Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

AP42 Section: 11.1

Reference Number: 118

Title: Source Sampling For Particulate Emissions, Henry S. Branscome, Inc., Suffolk, Virginia,

Ramcon Environmental Corporation, Memphis, TN,

September 18, 1989.

AP-42 Section	11.1
Reference	
Report Sect.	4
Reference	118

RAMCON
ENVIRONMENTAL CORPORATION

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
HENRY S. BRANSCOME, INC.
SUFFOLK, VIRGINIA
September 18, 1989

Mark Hockaday
Henry S. Branscome, Inc.

G. Sumner Buck, III
President

Sam Turner
Lab Director

RAMCON BUILDING, 223 SCOTT STREET, MEMPHIS, TENNESSEE 38112
TELEPHONE 800/458-4567 IN TENNESSEE 901/458-7000 FAX 901-458-3868

RAMCON
ENVIRONMENTAL CORPORATION

October 5, 1989

Mr. Mark Hockaday
Henry S. Branscome, Inc.
4551 John Tyler Highway
Williamsburg, VA 23185

Re: Particulate Emissions Test: Suffolk, Virginia

Dear Mr. Hockaday:

Enclosed you will find four copies of our report on the particulate emissions test we conducted at your plant. Based on our test results, the average grain loading of the three test runs do pass both EPA New Source Performance Standards and those set by the State of Virginia. Therefore, the plant is operating in compliance with State and Federal Standards.

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

Mr. John Stewart
Virginia Air Quality
Pembroke Office Park #IV
Suite #409
Virginia Beach, VA 23462

You will need to keep one copy of the report at the plant. We certainly have enjoyed working with you. Please let us know if we can be of further assistance.

Sincerely,

G. Sumner Buck, III
President

GSBIII:kh

Enclosures

TABLE OF CONTENTS

I. <u>INTRODUCTION</u>

On September 18, 1989 personnel from RAMCON Environmental Corporation conducted a source emissions test for particulate emissions compliance at Henry S. Branscome's CMI drum mix asphalt plant located in Suffolk, Virginia. RAMCON personnel conducting the test were Sam Turner, Lab Director and Billy Lockett. Kim Hipson was responsible for the laboratory analysis including taring the beakers and filters and recording final data in the laboratory record books. Custody of the samples was limited to Mr. Turner and Ms. Hipson.

The purpose of the test was to determine if the rate of particulate emissions from this plant's baghouse is below or equal to the allowable N.S.P.S. emissions limit set by US EPA and the State of Virginia.

II. <u>TEST RESULTS</u>

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

Mr. John Stewart of Virginia's Air Quality observed the testing conducted by RAMCON Environmental. Sam Turner conducted two opacity runs (Reference Method 9) which was 0% and therefore meets N.S.P.S. requirements.

TABLE I

SUMMARY OF TEST RESULTS

September 18, 1989

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	08:16 to 09:20	0.0062 gr/DSCF	109.9%	1.5 lbs/hr
2	10:18 to 11:22	0.0036 gr/DSCF	105.3%	0.8 lbs/hr
3	13:18 to 14:22	0.0036 gr/DSCF	101.3%	0.8 lbs/hr
	Average:	0.0045 gr/DSCF		1.0 lbs/hr

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

III. TEST PROCEDURES

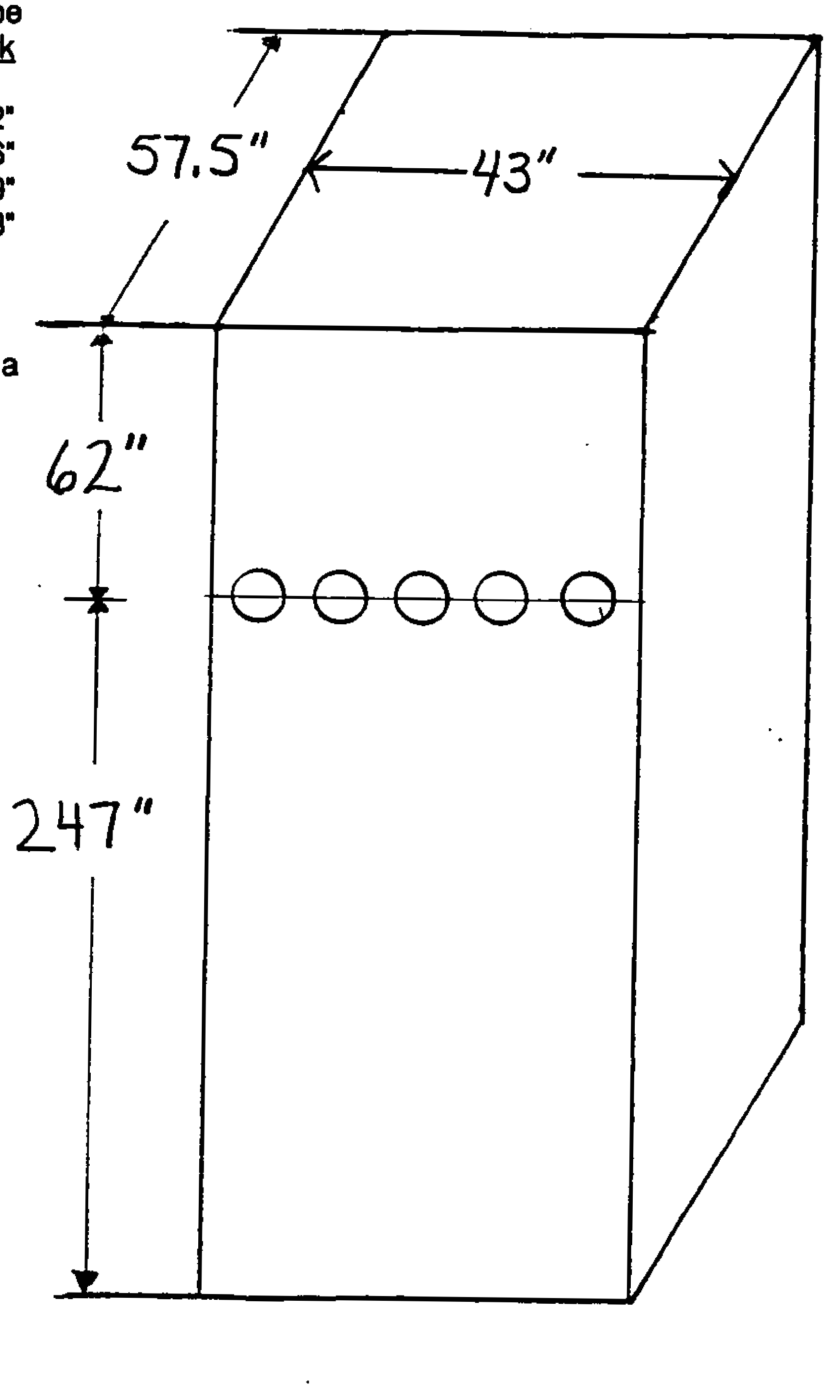
A. Method Used: Method 5 source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

B. Problems Encountered: No problems were encountered that affected testing.

C. Sampling Site: The emissions test was conducted after a baghouse on a rectangular stack measuring 43.0" x 57.5" with an equivalent diameter of 49.2". Five sampling ports were placed 62.0" down (1.3 diameters upstream) from the top of the stack and 247" up (5.0 diameters downstream) from the last flow disturbance. The ports were evenly spaced on 8.6" centers. The two outside ports are 4.3" from the side walls of the stack. Twenty points were sampled, four through each port for three minutes each.

Points on a Diameter	Probe Mark
1	*9.2"
2	23.6"
3	37.9"
4	52.3"

*Measurements include a 2" standoff.



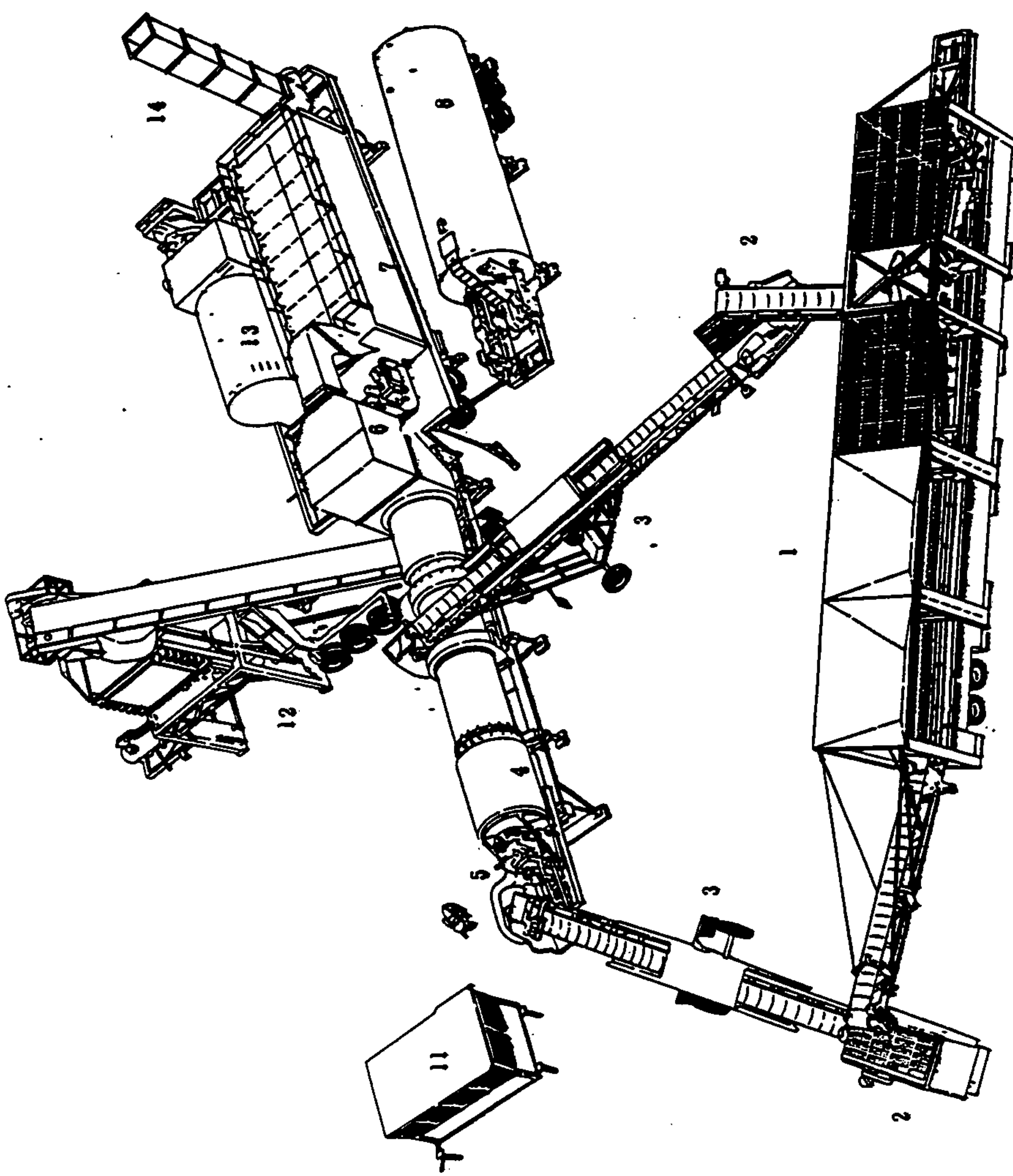
IV. THE SOURCE

IV. THE SOURCE

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

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

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



CMI drum mixer plant (baghouse)

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

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

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

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

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

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

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

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

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

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

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

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

13. Fuel Storage

14. Stack

DATA SUMMARY

Plant

1. Manufacturer of plant CMI Corporation.
2. Designed maximum operating capacity 400 TPH @ ____ % moisture.
3. Actual operation rate 392 TPH @ 3 % moisture.
4. Startup date ________.
5. Type of fuel used in dryer natural gas.
6. Quanity of fuel consumption 80,000,00 CFH.

Aggregate

7. Name/type of mix S-5.
8. Percent asphalt in mix 5.8 %.
9. Temperature of asphalt 275.
10. Sieve/Screening analysis: % Passing;

1"	—	3/8"	—	#	—
3/4"	—	#4	64.0	#	—
1/2"	100.0	#30	26.0	#200	5.0

Baghouse

11. Manufacturer CMI Corporation.
12. No. of bags 480. Type of bags fabric.
13. Air to cloth ratio 5.5:1. Designed ACFM 64,500.
14. Square feet of bags 11,688.
15. Type of cleaning; pulse jet X, reverse air ____, plenum pulse ________, other ________.
16. Cleaning cycle time 75 MS.
17. Interval between cleaning cycle 8-60 sec. (Automatic- Maintains pressure drop)
18. Pressure drop across baghouse 3-4 psi.
19. Pulse pressure on cleaning cycle 100 psi.

COMPANY NAME Henry S. Branscome, Inc. DATE 9-18-89

COMPANY REPRESENTATIVE John Tyson

Form #REC-03

PLANT DATA

COMPANY NAME Henry S. Branscome, Inc.

COMPANY REP. John Tyson DATE 9-18-89 PHONE # 804-539-7703

DATA SOURCE

PLANT LOCATION Suffolk, VA

PLANT MFG. CMI PLANT MODEL # 10.5 SVM PLANT TYPE Drum

MIX SPECIFICATION # OIL SPECIFICATION #

	Time 24 Hour	__ Fuel Oil __ Nat. Gas X Propane __ Coal __	Burner Setting	Aggregate TPH	Recycle TPH	Liquid Asphalt TPH	Mix Temp. °F	__ Venturi __ Baghouse Pressure Drop Inches Water
	08:25		85 %	365	0	22.6	270	3.3
	08:40		80 %	370	0	22.6	280	3.4
TEST	08:55		60 %	365	0	22.4	275	3.0
#1	09:10		55 %	366	0	22.4	272	2.9
AM	09:25		50 %	363	0	22.6	270	3.0
	09:30		55 %	366	0	22.5	270	3.0
	10:20		50%	360	0	22.3	275	3.0
AM	10:35		48 %	362	0	22.4	270	3.0
TEST	10:50		45 %	365	0	22.2	269	2.9
#2	11:05		50%	362	0	22.2	270	3.0
	11:20		68%	360	0	22.1	265	2.8
	11:25		75%	360	0	22.14	260	2.9
PM	13:20		80%	362	0	22.1	260	3.4
TEST	13:35		90%	363	0	22.4	270	3.6
#3	13:50		88%	365	0	22.2	270	3.8
	14:05		95%	360	0	22.24	260	4.0
	14:20		85%	363	0	22.6	275	4.0
	14:25		80 %	360	0	22.2	280	3.7
				363				

REC #04

V. EQUIPMENT USED

V. EQUIPMENT USED

Equipment used on conducting the particulate emissions test was:

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

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

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

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

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

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

VI. LABORATORY PROCEDURES & RESULTS

LABORATORY PROCEDURES FOR PARTICULATE SAMPLING

I. Field Preparation

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

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

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

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

II. Post - Testing Lab Analysis

A. FILTERS: The filters are returned to the lab in their sealed petri dishes. In the lab, the dishes are opened and placed into a desiccator for at least 24 hours. Then the filters are weighed continuously every six hours until a constant weight is achieved. All data is recorded on the laboratory forms that will be bound in the test report.

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

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

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

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

SPECIAL NOTE

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

WEIGHING PROCEDURE - SARTORIUS ANALYTICAL BALANCE

The Sartorius balance is accurate to 0.1 mg and has a maximum capacity of 200 grams. The balance precision (standard deviation) is 0.05 mg. Before weighing an item, the balance should first be zeroed. This step should be taken before every series of weighings. To do this, the balance should have all weight adjustments at the "zero" position. The beam arrest lever (on the lower left hand side toward the rear of the balance) is then slowly pressed downward to the full release position. The lighted vernier scale on the front of the cabinet should align with the "zero" with the mark on the cabinet. If it is not so aligned, the adjustment knob on the right hand side (near the rear of the cabinet) should be turned carefully until the marks align. Now return the beam arrest to the horizontal arrest position. The balance is now "zeroed".

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

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

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

Form REC#8

SAMPLE ANALYTICAL DATA FORM

Plant Location Branscome

Sample Location hot mix asphalt plant

Blank volume (V_a) 200 ml

Date/Time wt. blank 9/25/89

Date/Time wt. blank 9/26/89

Relative humidity in lab 51 %

Density of Acetone (p_a) .7857 mg/ml

Gross wt. 103.8849 mg

Gross wt. 103.8848 mg

Ave. Gross wt. 103.8849 mg

Tare wt. 103.8841 mg

Weight of blank (m_{ab}) 0.0008 mg

Acetone blank residue concentration (C_a) $(C_a) = (M_{ab}) / (V_a)(p_a)$ = (.000057 mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} p_a$ = (.00005?)(200)(.7857) = (.0008)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	200	200	200
Date/Time of wt 9/25 4:00 Gross wt	g	98.4738	100.4711	86.6274
Date/Time of wt 9/26 10:20 Gross wt	g	98.4735	100.4708	86.6269
Average Gross wt	g	98.4737	100.4710	86.6272
Tare wt	g	98.4588	100.4633	86.6179
Less acetone blank wt (W_a)	g	0.0008	0.0008	0.0008
Wt of particulate in acetone rinse (m_a)	g	0.0141	0.0069	0.0085

Filter Numbers	#	BS-3537	BS-3538	BS-3539
Date/Time of wt 9/25 4:00 Gross wt	g	0.5353	0.5384	0.5374
Date/Time of wt 9/26 10:20 Gross wt	g	0.5350	0.5379	0.5370
Average Gross wt	g	0.5352	0.5382	0.5372
Tare wt	g	0.5311	0.5360	0.5362

Weight of particulate on filters(s) (m_f)	g	0.0041	0.0022	0.0010
Weight of particulate in acetone rinse	g	0.0141	0.0069	0.0085
Total weight of particulate (m_n)	g	0.0182	0.0091	0.0095

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 K. Hipson Signature of reviewer [signature]

BRANSCOME 1.7489

Run # 1	1		2		3		
Collection Method Continuous/Grab GAS	Actual Reading	Net	Actual Reading	Net	Actual Reading	Net	Average Net Volume
CO_2	—	5	—	5	—	5	5
O_2 (Net is actual O_2 reading minus actual CO_2 reading)	—	12.2	—	12.2	—	12.2	12.2
CO (Net is actual CO reading minus actual O_2 reading)	—	0	—	0	—	0	0
N_2 (Net is 100 minus actual CO reading)	—	82.8	—	82.8	—	82.8	82.8

Run # 2	1		2		3		
Collection Method Continuous/Grab GAS	Actual Reading	Net	Actual Reading	Net	Actual Reading	Net	Average Net Volume
CO_2	—	4	—	4	—	4	4
O_2 (Net is actual O_2 reading minus actual CO_2 reading)	—	13.9	—	13.9	—	13.9	13.9
CO (Net is actual CO reading minus actual O_2 reading)	—	0	—	0	—	0	0
N_2 (Net is 100 minus actual CO reading)	—	82.1	—	82.1	—	82.1	82.1

Run # 3	1		2		3		
Collection Method Continuous/Grab GAS	Actual Reading	Net	Actual Reading	Net	Actual Reading	Net	Average Net Volume
CO_2	—	4	—	4.5	—	4.5	4.3
O_2 (Net is actual O_2 reading minus actual CO_2 reading)	—	13.9	—	13.03	—	13.07	13.3
CO (Net is actual CO reading minus actual O_2 reading)	—	0	—	0	—	0	0
N_2 (Net is 100 minus actual CO reading)	—	82.1	—	82.5	—	82.5	82.4

VII. CALCULATIONS

HENRY S. BRANSCOME, INC.
SUFFOLK, VIRGINIA

SUMMARY OF TEST DATA

			9-18-89	9-18-89	9-18-89
			RUN #1	**RUN #2**	**RUN #3**
	SAMPLING TRAIN DATA				
		start	08:16	10:18	13:18
		finish	09:20	11:22	14:22
1.	Sampling time, minutes	θ	60.0	60.0	60.0
2.	Sampling nozzle diameter, in.	D_n	.2810	.2810	.2810
3.	Sampling nozzle cross-sect. area, ft^2	A_n	.000431	.000431	.000431
4.	Isokinetic variation	I	109.9	105.3	101.3
5.	Sample gas volume - meter cond., cf.	V_m	44.672	38.990	41.860
6.	Average meter temperature, ^oR	T_m	539	546	551
7.	Avg. oriface pressure drop, in. H_2O	dH	1.92	1.50	1.47
8.	Total particulate collected, mg.	M_n	18.20	9.10	9.50
	VELOCITY TRAVERSE DATA				
9.	Stack area, ft^2	A	17.20	17.20	17.20
10.	Absolute stack gas pressure, in. Hg.	P_s	30.45	30.45	30.45
11.	Barometric pressure, in. Hg.	P_{bar}	30.45	30.45	30.45
12.	Avg. absolute stack temperature, R^o	T_s	699	698	704
13.	Average $-\sqrt{\text{vel. head}}$, (C_p= .80)	$-\sqrt{dP}$	0.81	0.72	0.76
14.	Average stack gas velocity, ft./sec.	V_s	52.72	46.82	49.16
	STACK MOISTURE CONTENT				
15.	Total water collected by train, ml.	V_{ic}	512.30	428.00	377.10
16.	Moisture in stack gas, %	B_{ws}	34.88	34.28	30.05
	EMISSIONS DATA				
17.	Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	1634	1466	1625
18.	Stack gas flow rate, cfm	acfm	54407	48318	50733
19.	Particulate concentration, gr/dscf	C_s	0.0062	0.0036	0.0036
20.	Particulate concentration, lb/hr	E	1.45	0.75	0.84
21.	Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000
	ORSAT DATA				
22.	Percent CO_2 by volume	CO_2	5.00	4.00	4.30
23.	Percent O_2 by volume	O_2	12.20	13.90	13.30
24.	Percent CO by volume	CO	.00	.00	.00
25.	Percent N_2 by volume	N_2	82.80	82.10	82.40

Format: summryR3

Dry Gas Volume

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

Where:

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

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

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

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

T_m = Absolute temperature at meter $^{\circ}R$.

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

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

Y = Dry gas meter calibration factor.

13.6 = Inches water per inches Hg.

RUN 1:

$$V_{m(std)} = (17.64)(1.006)(\ 44.672)\left[\frac{(30.45) + \frac{1.92}{13.6}}{539}\right] = 44.992\ \text{dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(1.006)(\ 38.990)\left[\frac{(30.45) + \frac{1.50}{13.6}}{546}\right] = 38.727\ \text{dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(1.006)(\ 41.860)\left[\frac{(30.45) + \frac{1.47}{13.6}}{551}\right] = 41.197\ \text{dscf}$$

Format: dgmR3

HENRY S. BRANSCOME, INC.
SUFFOLK, VIRGINIA

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:

$$c_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{18.20}{44.992}\right] = 0.0062 \text{ gr./dscf.}$$

Run 2:

$$c_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{9.10}{38.727}\right] = 0.0036 \text{ gr./dscf.}$$

Run 3:

$$c_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{9.50}{41.197}\right] = 0.0036 \text{ gr./dscf.}$$

Format: csR3

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

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:

$$M_d = 0.44(\ 5.00\%) + 0.32(12.20\%) + 0.28(\ .00\% + 82.80\%) = 29.29\ \frac{lb}{lb\text{-}mole}$$

Run 2:

$$M_d = 0.44(\ 4.00\%) + 0.32(13.90\%) + 0.28(\ .00\% + 82.10\%) = 29.20\ \frac{lb}{lb\text{-}mole}$$

Run 3:

$$M_d = 0.44(\ 4.30\%) + 0.32(13.30\%) + 0.28(\ .00\% + 82.40\%) = 29.22\ \frac{lb}{lb\text{-}mole}$$

Water Vapor Condensed

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

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

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), ml.

$V_f - V_i$ = Final volume of impinger contents less initial volume, ml.

$W_f - W_i$ = Final weight of silica gel less initial weight, g.

p_w = Density of water, 0.002201 lb/ml.

R = Ideal gas constant, 21.85 in.Hg. (cu.ft./lb.-mole)(^oR).

M_w = Molecular weight of water vapor, 18.0 lb/lb-mole.

T_{std} = Absolute temperature at standard conditions, 528^oR.

P_{std} = Absolute pressure at standard conditions, 29.92 inches Hg.

Run 1:

$V_{wc(std)}$ = (0.04707) (510.0) = 24.0 cu.ft
$V_{wsg(std)}$ = (0.04715) (2.3) = 0.1 cu.ft

Run 2:

$V_{wc(std)}$ = (0.04707) (426.0) = 20.1 cu.ft
$V_{wsg(std)}$ = (0.04715) (2.0) = 0.1 cu.ft

Run 3:

$V_{wc(std)}$ = (0.04707) (374.0) = 17.6 cu.ft
$V_{wsg(std)}$ = (0.04715) (3.1) = 0.1 cu.ft

$$B_{ws} = \frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{wc_{std}} + V_{wsg_{std}} + V_{m_{std}}} \times 100$$

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:

$$B_{ws} = \frac{24.0 + 0.1}{24.0 + 0.1 + 44.992} \times 100 = 34.88\ \%$$

Run 2:

$$B_{ws} = \frac{20.1 + 0.1}{20.1 + 0.1 + 38.727} \times 100 = 34.28\ \%$$

Run 3:

$$B_{ws} = \frac{17.6 + 0.1}{17.6 + 0.1 + 41.197} \times 100 = 30.05\ \%$$

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

Where:

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

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

Run 1:

M_s = 29.29 (1 - 34.88) + 18 (34.88) = 25.35 (lb./lb.-mole)

Run 2:

M_s = 29.20 (1 - 34.28) + 18 (34.28) = 25.36 (lb./lb.-mole)

Run 3:

M_s = 29.22 (1 - 30.05) + 18 (30.05) = 25.85 (lb./lb.-mole)

HENRY S. BRANSCOME, INC.
SUFFOLK, VIRGINIA

Stack Gas Velocity

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

Where:

V_s	=	Average velocity of gas stream in stack, ft./sec.
K_p	=	85.49 ft/sec $\left[(g/g\text{-mole})\text{-}(mm\ Hg) / (^{o}K)(mm\ H_2O) \right]^{1/2}$
C_p	=	Pitot tube coefficient, (dimensionless).
dP	=	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, (^{o}f).
T_s	=	Absolute stack temperature, (^{o}R). = 460 + t_s.
M_s	=	Molecular weight of stack gas, wet basis, (lb/lb-mole).

Run 1:

$$V = (85.49)\ (\ .80)\ (\ 0.81) \sqrt{\frac{699}{(30.45)(25.35)}} = 52.72 \text{ ft/sec.}$$

Run 2:

$$V = (85.49)\ (\ .80)\ (\ 0.72) \sqrt{\frac{698}{(30.45)(25.36)}} = 46.82 \text{ ft/sec.}$$

Run 3:

$$V = (85.49)\ (\ .80)\ (\ 0.76) \sqrt{\frac{704}{(30.45)(25.85)}} = 49.16 \text{ ft/sec.}$$

Format: VsR3

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, (^{o}f).

T_s = Absolute stack temperature, (^{o}R).

T_{std} = Standard absolute temperature, (528^{o}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:

$$Q_{sd}=3600(1- \quad .3488 \quad)(\; 52.72)(\; 17.20) \left[\frac{528}{699}\right] \left[\frac{30.45}{29.92}\right] = 1634192.4 \; \frac{dscf}{hr}$$

Run 2:

$$Q_{sd}=3600(1- \quad .3428 \quad)(\; 46.82)(\; 17.20) \left[\frac{528}{698}\right] \left[\frac{30.45}{29.92}\right] = 1466777.1 \; \frac{dscf}{hr}$$

Run 3:

$$Q_{sd}=3600(1- \quad .3005 \quad)(\; 49.16)(\; 17.20) \left[\frac{528}{704}\right] \left[\frac{30.45}{29.92}\right] = 1625240.0 \; \frac{dscf}{hr}$$

Emissions Rate from Stack

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

Where:

E = Emissions rate, lb/hr.

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

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

Run 1:

$$E = \frac{(0.0062)(1634192.4)}{7000} = 1.45 \text{ lb. / hr.}$$

Run 2:

$$E = \frac{(0.0036)(1466777.1)}{7000} = 0.75 \text{ lb. / hr.}$$

Run 3:

$$E = \frac{(0.0036)(1625240.0)}{7000} = 0.84 \text{ lb. / hr.}$$

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

Where:

I	=	Percent isokinetic sampling.
100	=	Conversion to percent.
T_s	=	Absolute average stack gas temperature, ^oR.
0.002669	=	Conversion factor, Hg - ft^3/ml - ^oR.
V_{ic}	=	Ttl vol of liquid collected in impingers and silica gel, ml.
T_m	=	Absolute average dry gas meter temperature, ^oR.
P_{bar}	=	Barometric pressure at sampling site, (in. Hg).
dH	=	Av pressure differential across the oriface meter, (in.H_2O).
13.6	=	Specific gravity of mercury.
60	=	Conversion seconds to minutes.
θ	=	Total sampling time, minutes.
V_s	=	Stack gas velocity, ft./sec.
P_s	=	Absolute stack gas pressure, in. Hg.
A_n	=	Cross sectional area of nozzle, ft^2.

Run 1:

$$I = (100)(699) \left[\frac{(0.002669)(512.30) + \frac{44.672}{539} \boxed{30.45 + \frac{1.92}{13.6}}}{60 \; (60.0) \; (52.72) \; (30.45) \; (.000431)} \right] = 109.9\%$$

Run 2:

$$I = (100)(698) \left[\frac{(0.002669)(428.00) + \frac{38.990}{546} \boxed{30.45 + \frac{1.50}{13.6}}}{60 \; (60.0) \; (46.82) \; (30.45) \; (.000431)} \right] = 105.3\%$$

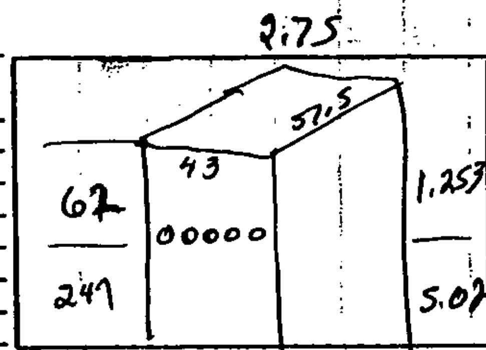
Run 3:

$$I = (100)(704) \left[\frac{(0.002669)(377.10) + \frac{41.860}{551} \boxed{30.45 + \frac{1.47}{13.6}}}{60 \; (60.0) \; (49.16) \; (30.45) \; (.000431)} \right] = 101.3\%$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Brunecom Paving
Location Suffolk Va
Operator Sam Turner
Date 9-18-89
Run No. 1
Sample Box No. 1
Meter Box No. C-185
Meter H @ 1.91
C Factor 1.006
Pitot Tube Coefficient Cp .80



Schematic of Stack Cross Section

Ambient Temperature 64
Barometric Pressure 30.43
Assumed Moisture, % 30
Probe Length, ft 6'
Nozzle Identification No. .000431
Avg. Calibrated Nozzle Dia., (in.) .241/.241/.241 ①
Probe Heater Setting 3
Leak Rate, m^3/min, (cfm) .014 at 12" Vac
Probe Liner Material Stainless Steel
Static Pressure, mm Hg (in. Hg) .19/13.6 = .01
Filter No. BS-3537

	Impinger Volume, ml	Silica Gel Weight, g
Final	710	203.6
Initial	200	201.3
Difference	510	2.3

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A) 1	8:14 / 8:19	1	228	.80 ~~1.70~~ (ST)	.83 ~~4.8~~ (ST)	657.45 / 659	70	66	240	60
2	8:22	1	228	1.20	.55	660.30	80	66	240	60
3	8:25	1	228	.55	1.5	662.00	86	66	250	55
4	8:28	1	234	.75	2.1	664.15	86	66	250	55
B) 1	8:29 / 8:32	2	244	.85	2.3	666.60	78	66	250	55
2	8:35	2	247	.65	1.8	669.20	80	66	250	55
3	8:38	2	247	.44	1.2	671.00	88	68	245	55
4	8:41	2	246	.30	.83	672.10	92	68	240	55
C) 1	8:42 / 8:45	5	248	1.1	3.0	675.40	88	68	245	55
2	8:48	5	252	.70	1.9	677.60	94	68	245	55
3	8:51	4	252	.49	1.3	680.00	94	68	250	55
4	8:54	4	245	.42	1.2	681.58	94	68	250	55

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 9-18-89 LOCATION Suffolk Va TEST NO. 1

TRAVERSE POINT	SAMPLING TIME φ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
D) 1	~~8:55~~ 8:58	6	237	1.4	3.9	685.00	92	70	60	250
2	9:01	6	237	.95	2.6	687.50	94	70	60	250
3	9:04	5	236	.72	2.0	689.60	96	70	60	245
4	9:07	4	236	.53	1.5	691.86	96	70	60	245
E 1	~~9:08~~ 9:11	6	237	1.4	3.9	694.90	90	71	60	245
2	9:14	11	237	1.1	3.0	698.00	92	72	50	230
3	9:17	4.5	234	.73	2.0	700.20	94	72	50	230
4	9:20	3.0	232	.37	1.0	702.122	94	72	50	230

RAMCON ENVIRONMENTAL CORPORATION

Plant Branscome Inc.
Location Suffolk Va
Operator [illegible]
Date 9-18-89
Run No. 2
Sample Box No. 2
Meter Box No. C-183
Meter H @ 1.91
C Factor 1.006
Pitot Tube Coefficient Cp .80

2.5

Schematic of Stack Cross Section

Ambient Temperature 72
Barometric Pressure 30.45
Assumed Moisture, % 10
Probe Length, ft 6'
Nozzle Identification No. 0.00043
Avg. Calibrated Nozzle Dia., (in.) .281/.281/.281
Probe Heater Setting 3
Leak Rate, m^3/min, (cfm) 0.017 at 13" Hg
Probe Liner Material Stainless Steel
Static Pressure, mm Hg (in. Hg) .01
Filter No. BS - 3538

	IMPINGER VOLUME ml	SILICA GEL WEIGHT g
FINAL	626	205
INITIAL	200	203
DIFFERENCE	426	2

TRAV. PT NO.	SAMPLING TIME (θ)min.	VACUUM in. Hg	STACK TEMP (T_S) °F	VELOCITY HEAD (P_S) in H20	PRESSURE DIFF. ORF. MTR in H20	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A) 1	10:18 / 10:21	1	252	.32	.83	702.71 / 704.40	94	74	225	60
2	10:24	1	252	.11	.80	704.90	94	74	225	60
3	10:27	1	252	.11	.80	705.00	94	74	230	60
4	10:30	1	246	.11	.80	706.10	94	74	240	60
B) 1	10:31 / 10:34	2	237	.70	1.9	708.50	92	74	240	60
2	10:37	2	237	.26	.72	709.80	92	74	240	60
3	10:40	2	238	.20	.50	711.20	92	74	245	60
4	10:43	2	238	.20	.50	712.53	98	ST 74	245	50
C) 1	10:44 / 10:47	ST 6	238	1.2	3.0	716.00	92	74	245	50
2	10:50	3	238	.60	1.5	717.80	92	74	240	50
3	10:53	3	234	.40	1.0	719.70	100	76	240	50
4	10:56	3	233	.40	1.0	721.80	100	76	240	55

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 9-18-89 LOCATION Suffolk TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
D 1	~~10:57~~ 11:00	7	234	1.4	3.5	724.30	96	74	250	50
2	11:03	9	235	1.2	3.0	727.00	100	74	250	50
3	11:06	3	235	.70	1.8	729.80	102	78	250	50
4	11:09	3	235	.55	1.4	732.01	102	78	245	55
C 1	~~11:10~~ 11:13	9	235	1.3	3.3	735.10	102	78	245	55
2	11:16	7	234	1.0	2.5	737.70	102	78	245	55
3	11:19	3	232	.63	1.6	739.80	102	78	240	55
4	11:22	2	231	.39	.98	741.70	102	78	240	55

RAMCON ENVIRONMENTAL CORPORATION

2.4

Plant Branscome Inc.
Location Suffolk Va.
Operator Sam Cumos
Date 9-18-89
Run No. 3
Sample Box No. 3
Meter Box No. C-185
Meter H @ 1.91
C Factor 1.006
Pitot Tube Coefficient Cp .80

Ambient Temperature 73
Barometric Pressure 30.45
Assumed Moisture, % 34
Probe Length, ft 6'
Nozzle Identification No. 0.000 431
Avg. Calibrated Nozzle Dia., (in.) .281/.281/.281
Probe Heater Setting 3
Leak Rate, m^3/min, (cfm) .01 at 4" Vac
Probe Liner Material Stainless Steel
Static Pressure, mm Hg (in. Hg) .01
Filter No. BS-3539

	IMPINGER VOLUME ml	SILICA GEL WEIGHT g
FINAL	574	204.9
INITIAL	200	201.8
DIFFERENCE	374	3.1

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H20	PRESSURE DIFF. ORF. MTR in H20	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A) 1	13:18 / 13:21	1	234	.45	1.1	741.98 / 743.60	80	78	250	60
2	13:24	1	234	.35	.88	745.30	90	78	250	60
3	13:27	2	237	.40	1.0	747.10	95	78	245	55
4	13:30	2	237	.40	1.0	749.00	98	78	245	55
B) 1	13:31 / 13:34	3	243	.70	1.8	751.50	95	78	245	55
2	13:37	3	245	.59	1.5	753.60	100	78	250	50
3	13:40	2	247	.45	1.1	755.00	104	78	250	55
4	13:43	2	246	.50	1.3	757.45	104	78	250	55
C) 1	13:44 / 13:47	3	247	.67	~~1.7~~ 1.7	759.70	104	78	245	55
2	13:50	3	246	.70	1.8	761.90	106	78	245	55
3	13:53	2	248	.58	1.5	763.80	108	78	245	55
4	13:56	3	246	.66	1.7	766.15	108	78	250	50

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 9-18-89 LOCATION Suffolk TEST NO. 3

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
D) 1	~~13:57~~ 14:00	3	245	.66	1.7	768.10	106	78	245	50
2	14:03	3	241	.67	1.7	770.40	108	78	245	50
3	14:06	3	239	.64	1.6	772.60	110	80	250	50
4	14:09	3.5	238	.78	2.0	775.15	110	80	250	50
E) 1	~~14:10~~ 14:13	3.0	246	.59	1.5	777.0	108	80	245	50
2	14:16	3.5	254	.61	1.5	779.20	110	80	245	50
3	14:19	3.0	256	.58	1.5	781.50	110	80	250	60
4	14:22	3.0	254	.58	1.5	783.84	110	80	250	60

IX. CALIBRATION

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number ________ Date 9-25-89 Meter box number C-185 Plant ________

Barometric pressure, P_b = 30.13 in. Hg Dry gas meter number 670775 Pretest Y 1.01

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average (t_d), °F	Time (Θ), min	Vacuum setting, in. Hg	Y_i	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
2.0	10	880.71 / 890.789	71	86 / 96	68 / 70	80	12.75	2	1.003	1.79
2.0	~~10~~ 11	891.00 / 902.154	71	80 / 100	70 / 72	80.5	14.07	2	.999	1.80
2.0	10	902.154 / 912.335	71	94 / 100	72 / 72	85	12.86	2	1.003	1.79
									Y =	1.002

* If there is only one thermometer on the dry gas meter, record the temperature under t_d $\Delta H@$ 1.79

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.

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number ____________ Date 9-10-89 Meter box number C-185 Plant ____________

Barometric pressure, P_b = 30.15 in. Hg Dry gas meter number ____________ Pretest Y ____________

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
2	10	626.60 / 636.57	75	75 / 97	70 / 72	79	13.02		1.006	1.89
2	10	646.625	75	92 / 100	72 / 73	84	13.17		1.006	1.92
2	10	656.73	75	98 / 102	73 / 74	87	17.20		1.006	1.92
									Y =	

* 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.

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-7-89 Thermocouple number inlet/outlet

Ambient temperature 20 °C Barometric pressure 29.88 in. Hg

Calibrator [illegible] Reference: mercury-in-glass ✓

other

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	Ice Bath	32	32	0
B	Boiling water	212	212	0
C	Boiling oil	381	381	0
D	Ambient 9-16-85	64	64	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 5-7-89 Thermocouple number Hotbox

Ambient temperature 20 °C Barometric pressure 29.88 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	Ice Bath	32°F	32	0
B	Boiling water	212	212	0
C	Boiling oil	381	381	0
D	Ambient 9-18-89	64	64	0

[a]Type of calibration system used.

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

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. 61 Date 5-6-89

Calibrated by: Sam T. Turner

"A" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp (s) cm H_2O (in. H_2O)	$C_p(s)$	DEVIATION $C_p(s)-\bar{C}_p(A)$
1	0.90	1.4	.802	
2	0.60	.93	.803	
3	0.41	.64	.800	
		$\bar{C}_p$ (SIDE A)	.802	

"B" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	$\Delta p(s)$ cm H_2O in. H_2O)	$C_p(s)$	DEVIATION $C_p(s)-\bar{C}_p(B)$
1	0.90	1.39	.805	
2	0.60	.94	.799	
3	0.41	.63	.807	
		$\bar{C}_p$ (SIDE B)	.804	

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

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

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

Form No. EED-17-1

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-5-89 Thermocouple number 61

Ambient temperature 20 °C Barometric pressure 29.88 in. Hg

Calibrator Tuna 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	212	212	0
B	Boiling oil	381	381	0
C	Ice Bath	32	32	0
D	ambient 5-18-85	64	64	0

[a] Type of calibration system used.

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

RAMCON

Lear Siegler Stack Sampler

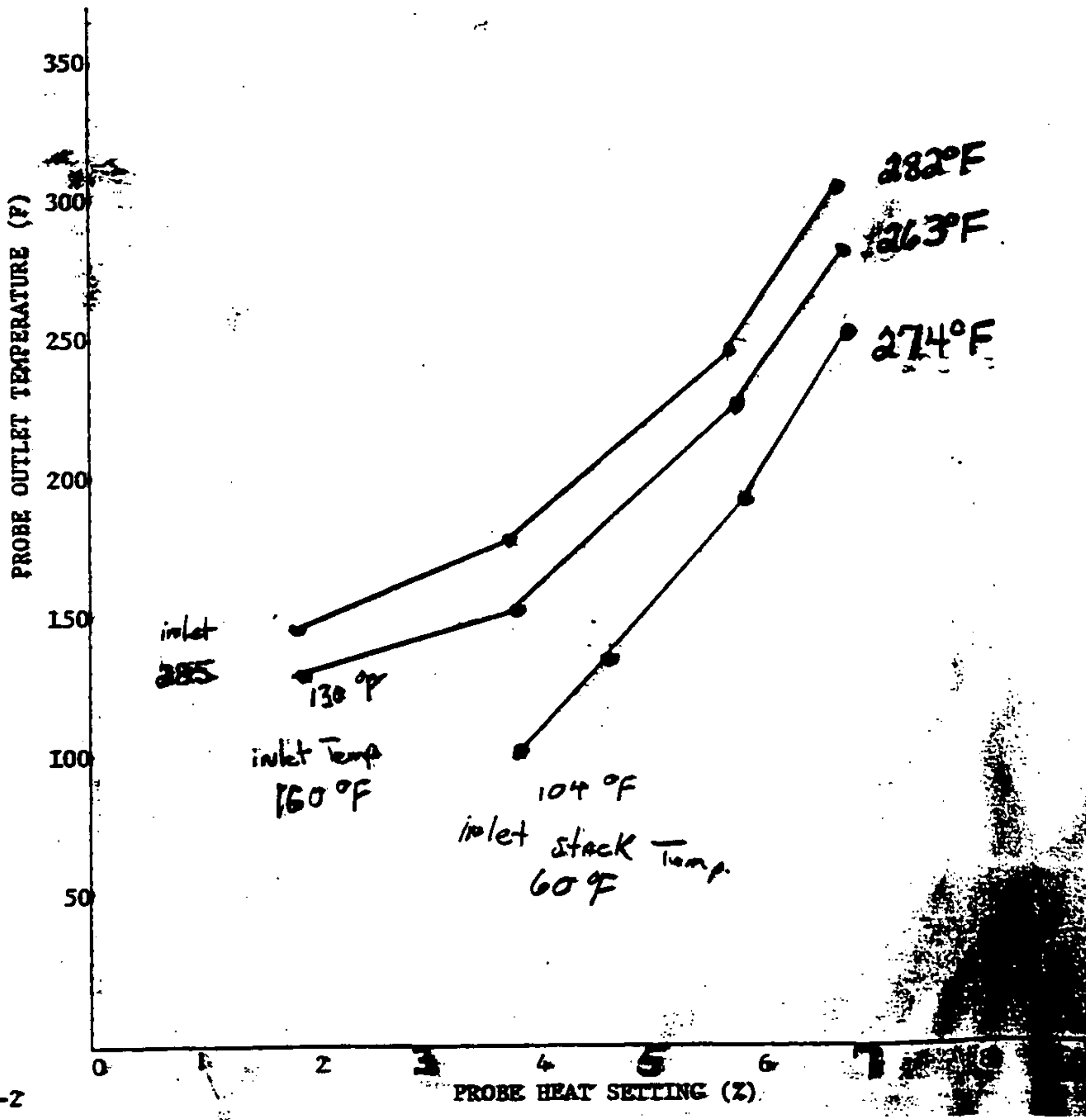
Heating Probe Calibration

Probe No. 61 Probe Length 6'

Date of Calibration 5-8-89 Signature Sam T Turner

Name of Company to be tested ____________

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



Form No. EED-17-2

X. RAMCON PERSONNEL

RAMCON Environmental Stack Test Team

Sumner Buck - President

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

Sam Turner - Lab Director

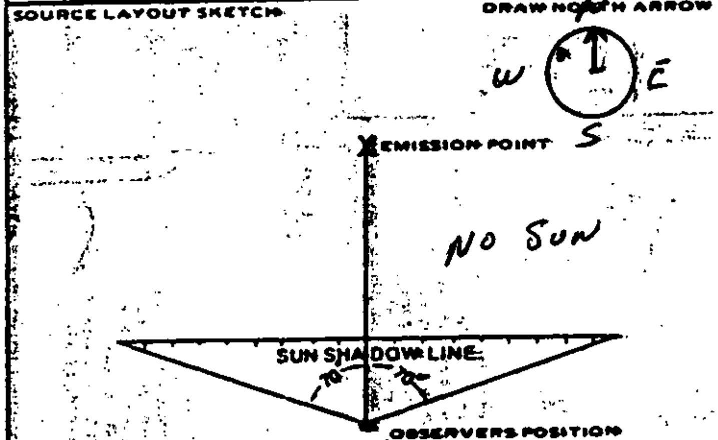
Sam Turner has five years experience in the Air Division and is our lab director. He has sampled over 600 plants, including 40 large boiler stacks, 50 incinerators, 400 asphalt plants and others. He is a graduate of State Technical Institute of Memphis and holds an Associate Degree in Environmental Engineering. He also has current certification as a V.E. reader.

XI. VISIBLE EMISSIONS

SOURCE NAME	Branscome Inc
ADDRESS	
CITY	Suffolk
STATE	Va.
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Asphalt Plant
OPERATING MODE	yes
CONTROL EQUIPMENT	Baghouse
OPERATING MODE	yes
DESCRIBE EMISSION POINT	Stack exit
HEIGHT ABOVE GROUND LEVEL	30'
HEIGHT RELATIVE TO OBSERVER	29'
DISTANCE FROM OBSERVER	30'
DIRECTION FROM OBSERVER	East
DESCRIBE EMISSIONS	Steam
EMISSION COLOR	White
PLUME TYPE	CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT	NO ☑ YES ☐
IS WATER DROPLET PLUME	ATTACHED ☑ DETACHED ☐
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	60 yards South
DESCRIBE BACKGROUND	~~Sky~~ SKY
BACKGROUND COLOR	White/Gray
SKY CONDITIONS	100% Cloudy
WIND SPEED	5-15 MPH
WIND DIRECTION	South
AMBIENT TEMPERATURE	64
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



OBSERVATION DATE	START TIME	STOP TIME
9-18-89	8:16	9:20

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR HIGHEST PERIOD	0
NUMBER OF READINGS ABOVE 20 % WERE	0
RANGE OF OPACITY READINGS	MINIMUM 0 MAXIMUM 0
OBSERVER'S NAME (PRINT)	SAM TURNER
OBSERVER'S SIGNATURE	Sam Turner
DATE	9-18-89
ORGANIZATION	Ransom Co.
CERTIFIED BY	State of Va.
DATE	6-7-89
VERIFIED BY	Carl Knoott
DATE	6-7-89

COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE

DATE

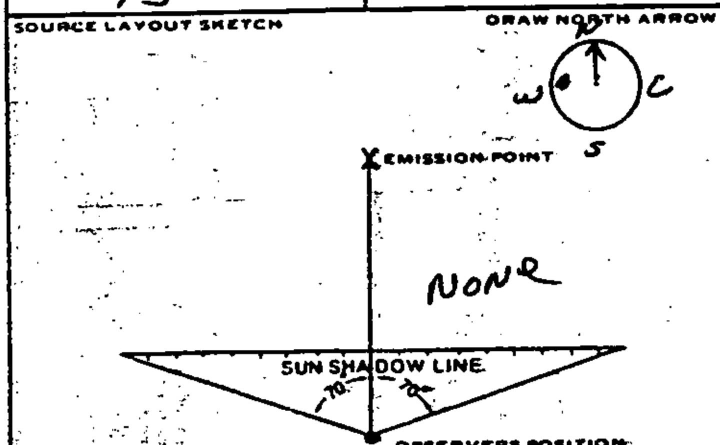
EPA-1-10101

REC#14

#3 (41)

SOURCE NAME	Branscome Inc.
ADDRESS	
CITY	Suffolk
STATE	Va
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Asphalt Plant
OPERATING MODE	✓
CONTROL EQUIPMENT	Baghouse
OPERATING MODE	✓
DESCRIBE EMISSION POINT	Stack exit
HEIGHT ABOVE GROUND LEVEL	30
HEIGHT RELATIVE TO OBSERVER	29
DISTANCE FROM OBSERVER	30'
DIRECTION FROM OBSERVER	East
DESCRIBE EMISSIONS	Steam
EMISSION COLOR	White
PLUME TYPE	CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT	NO ☑ YES ☐
IS WATER DROPLET PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	60 yard South
DESCRIBE BACKGROUND	SKY
BACKGROUND COLOR	Gray White
SKY CONDITIONS	100% Cloudy
WIND SPEED	5-15 mph
WIND DIRECTION	Southwest
AMBIENT TEMPERATURE	73
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH



OBSERVATION DATE	START TIME	STOP TIME
9-18-89	13:18	14:22

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR HIGHEST PERIOD	0
NUMBER OF READINGS ABOVE 20 % WERE	0
RANGE OF OPACITY READINGS	0 MINIMUM, 0 MAXIMUM
OBSERVER'S NAME (PRINT)	SAM TURNER
OBSERVER'S SIGNATURE	Sam Turner
DATE	9-18-89
ORGANIZATION	Ramcon
CERTIFIED BY	State of Tn.
DATE	6-7-89
VERIFIED BY	Carl ~~[illegible]~~ Kuntz
DATE	6-7-89

COMMENTS

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SIGNATURE

TITLE

DATE

EPA [illegible]

REC#14

TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
CUSTOMS HOUSE
701 BROADWAY
NASHVILLE, TENNESSEE 37219-5403

JUN 29 1989

Sam Turner
RAMCON
223 Scott
Memphis, TN 38112

RE: Certificate Number 0955

Dear Mr. Turner:

Enclosed you will find your certification card for successfully completing the June 6-8, 1989 Visible Emissions Evaluation School held in Memphis, Tennessee. In order to be certified as a qualified Visible Emissions Evaluator for all the methods approved by the Tennessee Air Pollution Control Board, one must meet an intensive array of criteria.

The individual reading criteria is as follows:

1. EPA Method 9 (6 Minute Average) requires a deviation of less than 7.5 on white and black smoke, and that the reader miss no reading by more than 15% opacity.

2. Tennessee Visible Emissions Evaluation Method 1 (Roads and Parking Areas) requires a worst-two-minute deviation of 8.8 or less.

3. TVEE Method 2 (Aggregate or Time Count) has the same criteria requirements as EPA Method 9.

4. TVEE Method 3 (Zero Percent Opacity) requires that the value assigned to a zero reading during a certification run shall not exceed 10% opacity, nor shall the combination of other zero readings exceed 10% opacity (i.e. two readings of five percent opacity).

5. TVEE Method 4 (Fugitive Dust Emissions from Non-Stack Emission Points) has the same criteria requirements as EPA Method 9.

Based on these criteria you are certified by the State of Tennessee to read EPA Method 9, and TVEE Methods 1, 2, 3, and 4.

This certification is valid until December 07, 1989.

You must complete the requirements for recertification prior to this expiration date to retain your status as a qualified Visible Emissions Evaluator.

It was a pleasure having your participation in our Visible Emissions School. The Tennessee Division of Air Pollution Control would welcome any comments, or suggestions you may have concerning the operation of the school. Please forward any comments to the Division at (615)741-3931 or at the above address.

Sincerely yours,

Carl Koontz

Carl Koontz, Instructor
Visible Emissions Evaluation School
Division of Air Pollution Control

Enclosure

PES EVALUATOR Penelope Weiler EVALUATION DATE 5-28-93

A

METHOD 5: SECONDARY EMISSIONS TEST REPORT EVALUATION

AGENCY: VA FACILITY: Henry S. Branscome, Inc TEST DATE: 9-18-89

PROCESS TESTED (SCC):

drum mix asphalt plant baghouse

TEST RESULTS/PROCESS RATES/EMISSION FACTOR RATINGS:

Emis Rate: 1.0 lb (PM) / hr

Prod. Rate: 392 ton (Agg + Liq Asph) / hr

Emis Fact: 0.00255 lb/ton

PROCESS RATE 3
is process rate during testing representative of normal operations

392 tph

FLOW/STREAM ANALYSIS 3
Methods 1-4 or equivalent (including traverse and port illustrations, cyclonic flow determination, MW and moisture calculations) performed to allow calculation of emission rates at standard conditions

1 3 ports ✓ 4 pts/port ✓
2 VH ✓ T ✓ SP ✓ ΔP, A, MW ✓
3 CO2 O2 ✓
4 ✓

FIELD DATA 3
is field data on standard forms, and does raw data correspond with printout

SAMPLING DURATION 3
must have at least 3 runs, each ≥ 1 hour duration, with sampling ≥ 2 minutes at each ✓ traverse point, and total sampling volume ≥ 30 dscf ✓

3 min/pt

SAMPLING TEMPERATURE 3
both probe and filter must be maintained at 248 ± 25°F or other temperature specified in NSPS

ISOKINETICS 3
within 100±10% for all runs

BACK-HALF NA
if any, what method was used to catch and recover condensible matter

PM = Filterable PM

EQUIPMENT 3
borosilicate glass probe liner, quartz fiber filter

SS

CALIBRATION were both pre- and post-test calibrations performed for

meter box Pre ✓ Post no doc 2

pitot tube 3

temperature sensor 3

nozzle (3 #) 3

LEAK CHECKS 3
pretest optional; post-test, conducted at vacuum ≥ highest sampling vacuum, leakage rate < 0.02 cfm or 4% of average sampling rate

BLANKS 3
acetone blank analyzed, < 0.001% residue

SAMPLE PREP 3
filter desiccation ✓ and tare weights documented ✓

AIR POLLUTION CONTROL DEVICE(S)

FACILITY: Henry S. Branscome, Inc TEST DATE: 9-18-89.

CONTROL SYSTEM CONFIGURATION:

drum mix asphalt ⇒ baghouse

BAGHOUSE

Make/Model No./Specifications CMI Corp. 480 bags

Pressure Drop 3-4 psi

Gas-to-Cloth Ratio 5.5:1

Design Efficiency / Exit Concentration 64,500 acfm

Fiber Type/Weave fabric

INERTIAL SEPARATOR

Make/Model No./Specifications

Design Efficiency / Exit Concentration

Pressure Drop

ELECTROSTATIC PRECIPITATOR

Make/Model No./Specifications

Design Efficiency / Exit Concentration

No. of Fields in Operation

Pressure Drop

Voltage

No. of Fields

Amperage

SCRUBBER

Make/Model No./Specifications

Scrubbing Liquid

Design Efficiency / Exit Concentration

Scrubbant Flow Rate

Pressure Drop

Scrubbant pH

ADSORPTION SYSTEM

Make/Model No./Specifications

Adsorbent

Design Efficiency / Exit Concentration

System Analyzer Readings

INCINERATOR

Make/Model No./Specifications

Design Efficiency / Exit Concentration

Chamber Temperature(s)

Residence Time

Catalyst/Bed Type