

MARYLAND STATE DEPARTMENT OF HEALTH AND MENTAL HYGIENE
OFFICE OF ENVIRONMENTAL PROGRAMS
Air Management Administration
O'Conor Building
201 W. Preston Street
Baltimore, Maryland 21201

REPORT OF OBSERVATION OF VISIBLE EMISSIONS

Date August 7, 1984

Time At Start Of Observation 9:35 am

Premise Name James Juliano Asphalt (Northeast)

ddress Maryland Materials Quarry / Stevenson Rd. County Cecil Co.

ype of Installation Asphot Batching Plant Color of Plume ——————

int of Discharge From Scrubber Stack

Steam Plume ☐ None ☑ Attached ☐ Detached

Point of Observation 220' South of Scrub. Stack

Sky Conditions Partly Cloudy Ambient Temperature 78°F ±

Wind Direction From West Wind Speed 1–3 mph

Min \ Sec	0	15	30	45	Min \ Sec	0	15	30	45	Min \ Sec	0	15	30	45
0	0%	0	0	0	20	0%	0	0	0	40	0%	0	0	0
1	0%	0	0	0	21	0%	0	0	0	41	0%	0	0	0
2	0%	0	0	0	22	0%	0	0	0	42	0%	0	0	0
3	0%	0	0	0	23	0%	0	0	0	43	0%	0	0	0
4	0%	0	0	0	24	0%	0	0	0	44	0%	0	0	0
5	0%	0	0	0	25	0%	0	0	0	45	0%	0	0	0
6	0%	0	0	0	26	0%	0	0	0	46	0%	0	0	0
7	0%	0	0	0	27	0%	0	0	0	47	0%	0	0	0
8	0%	0	0	0	28	0%	0	0	0	48	0%	0	0	0
9	0%	0	0	0	29	0%	0	0	0	49	0%	0	0	0
10	0%	0	0	0	30	0%	0	0	0	50	0%	0	0	0
11	0%	0	0	0	31	0%	0	0	0	51	0%	0	0	0
12	0%	0	0	0	32	0%	0	0	0	52	0%	0	0	0
13	0%	0	0	0	33	0%	0	0	0	53	0%	0	0	0
14	0%	0	0	0	34	0%	0	0	0	54	0%	0	0	0
15	0%	0	0	0	35	0%	0	0	0	55	0%	0	0	0
16	0%	0	0	0	36	0%	0	0	0	56	0%	0	0	0
17	0%	0	0	0	37	0%	0	0	0	57	0%	0	0	0
18	0%	0	0	0	38	0%	0	0	0	58	0%	0	0	0
19	0%	0	0	0	39	0%	0	0	0	59	0%	0	0	0

Remarks: Steam plume max. length 350'–370'.

Name of Observer

MARYLAND STATE DEPARTMENT OF HEALTH AND MENTAL HYGIENE
OFFICE OF ENVIRONMENTAL PROGRAMS
Air Management Administration
O'Conor Building
201 W. Preston Street
Baltimore, Maryland 21201

REPORT OF OBSERVATION OF VISIBLE EMISSIONS

Date August 7, 1984

Time At Start Of Observation 8:18 am

Premise Name James Julian Asphalt

Address Box #647

County Cecil Co

Type of Installation Asphalt Batching Plant

Color of Plume Gray

Point of Discharge From Scrubber Stack

Steam Plume ☐ None ☒ Attached ☐ Detached

Point of Observation 120' South of Stack

Sky Conditions Partly Cloudy

Ambient Temperature 76° F I

Wind Direction From West

Wind Speed 1-3 mph

Sec / Min	0	15	30	45	Sec / Min	0	15	30	45	Sec / Min	0	15	30	45
8:18 0	0%	0	10	5	20	0%	0	0	0	40				
1	0%	0	0	0	21	0%	0	0	0	41				
2	0%	0	0	0	22	0%	0	0	0	42				
3	0%	0	0	0	23	0%	0	0	0	43				
4	0%	0	0	0	24	0%	0	0	0	44				
5	0%	0	0	0	25	0%	0	0	0	45				
6	0%	0	0	0	26	0%	0	0	0	46				
7	0%	0	0	0	27	0%	0	0	0	47				
8	0%	0	0	0	28	0%	0	0	0	48				
9	0%	0	0	0	29	0%	0	0	0	49				
10	0%	0	0	0	30					50				
11	0%	0	0	0	31					51				
12	0%	0	0	0	32					52				
13	0%	0	0	0	33					53				
14	0%	0	0	0	34					54				
15	0%	0	0	0	35					55				
16	0%	0	0	0	36					56				
17	0%	0	0	0	37					57				
18	0%	0	0	0	38					58				
19	0%	0	0	0	39					59				

Remarks:

Name of Observer E. Lee Haskins