RAMCON
ENVIRONMENTAL CORPORATION

Source Sampling for Particulate Emissions

Barber-Greene Batch-Mix Baghouse
Permit No. 143140010P902

VALLEY ASPHALT CORPORATION
SHARONVILLE, OHIO #9 Plant
September 21, 1994

Fred Brammer
Valley Asphalt Corporation

RECEIVED
OCT 14 1994
Hamilton County Department
of Environmental Services

G. Sumner Buck, III
President
RAMCON Environmental Corporation

RAMCON BUILDING, 6707 FLETCHER CREEK COVE, MEMPHIS, TENNESSEE 38133
TELEPHONE 800/458-4567 IN TENNESSEE 901/387-0500 FAX 901/387-0400

RAMCON
ENVIRONMENTAL CORPORATION

October 6, 1994

Mr. Fred Brammer
Valley Asphalt Corporation
11641 Mosteller Road
Cincinnati, Ohio 45421

RE: Particulate Emissions Test: September 21, 1994

Dear Mr. Brammer:

Enclosed you will find three (3) copies of our report on the particulate emissions test we conducted pursuant to permit no. 143140010P902 at your asphalt plant located in Sharonville, Ohio. Based on our test results, the average grain loading of the three test runs do pass the standards set by the State of Ohio. Therefore, the plant is operating in compliance with State standards.

You will want to sign the report covers and send one copy to:

Ms. Susan Kestler
Southwestern Ohio Air Pollution
Control Agency
1632 Central Parkway
Cincinnati, Ohio 45210

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:wpc
Enclosures

RAMCON BUILDING, 6707 FLETCHER CREEK COVE, MEMPHIS, TENNESSEE 38133
TELEPHONE 800/458-4567 IN TENNESSEE 901/387-0500 FAX 901/387-0400

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SECTION A:

1. INTRODUCTION
2. TEST RESULTS
3. TEST PROCEDURES

SECTION A.

1. INTRODUCTION

On September 21, 1994 personnel from RAMCON Environmental Corporation conducted a source emissions test pursuant to permit no. 1431400010P902 for particulate emissions compliance at Valley Asphalt Corporation's Barber-Greene batch-mix asphalt plant located in Sharonville, Ohio. RAMCON personnel conducting the test were Rob Bade, Team Leader, and Charles Dicks. Tommy South 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. Bade and Mr. South.

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 emissions limit set by US EPA and the State of Ohio.

Ms. Susan Kestler of Ohio's Southwestern Regional Pollution Control Agency observed the testing conducted by RAMCON Environmental Corporation.

2. TEST RESULTS

The table below 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 Ohio are the same as those set by EPA.

Summary of Test Results

September 21, 1994

Test Run	Time	Actual Emissions gr/dscf	Emissions lbs/hr	Isokinetic Variation %
1	06:52 - 07:52	0.0219	4.06	100.1
2	09:50 - 10:53	0.0207	3.57	100.2
3	12:07 - 13:10	0.0131	2.24	103.0
	Average:	0.0186	3.29	

Limit 60.96 Lb/hr

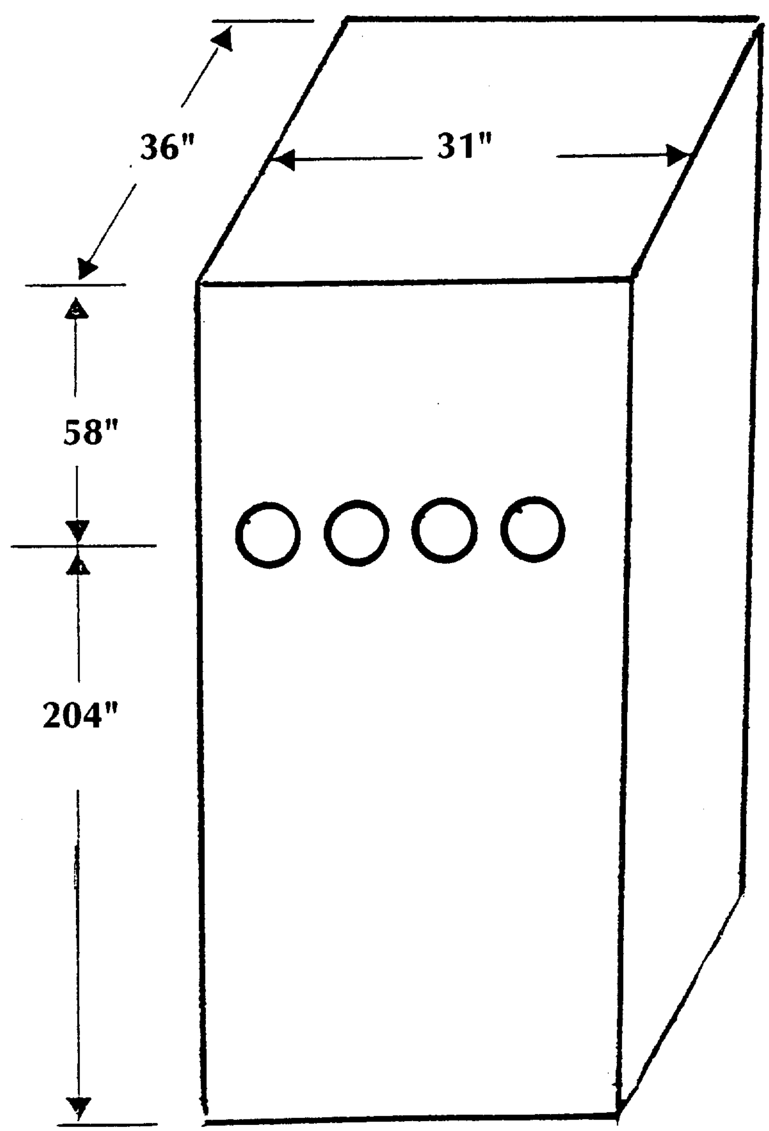
On the basis of these test results, the average grain loading of the three test runs is below the .04 gr/DSCF allowable emissions limitation set by EPA and the State of Ohio. Therefore, the plant is operating in compliance with State standards.

3. 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 would affect test results.

(c) Sampling Site: The emissions test was conducted after a baghouse on a rectangular stack measuring 36" x 31" with an equivalent diameter of 33.3". Four (4) sampling ports were placed 58" down (1.7 diameters upstream) from the top of the stack and 204" up (8 diameters downstream) from the last flow disturbance. The ports were evenly spaced on 7.8" centers. The two outside ports are 3.9" from the side walls of the stack. Sixteen (16) points were sampled, four (4) through each port for three minutes forty-five seconds (3.75) minutes each for a total testing time of sixty (60) minutes.



SECTION B:

THE SOURCE

THE SOURCE

Valley Asphalt Corporation employs a Barber-Greene batch-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 is a general description of the plant's manufacturing process: The cold feed materials (aggregate) are dumped into 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. When recycled asphalt mix is used, it is added directly into the pugmill. The dried aggregate is pulled by a bucket elevator to the top of a gradation control unit which separates and stores the aggregate by size. The required amount of each aggregate is dispensed into a weigh-hopper and from there into a pugmill where the hot liquid asphalt pavement is mixed thoroughly with the aggregate. 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 mixer uses a burner fired with natural gas to heat air to dry the aggregate. The air is drawn into the system via an exhaust fan. After passing through the gas burner, the air passes through a baghouse. The baghouse is manufactured by Barber-Greene. The exhaust gas is 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 pugmill.

F... R... 03

TODAY'S DATE: SEPT. 21, 1994

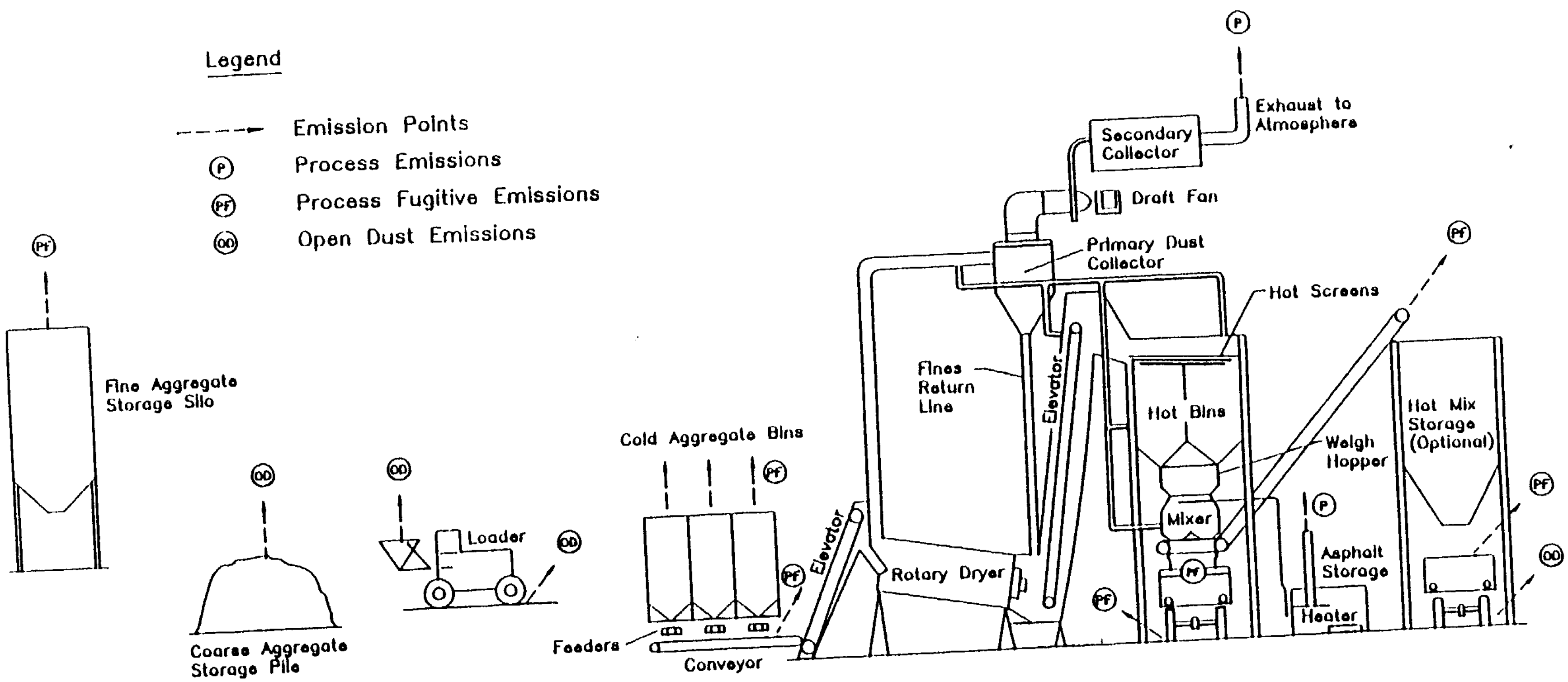
DATA ON FACILITY BEING STACK TESTED

COMPANY NAME VALLEY ASPHALT COMPANY REP. FRED BRAMMER PHONE (513) 771-0980

LOCATION OF FACILITY SHARONVILLE ORIGINAL START-UP DATE ______ DESIGNED CAPACITY 230

OEM BARBER GREEN MODEL NO. ______ TYPE BATCH AC TYPE 20

1	2	3	4	5		6	7	8	9		10	11	12
Time (24 HR) NOTE: check small box in column when moisture sample is taken	Fuel Use: #Fuel Oil ___ Nat. Gas ✓ Propane ___ Coal ___ NG other	Burner Setting	Blower Pressure	Production Rate: 301M Mix Aggregate TPH	Production Rate: 10% RAP TPH	Asphalt Cement %	Mix Temp. °F	Exhaust Gas Temp. °F	✓ Baghouse (~~Venturi Scrubber~~): Pressure Drop in w.g.	Water Pressure psi	Ambient Temp. LOCAL °F	Relative Humidity %	Exhaust Damper Position
8:00	NG	50%		200		4.3%	370°	275°	.21		65°		50%
8:15	"	50%		200		"	365°	"	.215		65°		"
8:30	"	"		"		"	370°	"	.21		66°		"
8:45	"	"		"		"	375°	"	.22		67°		"
9:50	"	"		197		"	366°	"	.20		70°		"
10:10	"	45%		200		"	375°	"	.21		70°		"
10:25	"	50%		"		"	365°	"	.20		71°		"
10:40	"	50%		200		"	365°	"	.15		71°		"
10:55	"	50%		"		"	365°	"	.20		75°		"
11:55	"	50%		"		"	365°	"	.20		75°		"
12:10	"	50%		"		"	365	"	.19		75°		"
12:25	"	"		197		"	360°	"	.19		75°		"
12:40	"	"		200		"	355°	"	.19		75°		"
12:55	"	"		"		"	360°	"	.21		75°		"
1:10	"	"		"		"	370°	"	.20		75°		"
1:25													



General Process Flow Diagram for A Batch-Mix Asphalt Paving Plant

SECTION C:

EQUIPMENT USED

EQUIPMENT USED

Equipment used to conduct the particulate emissions test was:

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

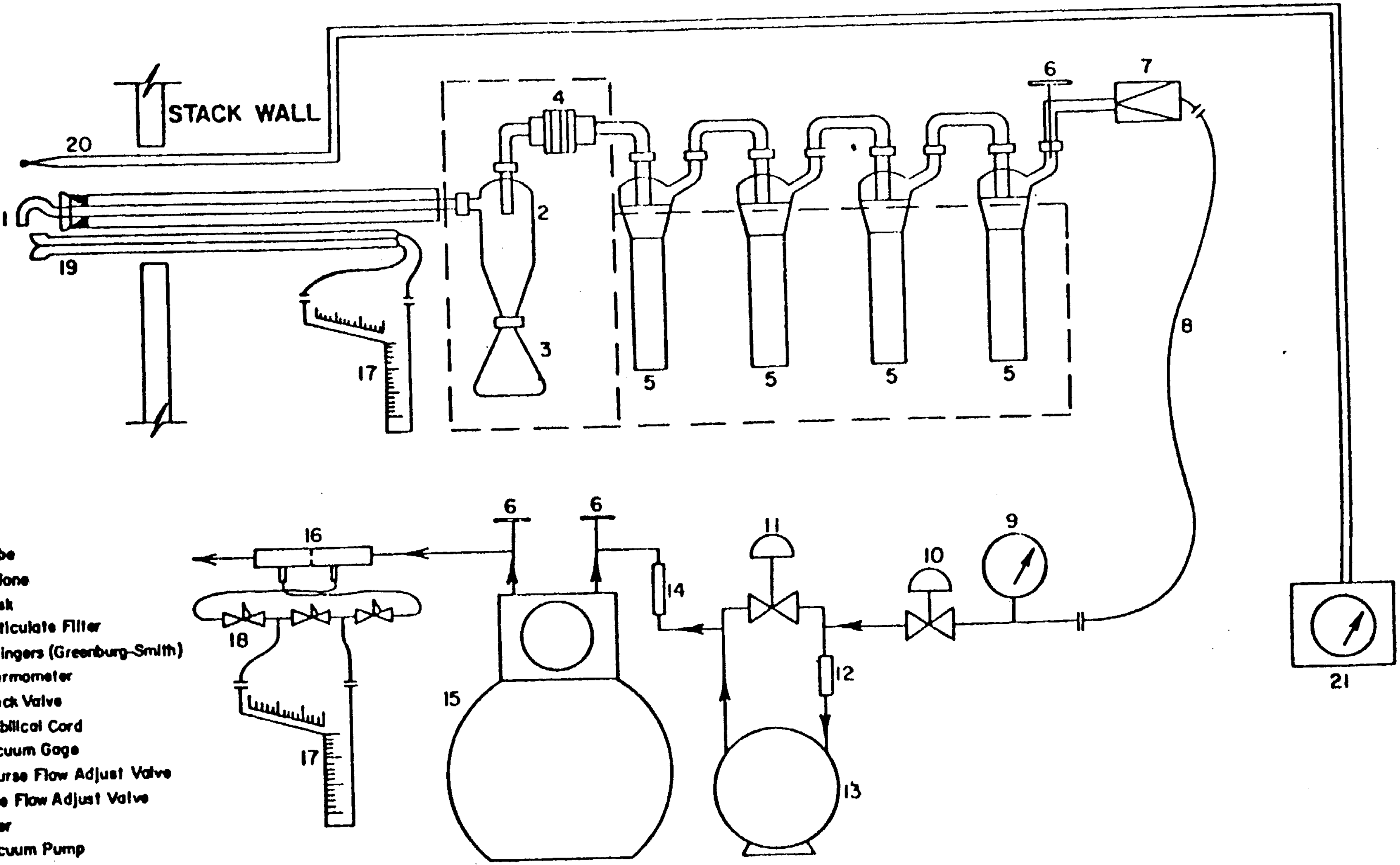
B. An Airguide Instruments Model 211-B (uncorrected) aneroid barometer for checking the barometric pressure.

C. Weston dial thermometers to check meter temperatures or an Analogic Model 2572 Digital Thermocouple to check stack temperatures.

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

E. Schleicher and Schuell Type 1-HV filters with a porosity of .03 microns.

F. Reagent- or ACS-grade acetone with a residue of ≤ .001.



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

SAMPLING TRAIN
USED FOR ISOKINETIC SAMPLING

SECTION D:

LABORATORY PROCEDURES AND 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 Valley asphalT #9 　　Relative humidity in lab 45 %

Sample Location Sheronville, OHIO 　　Density of Acetone (pa) .7857 mg/ml

Blank volume (V_a) 100 ml

Date/Time wt. blank 9/27 1:00P 　　Gross wt. 46.9149 mg

Date/Time wt. blank 9/28 8:00A 　　Gross wt. 46.9149 mg

Ave. Gross wt. 46.9149 mg

Tare wt. 46.9148 mg

Weight of blank (m_{ab}) .0001 mg

Acetone blank residue concentration (C_a) 　　$(C_a) = (M_{ab}) / (V_a)(p_a)$ = (.000001) mg/g

Weight of residue in acetone wash: $W_a = C_a V_{aw} P_a$ = (.000001)(250)(.7857) = (.0002)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	250	250	250
Date/Time of wt 9/27 1:00P Gross wt	g	99.9531	110.4375	95.1665
Date/Time of wt 9/28 8:00A Gross wt	g	99.9531	110.4379	95.1668
Average Gross wt	g	99.9531	110.4377	95.1667
Tare wt	g	99.9008	110.3936	95.1415
Less acetone blank wt (W_a)	g	.0002	.0002	.0002
Wt of particulate in acetone rinse (m_a)	g	.0521	.0439	.0250

Filter Numbers	#	TS00612	TS00911	TS00913
Date/Time of wt 9/27 1:00P Gross wt	g	.6003	.6066	.6079
Date/Time of wt 9/28 8:00A Gross wt	g	.6000	.6065	.6079
Average Gross wt	g	.6002	.6066	.6079
Tare wt	g	.5938	.6000	.6006

Weight of particulate on filters(s) (m_f)	g	.0064	.0066	.0073
Weight of particulate in acetone rinse	g	.0521	.0439	.0252
Total weight of particulate (m_n)	g	.0575	.0505	.0325

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 Thomas Smith 　　Signature of reviewer [signature]

NAME: Valley Asphalt Corporation, No. 9
LOCATION: Sharonville, Ohio

DATE: September 21, 1994

SUMMARY OF TEST DATA

Permit No. 1431400140P902

			09-21-94	09-21-94	09-21-94	
			Run #1	Run #2	Run #3	
		start	06:52	09:50	12:07	
		finish	07:52	10:53	13:10	
	SAMPLING TRAIN DATA					*
1.	Sampling time, minutes	Θ	60.00	60.00	60.00	
2.	Sampling nozzle diameter, inches	D_n	0.210	0.210	0.210	
3.	Sampling nozzle cross-section area, ft²	A_n	0.000241	0.000241	0.000241	
4.	Isokinetic variation	I	100.1	100.2	103.0	10
5.	Sample gas volume — std. condition, ft³	$V_{m(std)}$	40.347	38.200	38.242	1
6.	Average meter temperature, °R	T_m	527 67	536 76	548 88	
7.	Average orifice pressure drop, inches H_2O	ΔH	1.48	1.34	1.32	
8.	Total Particulate collected, mg.	M_n	57.50	50.50	32.50	
	VELOCITY TRAVERSE DATA					
9.	Stack area, ft²	A	7.75	7.75	7.75	
10.	Absolute stack gas pressure, inches Hg.	P_s	30.05	30.05	30.05	
11.	Barometric pressure, inches Hg.	P_{bar}	30.05	30.05	30.05	
12.	Average absolute stack temperature, R°	T_s	685 225	695 235	695 235	
13.	Average √vel. head, (C_p = .84)	√dP	1.15	1.11	1.09	
14.	Average stack gas velocity, ft/second	V_s	76.39	74.50	73.25	7
	STACK MOISTURE CONTENT					
15.	Total water collected by train, ml	V_{ic}	234.00	238.00	246.00	4
16.	Moisture in stack gas, percent (%)	B_{ws}	21.42	22.67	23.27	5
	STACK MOLECULAR WEIGHT					
17.	Percent CO_2 by volume	CO_2	2.0	2.0	2.0	
18.	Percent O_2 by volume	O_2	17.0	16.0	16.0	
19.	Percent CO by volume	CO	0.0	0.0	0.0	
20.	Percent N_2 by volume	N_2	81.0	82.0	82.0	
21.	Dry molecular weight, lb/lb-mole	M_d	29.00	28.96	28.96	3
22.	Stack molecular weight, lb/lb-mole	M_s	26.64	26.48	26.41	6
	EMISSIONS DATA			dscfm		
			21,609	20,410	19,941	
23.	Stack gas flow rate, dscf/hr	Q_{sd}	1,296,519.3	1,226,423.6	1,196,489.9	8
24.	Stack gas flow rate, cfm	acfm	35,521	34,643	34,061	
25.	Particulate concentration, gr/dscf	C_s	0.0219	0.0204	0.0131	2
26.	Particulate emission, lb/hr	E	4.06	3.57	2.24	9

* see Calculation No. on following pages

F:\Forms\SummryR3:100694

SECTION E:

CALCULATIONS

1. Dry Gas Volume

$$V_m \left[\frac{T_{(std)}}{T_m}\right] \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right] = 17.64 \ \frac{°R}{\epsilon.\ Hg} \ Y \ V_m \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

Where:

- $V_{m(std)}$ = Dry gas volume through meter at standard conditions, ft^3.
- V_m = Dry gas volume measured by meter, ft^3.
- P_{bar} = Barometric pressure at orifice 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 = Avg. pressure drop across orifice meter, in. H_2O.
- Y = Dry gas meter calibration factor.
- 13.6 = Inches of water per Hg.

2. Total Contaminants By Weight: Grain Loading

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

Where:

- C_s = Concentration of particulate (or pollutant) in stack gas, dry basis, corrected to standard conditions, gr/dscf.
- M_n = Total amount of particulate (or pollutant) collected, mg.
- $V_{m(std)}$ = Dry gas volume through meter at standard conditions, cu. ft.

3. Dry Molecular Weight

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

Where:

- M_d = Dry molecular weight, lb/lb-mole.
- $\%CO_2$ = Percent carbon dioxide by volume, dry basis.
- $\%O_2$ = Percent oxygen by volume, dry basis.
- $\%N_2$ = Percent nitrogen by volume, dry basis.
- $\%CO$ = Percent carbon monoxide by volume, dry basis.
- 0.264 = Ratio of O_2 to N_2 in air, v/v.
- 0.28 = Molecular weight of N_2 or CO, divided by 100.
- 0.32 = Molecular weight of O_2 divided by 100.
- 0.44 = Molecular weight of CO_2 divided by 100.

4. Water Vapor Condensed

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

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

Where:

- 0.04707 = Conversion factor, ft^3/ml.
- 0.04715 = Conversion factor, ft^3/g.
- Vwc_{std} = Volume of water vapor condensed (std. cond.), ml.
- $Vwsg_{std}$ = 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)(°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.

5. Moisture Content of Stack Gases

$$B_{ws} = \left[\frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{wc_{std}} + V_{wsg_{std}} + V_{mstd}}\right] \times 100$$

Where:

- B_{ws} = Proportion of water vapor, by volume, in the gas stream.
- V_m = Dry gas volume measured by dry gas meter, dcf.
- Vwc_{std} = Volume of water vapor condensed, corrected to standard conditions, scf.
- $Vwsg_{std}$ = Volume of water vapor collected in silica gel corrected to std. cond., scf.

6. Molecular Weight of Stack Gases

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

Where:

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

7. Stack Gas Velocity

$$V_s = K_p \; C_p \; \left[\sqrt{\Delta P}\right] \text{avg} \; \sqrt{\frac{T_s(\text{avg})}{P_s \; M_s}}$$

Where:

- V_s = Average velocity of gas stream in stack, ft/sec.
- K_p = 85.49 ft/sec [(g/g-mole) — (mm Hg)/(°K)(mm H_2O]$^{1/2}$
- C_p = Pitot tube coefficient, dimensionless.
- ΔP = Velocity head of stack gas, in. H_2O.
- P_{bar} = Barometric pressure at measurement site, in. Hg.
- P_g = Stack static pressure, in. Hg.
- P_s = Absolute stack gas pressure, in. Hg. = $P_{bar} + P_g$
- P_{std} = Standard absolute pressure, 29.92 in. Hg.
- t_s = Stack temperature, °F.
- T_s = Absolute stack temperature, °R. = 460 + t_s.
- M_s = Molecular weight of stack gas, wet basis, lb/lb-mole.

8. Stack Gas Flow Rate

$$Q_{sd} = 3600 \; [1 - B_{wc}] \; V_s \; A \left[\frac{T_{std}}{T_{stk}}\right] \left[\frac{P_s}{P_{std}}\right]$$

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_{stk} = Absolute stack temperature (°R).
- T_{std} = Standard absolute temperature (528°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.).

9. Emissions Rate From Stack

$$E = \left[\frac{(C_s^{`})\ (Q_{sd})}{7{,}000\ gr/lb}\right] = lb/hr$$

Where:

- E = Emissions rate, lbs/hr.
- C_s = Concentration of particulate (or pollutant) 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.

10. Isokinetic Variation

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

Where:

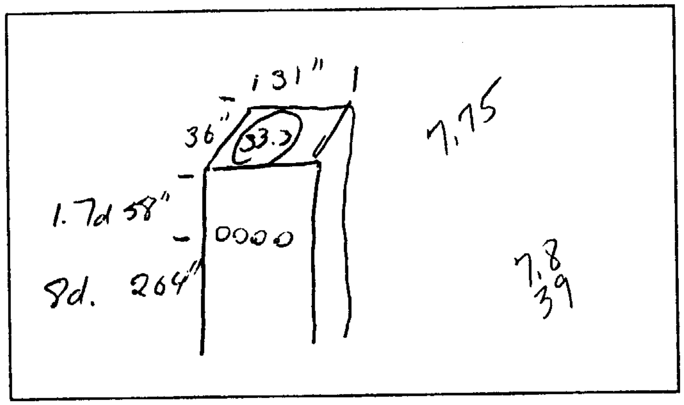
- I = Percent isokinetic sampling.
- 100 = Conversion to percent.
- T_s = Absolute average stack gas temperature, °R.
- 0.002669 = Conversion factor, Hg - ft^3/ml - °R.
- V_{ic} = Total volume of liquid collected in impingers and silica gel, ml.
- T_m = Absolute average dry gas meter temperature, °R.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

SECTION F:

FIELD DATA

RAMCON Environmental Corporation

Plant Valley #9
Location Sheldonville, OH
Operator CB
Date 9/21/94
Run No. 1
Sample Box No. 1
Meter Box No. Nutech #2
Meter ΔH @ 1.816
Y Factor 1.003
Pitot Tube Coefficient Cp .84



Schematic of Stack Cross Section

16 | 60   1.09

Ambient Temperature 60
Barometric Pressure 30.05
Assumed Moisture, % 22
Probe Length, m (ft) 3
Probe Heater Setting 4
Nozzle Identification No. 0002405
Avg. Calibrated Nozzle Dia., (in.) .210/.210/.219
Leak Rate, m³/min. (cfm) .016 @ 11"
Static Pressure, mm Hg (in. Hg) +.10
Filter No. 7500812

	Impinger Volume, ml	Silica Gel Weight, g
Final	434	440
Initial	200	440
Difference	234	0

Traverse Point No.	Sampling Time (Θ) min.	Vacuum in. Hg	Stack Temperature (T_s) °F	Velocity Head (P_s) in H_2O	Pressure Diff. Orf. Meter in H_2O	Gas Sample Volume, ft³	Gas Sample Temperature at Dry Gas Meter °F Inlet	Gas Sample Temperature at Dry Gas Meter °F Outlet	Filter Holder Temperature °F	Gas Temp. Lvg Condenser or Last Impinger °F
1	7:52 / 7:55.45	6	210	1.1	1.2	156.931 / 158.8	63	61	260	68
2	7:59.30	7	225	1.1	1.2	161.4	63	61	250	64
3	7:03.15	8	225	1.5	2.1	164.1	65	61	251	66
4	7:07	9	226	1.7	1.9	166.9	67	61	257	59
1	7:09 / 7:11.45	5	223	.95	1.0	167.2	68	61	257	56
2	7:15.30	7	225	1.4	1.5	171.7	70	62	254	54
3	7:19.15	9	225	1.7	1.9	174.5	72	62	255	53
4	7:23	10	225	2.1	2.3	177.6	74	63	256	53
1	7:24 / 7:27.45	5	224	.85	.93	179.9	73	64	255	58
2	7:31.30	6	227	1.0	1.1	182.1	73	65	253	57
3	7:35.15	8	228	1.6	1.7	184.8	74	65	254	55
4	7:39	9	229	1.7	1.9	187.5	76	66	256	53

RAMCON emissions test log sheet, cont. Date 9/21/94 Location Sharonville, OH Test No. 1 1591

Traverse Point No.	Sampling Time (Θ) min.	Vacuum in. Hg	Stack Temperature (T_S) °F	Velocity Head (P_S) in H_2O	Pressure Diff. Orf. Meter in H_2O	Gas Sample Volume, ft³	Gas Sample Temperature at Dry Gas Meter °F		Filter Holder Temperature °F	Gas Temp. Lvg Condenser or Last Impinger °F
							Inlet	Outlet		
1	~~7:40~~ 7:43:45	4	221	.55	.60	189.3	73	66	255	58
2	7:47:30	5	228	.60	.61	191.3	74	67	256	53
3	7:51.15	6	223	1.3	1.4	193.8	75	67	255	53
4	7:5	10	228	1.9	2.1	196.679	76	69	256	53
			224.81	1.146	1.47	39.848	67			

RAMCON Environmental Corporation

Plant Valley W9
Location Sheridanville, ?W
Operator [illegible]
Date 9/21/94
Run No. 2
Sample Box No. 1
Meter Box No. Nutech
Meter H @ 1.816
C Factor 1.003
Pitot Tube Coefficient Cp .84

Schematic of Stack Cross Section

Ambient Temperature 70
Barometric Pressure 30.05
Assumed Moisture, % 22
Probe Length, m (ft) 3
Probe Heater Setting 4
Nozzle Identification No. 0002405
Avg. Calibrated Nozzle Dia., (in.) .210/.210/.210
Leak Rate, m³/min. (cfm) .014 @ 12"
Static Pressure, mm Hg (in. Hg) 1.19
Filter No. T500911

	Impinger Volume, ml	Silica Gel Weight, g
Final	2138	422
Initial	200	422
Difference	238	0

Traverse Point No.	Sampling Time (Θ) min.	Vacuum in. Hg	Stack Temperature (T_s) °F	Velocity Head (P_s) in H_2O	Pressure Diff. Orf. Meter in H_2O	Gas Sample Volume, ft³	Gas Sample Temperature at Dry Gas Meter °F		Filter Holder Temperature °F	Gas Temp. Lvg Condenser or Last Impinger °F
							Inlet	Outlet		
1	9:50 / 9:53.45	5	234	.75	.83	196.636 / 198.8	69	68	261	68
2	9:57:30	5	237	.73	.78	200.9	70	68	253	63
3	10:01:15	5	236	.70	.76	202.6	72	65	254	60
4	10:05	7	230	1.5	1.6	205.3	74	69	258	61
1	10:06 / 10:09.45	5	232	.99	.97	207.3	76	70	257	63
2	10:13:30	6	232	1.1	1.2	209.7	77	70	254	62
3	10:17.15	7	231	1.3	1.4	212.6	79	71	254	61
4	10:21	10	230	1.8	1.9	215.0	81	72	256	59
1	10:22 / 10:25.45	7	231	1.3	1.4	217.5	82	73	255	61
2	10:29.30	7	231	1.1	1.2	220.0	83	73	256	61
3	10:33.15	9	236	1.6	1.7	222.8	84	74	255	61
4	10:37	10	237	2.1	2.2	225.5	85	75	255	59

RAMCON emissions test log sheet, cont. Date 9/21/94 Location Sharonville, OH Test No. 2

Traverse Point No.	Sampling Time (Θ) min.	Vacuum in. Hg	Stack Temperature (T_s) °F	Velocity Head (P_s) in H_2O	Pressure Diff. Orf. Meter in H_2O	Gas Sample Volume, ft³	Gas Sample Temperature at Dry Gas Meter °F		Filter Holder Temperature °F	Gas Temp. Lvg Condenser or Last Impinger °F
							Inlet	Outlet		
1	10:39 ~~10:41:45~~	6	237	.99	.97	227.6	84	75	255	62
2	10:45:30	8	239	1.1	1.2	230.0	85	76	256	62
3	10:51.15	9	240	1.3	1.4	232.7	65	76	258	63
4	10:53	10	242	1.8	1.5	235.321	67	77		63
			235.25	1.10	1.34	34.385	71			

RAMCON Environmental Corporation

Plant Valley Hg
Location Shadyville, OH
Operator RS
Date 7/21/94
Run No. 3
Sample Box No. 1
Meter Box No. Nutic #2
Meter H @ 1.816
C Factor 1.003
Pitot Tube Coefficient Cp .84

Schematic of Stack Cross Section

Ambient Temperature 65
Barometric Pressure 30.05
Assumed Moisture, % [illegible]
Probe Length, m (ft) 3
Probe Heater Setting 4
Nozzle Identification No. 00022405
Avg. Calibrated Nozzle Dia., (in.) .210/.210/.210
Leak Rate, m³/min. (cfm) .017 @ 9"
Static Pressure, mm Hg (in. Hg) +1.10
Filter No. ~~[illegible]~~ 15009.3

	Impinger Volume, ml	Silica Gel Weight, g
Final	446	464
Initial	200	464
Difference	246	6

Traverse Point No.	Sampling Time (Θ) min.	Vacuum in. Hg	Stack Temperature (T_s) °F	Velocity Head (P_s) in H_2O	Pressure Diff. Orf. Meter in H_2O	Gas Sample Volume, ft³ (231.346)	Gas Sample Temperature at Dry Gas Meter °F Inlet	Outlet	Filter Holder Temperature °F	Gas Temp. Lvg Condenser or Last Impinger °F
1	~~12:01~~ 12:10.45	5	232	1.0	1.1	~~[illegible]~~ 239.6	82	80	229	61
2	12:14.30	6	235	1.3	1.4	242.2	83	80	265	63
3	12:18.15	7	235	1.6	1.7	245.0	86	81	265	61
4	12:22	8	236	1.8	2.0	247.9	88	81	254	62
1	~~12:23~~ 12:26.45	5	234	1.0	1.1	250.3	89	82	257	68
2	12:30.30	6	238	1.1	1.2	252.8	91	83	257	65
3	12:34.15	7	237	1.5	1.7	255.4	92	84	257	64
4	12:38	8	237	1.6	1.8	258.3	94	85	252	64
1	~~12:39~~ 12:42.45	5	234	.80	.88	260.2	93	86	255	68
2	12:46.30	6	238	1.1	1.2	262.6	94	86	259	68
3	12:50.15	7	237	1.3	1.4	265.3	96	87	256	68
4	12:54	8	~~237~~	1.7	1.9	268.1	98	88	252	66
			236							

RAMCON emissions test log sheet, cont. Date 9/21/94 Location Shrenville, OH Test No. 3

Traverse Point No.	Sampling Time (Θ) min.	Vacuum in. Hg	Stack Temperature (T_s) °F	Velocity Head (P_s) in H_2O	Pressure Diff. Orf. Meter in H_2O	Gas Sample Volume, ft³	Gas Sample Temperature at Dry Gas Meter °F		Filter Holder Temperature °F	Gas Temp. Lvg Condenser or Last Impinger °F
							Inlet	Outlet		
1	~~12:35~~ 1258.45	5	230	.65	.71	270.1	96	88	256	68
2	13:02.30	5	235	.70	.77	272.0	98	89	255	68
3	13:06.15	5	235	.92	1.0	274.3	98	89	252	68
4	13:10	6	237	1.2	1.3	276.636	98	90	257	67
			235	1.086	1.32	39.290	88.4			

F:\Forms\18-00001

SECTION G:

CALIBRATION

4A

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes ______ no

Pitot tube openings damaged? ______ yes (explain below) ✓ no

α_1 = 1.3 ° (<10°), α_2 = 0.8 ° (<10°), β_1 = 0.5 ° (<5°), β_2 = 1.8 ° (<5°)

γ = 2.9 °, θ = 1.7 °, A = .97 cm (in.)

$z = A \sin \gamma$ = .05 cm (in.); <0.32 cm (<1/8 in.),

$w = A \sin \theta$ = .03 cm (in.); <.08 cm (<1/32 in.)

P_A .48 cm (in.) P_b .49 cm (in.)

D_t = .38 cm (in.)

Comments: ______

______

______

Calibration required? ______ yes ✓ no

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes ______ no

Pitot tube openings damaged? ______ yes (explain below) ______ no

α_1 = 2.3 ° (<10°), α_2 = .5 ° (<10°), β_1 = 1.8 ° (<5°),
β_2 = 1.8 ° (<5°)

γ = 3.2 °, θ = 1.0 °, A = .98 cm (in.)

$z = A \sin \gamma$ = .05 cm (in.); <0.32 cm (<1/8 in.),
$w = A \sin \theta$ = .02 cm (in.); <.08 cm (<1/32 in.)

P_A .49 cm (in.) P_b .49 cm (in.)

D_t = .38 cm (in.)

Comments: ______

______

______

Calibration required? ______ yes ✓ no

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

ate 2-2[illegible] Thermocouple number 41

Ambient temperature [illegible] °C Barometric pressure [illegible] in. Hg

Calibrator ______ Reference: mercury-in-glass ______

Other ______

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference[c] %
A	Ice Water	33	31	.4
B	Boiling Water	212	213	.1
C	Hot [illegible]	535	550	1.5

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

[b]Type of calibration system used.

[c]

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

SECTION H:

RAMCON PERSONNEL

Name: Mr. Sumner Buck
Title: President

Qualifications: Mr. Buck is a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis. He is a graduate of the EPA 450 "Source Sampling for Particulate Pollutant's" course and the 474 "Continuous Emissions Monitoring" courses outlined by EPA at Research Triangle Park, N.C. He has been directly involved in conducting and supervising air emission testing for over 15 years. He has personally conducted over 400 air emission tests. He currently sponsors and directs visual emission certification schools for US EPA Method 9.

Project Duties: Mr. Buck is responsible for the overall supervision of each testing project. This includes the correspondence to the State Regulatory Agency and the plant personnel regarding scheduling, testing requirements, etc. He will assist in supervision of the project preparation for each team involved and the overall organization between the testing crew(s) and facility.

Name: Mr. Joe Sewell
Title: Vice President

Qualifications: Mr. Sewell is currently serving as the Vice President of RAMCON Environmental Corporation. Mr. Sewell is a graduate of Christian Brothers University in Memphis, Tennessee where he obtained a Bachelor of Science degree in Chemical Engineering. He has conducted and supervised air emissions testing projects ranging a broad spectrum of facility process categories. His accomplishments include the development of the instrumental branch of emissions testing utilizing continuous emission monitors and gas chromatography. Mr. Sewell performs a major role in the upgrading of testing capabilities and professional quality that RAMCON Environmental Corporation offers.

Project Duties: Mr. Sewell provides staff engineering and project administration to ensure the integrity of the requested services. He serves as the primary contact person for

RAMCON Environmental Corporation handling all correspondence between the facility personnel involved in the project and respective state agency representative(s). He provides project leadership to RAMCON Environmental Corporation field supervisors and managers involved in the testing project.

Name: Mr. Ray Jenkins
Title: Source Sampling Director

Qualifications: Mr. Jenkins is serving as the Source Sampling Director for RAMCON Environmental Corporation. He was promoted to this leadership position after gaining a significant amount of experience in conducting and providing field supervision of a variety of air testing projects. Mr. Jenkins has personally conducted and/or supervised all of the prevalent EPA approved procedures with expertise in the instrumental analyzer procedures. He graduated from Memphis State University obtaining a Bachelor of Science degree in Biology. He is also currently certified to conduct US EPA Reference Method 9 for the visual determination of emission opacity.

Project Duties: Mr. Jenkins provides project leadership to the Team Leaders and Field Technicians. He ensures the test crew(s) involved in the test project will be properly informed to his respective duties and responsibilities during the testing process. Mr. Jenkins also serves as the Quality Assurance/Quality Control Coordinator and provides guidance in QA/QC to each Team Leader with regard to sample integrity.

Name: Mr. Tommy South
Title: Laboratory Technician

Qualifications: Mr. South is currently serving as Laboratory Technician. He is proficient in conducting many analysis procedures such as front and back-half particulate analysis, titrations, extractions, etc.

Project Duties: Mr. South conducts the laboratory analysis on the particulate samples. He is also responsible for accepting the remaining field samples from the Field Sample Bank Manager and performing inspection as to integrity. He documents the transfer on the chain of custody forms and distributed the subcontracted samples to the respective laboratories.

Name: Rob Bade
Title: Team Leader

Qualifications: Mr. Bade is currently serving RAMCON Environmental Corporation as an Isokinetic Team Leader. He is proficient in all sampling procedures employing this type of testing. He is currently certified in conducting US EPA Reference Method 9 for opacity.

Project Duties: Mr. Bade is responsible for conducting isokinetic sampling procedures at the facility. He is also responsible for preparation and calibration of the necessary equipment for the project. His duties on-site include assembling the sample train, operation of the sampling equipment, sample recovery, and quality assurance/quality control checks.