Commonwealth of Pennsylvania
Environmental Resources
July 16, 1986

Subject: Stack Test Review

To: Data File
Sharp Excavating and Blacktopping
Armstrong, Indiana

From: Jaydeb Pai
Air Pollution Control Engineer
Division of Technical Services and Monitoring
Bureau of Air Quality Control

Through: Chief, Source Testing and Monitoring Section

Sharp Excavating and Blacktopping operates an H&B batch asphalt plant rated at 80 pounds per hour at the aforementioned location. The exhaust from the dryer is drawn through a PAA multi-cyclone and an Eastern Control Systems baghouse before being discharged to the atmosphere through a 43 inch inside diameter stack.

Three particulate test runs were performed by Ramcon Environmental Corporation in the baghouse exhaust stack to determine compliance with the NSPS. The tests, performed in accordance with a preapproved test protocol, are acceptable to the Department.

The following data was extracted from the test report:

Test date	5/29/86	5/29/86	5/29/86
Test run no.	1	2	3
Process rated capacity (tons/hr.)	80	80	80
Process rate during test (tons/hr.)	65.5	65.5	65.5
Material produced during test	ID2 Wearing	ID2 Wearing	ID2 Wearing
Percent passing through 200 mesh	4.8	4.8	4.8
Volumetric flow rate (dscfm)	11,200	11,197	11,337
*Particulate emission concentration (gr./dscf)	0.034	0.039	0.033
*Particulate emission rate (lb./hr.)	3.2	3.7	3.2
Allowable particulate emission concentration (gr./dscf) per NSPS)	0.04	0.04	0.04

* Corrected values excluding back half soluble particulate.

cc: Richard L. Murray, Greensburg District Office
File - No. 32-303-003
EPA/RSL
Reading File
Doug Lesher

DPadlw

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
BUREAU OF AIR QUALITY CONTROL

WEP Fact

TEST # 12486

PLAN APPROVAL

Approval No.: 32-303-003
Owner: Sharp Excavating & Blacktopping

Address: Box 156
Shelocta, PA 15774

Attention: Kenneth L. Sharp
President

Source & Air
Cleaning Devices: Asphaltic Concrete
Batch Plant

Location: Shelocta Plant
Armstrong
Indiana County

In accordance with provisions of the Air Pollution Control Act, the Act of January 8, 1960, P.L. 2119, as amended, and with Chapter 127 of the Rules and Regulations of the Department of Environmental Resources, the Department on August 29, 1985 approved plans for the construction of the above indicated air contamination source(s).

This PLAN APPROVAL expires 07/31/86 .

The plan approved is subject to the following conditions:

1. The construction is to be completed in accordance with the plans submitted with the application (as approved herein).

   A. Source test requirements

      (1) Permittee shall submit within the startup notification time requirement specified at 40CRF60.7, a stack test sampling and test protocol, in duplicate, to the Department of Environmental Resources, Bureau of Air Quality Control, 121 South Highland Avenue, Pittsburgh, PA 15206 (Regional Office).

      (2) Permittee shall perform the requisite number of tests as required by 40CFR60.8(f) within the time specified by 40CFR60.8(a) and provide notice to the Regional office within the time specified at 40CFR60.8(d).

   B. Application Emission Standard

      (1) Permittee shall comply with the provisions of 40CFR60.92.

      (2) Violation of any of the conditions and limitations of plan approval 32-303-003 shall be deemed a violation of 25 Pa. Code Section 127.25.

2. See attached Page(s).

Notify the person noted below when the installation is completed so that the source can be inspected for issuance of an OPERATING PERMIT.

NOTE:

Kenneth Bowman
Bureau of Air Quality Control
Armbrust Professional Center
R.D. #2, Box 603-C
Greensburg, PA 15601

Regional Air Pollution Control Engineer

RAMCON

ENVIRONMENTAL CORPORATION

RAMCON BUILDING 323 SCOTT STREET MEMPHIS, TENNESSEE 38112 TELEPHONE 901/458-7000 800/456-4867

KEY EAST
TEST #4265

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
SHARP'S EXCAVATING & BLACKTOPPING
INDIANA, PENNSYLVANIA
May 29, 1986

Ken Sharp
Sharp's Excavating

G. Sumner Buck, III
President

Sam Turner
Field Supervisor

RAMCON ENVIRONMENTAL CORPORATION

RAMCON BUILDING 829 SCOTT STREET MEMPHIS, TENNESSEE 38112 TELEPHONE 901/458-7000 800/458-4567

June 4, 1986

Mr. Ken Sharp
Sharp's Excavating & Blacktopping
P.O. Box 156
Shelocta, PA 15774

Subject: Particulate Emissions Test - Indiana, Pennsylvania

Dear Mr. Sharp:

Enclosed are four copies of our report on the particulate emissions test we conducted at your plant. Based on our test results, your plant does pass both EPA New Source Performance Standards and those set by the State of Pennsylvania. The average grain loading of the three test runs was in compliance with State and Federal Standards.

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

Mr. Michael Mendicino
Department of Environmental Resources
Bureau of Air Quality Control
Armbrust Professional Center
R.D. #2, Box 603-C
Greensburg, PA 15601

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

Sincerely,

G. Sumner Buck, III
President

GSBIII:kr

Enclosures

TABLE OF CONTENTS

I. INTRODUCTION

On May 29, 1986, personnel from RAMCON Environmental Corporation (REC) conducted a source emissions test for particulate emissions compliance at Sharp's Excavating & Blacktopping's H & B batch mix asphalt plant located in Indiana, Pennsylvania. RAMCON personnel conducting the test were Sam Turner, Field Supervisor and Greg Cook. Kim Rea was responsible for the final laboratory analysis including taring the beakers and filters and recording final data in the laboratory record books. Custody of the samples were limited to Mr. Turner and Ms. Rea.

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

II. TEST RESULTS

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

Mr. Michael Mendicino of Pennsylvania's Bureau of Air Quality Control observed the testing conducted by RAMCON.

TABLE 1

SUMMARY OF TEST RESULTS
May 29, 1986

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	07:34 to 08:51	0.0350 gr/DSCF	958	3.4 lbs/hr
2	09:36 to 11:00	0.0423 gr/DSCF	958	4.1 lbs/hr
3	11:50 to 13:08	0.0373 gr/DSCF	938	3.6 lbs/hr
	Averages:	0.0382 gr/DSCF		3.7 lbs/hr

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

III. TEST PROCEDURES

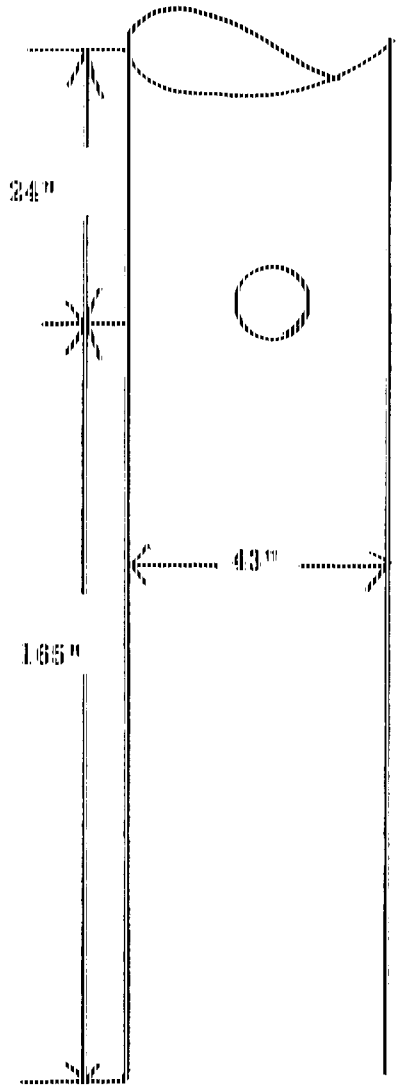
A. Method Used: The source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

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

C. Sampling Site: The emissions test was conducted after a baghouse on a round stack with a diameter of 43". The sampling ports were placed 24" down (0.6 diameters upstream) from the top of the stack and 165" up (3.8 diameters downstream) from the last flow disturbance. Twenty four points were sampled, twelve through each traverse for three minutes each.

Points on a Diameter	Probe Mark
1	"7.0"
2	8.9"
3	11.1"
4	13.6"
5	16.8"
6	21.3"
7	33.7"
8	38.3"
9	41.4"
10	43.9"
11	46.1"
12	48.0"

* Measurements include a 6" standoff.



IV. THE SOURCE

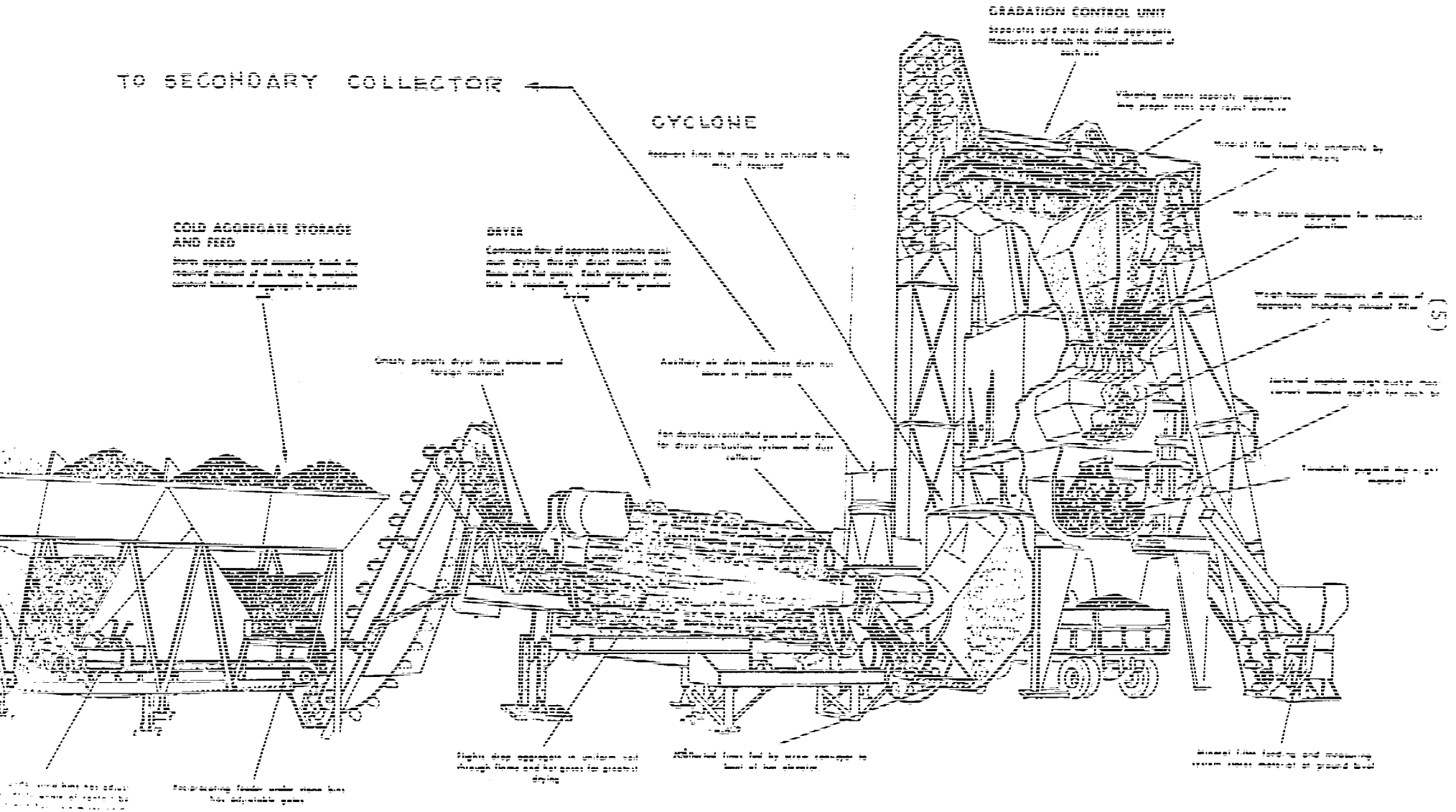
Sharp's Excavating & Blacktopping employs an H & B batch mix asphalt plant which is used to manufacture hot mix asphalt for road pavement. The process consists of blending prescribed portions of cold feed materials (sand, gravel, screenings, chips, etc.) uniformly and adding sufficient hot asphalt oil 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 and then compacted with a heavy roller to produce the final product.

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

The drum dryer 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 burner and the mixing drum, the air passes through a baghouse. The baghouse is manufactured by Eastern Controls Systems. 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 1 - 4 inches of water. The particulate matter, which is removed by the baghouse is reinjected into the pugmill. The following sketch shows a typical batch mix asphalt plant.

Figure 4-1

ASPHALT BATCH MIX PLANT - AN EXPLODED VIEW



DATA SUMMARY

Plant

1. Manufacturer of plant CPG.
2. Designed maximum operating capacity 35 TPH @ 2% moisture.
3. Actual operation rate 70 TPH @ 2.5 % moisture.
4. Startup date 11/25/15.
5. Type of fuel used in dryer NATURAL GAS.
6. Quanity of fuel consumption 2034 CFM.

Aggregate

7. Name/type of mix ID#2 (OGAC)
8. Percent asphalt in mix 6.4% %.
9. Temperature of asphalt 300°.
10. Sieve/Screening analysis: % Passing;

1"		#4	91.36		
3/4"		3/8"		#50	24.29
		#8	77.66		
1/2"		#16	56.35	#100	13.7
3/8"	100	#30	36.61	#200	4.6

Baghouse

11. Manufacturer Astec Combo Systems Inc. model 225-14
12. No. of bags 225. Type of bags NOMEX
13. Air to cloth ratio 5.29:1 MAC. Designed ACFM 22,500.
14. Square feet of bags 4,253.
15. Type of cleaning: pulse jet X, reverse air X, plenum pulse , other Reverse Pulse
16. Cleaning cycle time 22 Min.
17. Interval between cleaning cycle
18. Pressure drop across baghouse 1/2 in.
19. Pulse pressure on cleaning cycle psi.

COMPANY NAME Shaw Excavating & Surfacing DATE 6/29/16

COMPANY REPRESENTATIVE [signature]

PLANT DATA

COMPANY NAME [illegible] Excavating & Blacktopping

COMPANY REP. [illegible]

DATA SOURCE ______ DATE 5/25/86 Phone # [illegible]

PLANT LOCATION [illegible]

PLANT MANUFACTURER [illegible] PLANT MODEL NO. T 200 PLANT TYPE Batch

MIX SPECIFICATION NO. [illegible] OIL SPECIFICATION NO. AC-20

TIME: START 7:30 AM STOP ______

A.T. ______ °F R.H. ______ %

TIME 24 HOUR	FUEL OIL ☐ NATURAL GAS ☒ PROPANE ☐	BURNER SETTING	AGGREGATE TPH	RECYCLE TPH	ASPHALT	MIX TEMPERATURE °F	VENTURI ☐ Baghouse ☒ DIFFERENTIAL
		340°	325				
7:35 AM		340°	65.52	0	4.45 T/H	300°	1 in.
1:10 PM		340°	65.52	0	[illegible]	300°	1 in.

REMARKS:

V. EQUIPMENT USED

V. EQUIPMENT USED

Equipment used on conducting the particulate emissions test was:

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

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

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

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

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

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

VI. LABORATORY PROCEDURES & RESULTS

LABORATORY PROCEDURES FOR PARTICULATE SAMPLING

I. Field Preparation

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

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

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

Approximately 200 g of silica gel is placed in a wide mouth "Mason" type jar and dried in an oven (175°C for two hours). The open jars are removed and placed in a dessicator until cool (2 hours) and then tightly sealed. The jars are then numbered and weighed on the triple beam balance to the closest tenth of a gram, and this weight is recorded for each sealed jar. The number of silica gel jars used is the same as the number of filters. Silica gel should be indicating type, 6-16 mesh.

II. Post-Testing Lab Analysis

A. FILTERS: The filters are returned to the lab in their sealed glass filter holder which was used in field sampling. In the lab these holders are opened. The filter is placed in its petri dish with the lid off and returned to the dessicator for at least 24 hours. The top half of the filter holder is washed into the corresponding probe wash bottle and the bottom half of the filter holder is washed into the corresponding impinger catch bottle. (See II, C and D). After dessication, the filters are reweighed. The final weight is recorded in the lab record book. The filter pick up weight is calculated and recorded also. This procedure is repeated for all filters used in the field.

Alternately, the test team may opt to oven dry the filters at 220°F for two to three hours, weigh the sample, and use this weight as a final weight.

B. SILICA GEL: The sealed silica gel jars should be reweighed on the triple-beam balance and their weights recorded as shown on previous page.

C. PROBE RINSINGS: In all tests, a probe wash-out analysis will be necessary. These samples are returned in sealed Mason jars and consist of A.R. Acetone with an unknown solid content. Clean 250 ml beakers are used to make this analysis. These should be immaculately washed and rinsed with deionized water, then oven dried at 105°C for about one hour. The beakers should be moved to the dessicator to cool for ninety (90) minutes, then labeled with a pencil and weighed on the Sartorius analytical balance. Any variance from this procedure should be duplicated exactly when reweighing, as this procedure has been found to be quite sensitive. After preparing the necessary number of beakers (one for each probe wash and one blank) the Mason jars should be opened, poured into the beaker, and any material remaining on the jar walls rinsed with an acetone wash bottle into the beaker. The amount of liquid in the beaker should be noted on the analysis form. The acetone rinsings are evaporated on a warming plate. The liquid is kept swirled with an air sweep to prevent "bumping". When the acetone is evaporated the beakers are weighed as in Section II A.

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

E. ACETONE: Conduct a blank analysis of acetone in the 1 gallon glass container. This acetone will be used in the field for rinsing the probe, nozzle, and top half of the filter holder. Performing such a blank analysis prior to testing will insure that the quality of the acetone to be used will not exceed the .001% residual purity standard.

SPECIAL NOTE

When sampling sources high in moisture content, (such as asphalt plants) the filter paper sometimes sticks to the filter holder. When removing the filter it may tear. In order to maintain control of any small pieces of filter paper which may be easily lost, they are washed with acetone into the probe washing. This makes the filter weight light (sometimes negative) and the probe wash correspondingly heavier. The net weight is the same and no particulate is lost. This laboratory procedure is taught by EPA in the Quality Assurance for Source Emissions Workshop at Research Triangle Park and is approved by EPA.

WEIGHING PROCEDURE - SARTORIUS ANALYTICAL BALANCE

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

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

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

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

Form RBCH8 SAMPLE ANALYTICAL DATA FORM

Plant Location Sept Mig Asphalt Plant Relative humidity in lab 49 %

Sample Location Shops Excavating Density of Acetone (ρa) .7857 mg/ml

Blank volume (V_a) 200 ml

Date/Time wt. blank 6/4 Gross wt. 94.4795 mg

Date/Time wt. blank 6/5 Gross wt. 94.4792 mg

Ave. Gross wt. 94.4794 mg

Tare wt. 94.4789 mg

Weight of blank (m_{ab}) .0005 mg

Acetone blank residue concentration (C_a) (C_a) = (M_{ab}) / (V_a) (ρ_a) = (.0005mg/200)(.7857) = .0005

Weight of residue in acetone wash: $W_a = C_a V_{aw} \rho_a$ = (.0005mg/200)(.7857) = .0005

	Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw}) ml	200	200	200
Date/Time of wt. 6/4 Gross wt. g	95.5135	94.4469	95.3500
Date/Time of wt. 6/5 Gross wt. g	95.5138	94.4465	95.3500
Average Gross wt. g	95.5134	94.4467	95.3500
Tare wt g	95.4084	94.3239	95.2466
Less acetone blank wt. (W_a) g	.0005	.0005	.0005
Wt of particulate in acetone rinse (m_a) g	.1045	.1223	.1029

	Filter Numbers	ST-1435	ST-1439	ST-1440
Date/Time of wt. 6/4	Gross wt. g	.6906	.6894	.6874
Date/Time of wt. 6/5	Gross wt. g	.6903	.6891	.6870
	Average Gross wt. g	.6904	.6893	.6871
	Tare wt. g	.6894	.6885	.6862
Plus Back Half		.0183	.0190	.0806

Weight of particulate on filters(s) (mg)	g	.0005	.0008	.0009
Weight of particulate in acetone rinse	g	.1045	.1223	.1029
Total weight of particulate (m_n)	g	.1173	.1431	.1944

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 Ken Pea Signature of reviewer Steve

COMPANY NAME Sharp's Excavating

Soluble and Insoluble Extraction for EPA Method 5 (back half)

Relative humidity in lab 49 %

			RUN 1	RUN 2	RUN 3
Impinger rinse volume (Filterable Extraction)		ml	200	198	185
Date/Time of wt. 6/5	Gross wt.	g	.0398	.0381	.0356
Date/Time of wt. 6/6	Gross wt.	g	.0398	.0379	.0355
	Gross wt.	g	.0398	.0380	.0354
Filter Avg.	Tare wt.	g	.0380	.0315	.0303
Weight of insoluble particulate impinger rinse		g	.0018	.0065	.0053
		#	Imp#1	Imp#2	Imp#3
Water evaporation					
Date/Time of wt. 6/5	Gross wt.	g	148.6700	138.6880	145.7004
Date/Time of wt. 6/6	Gross wt.	g	148.6699	138.6881	145.7003
	Gross wt.	g	148.6700	138.6880	145.7003
Beaker Avg.	Tare wt.	g	148.6655	138.6695	145.7550
Weight of soluble particulate from water		g	.0045	.0185	.0153
Total weight of particulate (m_n)		g	.0163	.0190	.0206

Remarks _____

Signature of Analyst _____

Signature of Reviewer _____

VII. CALCULATIONS

NAME: SHARP'S EXCAVATING & BLACKTOP[14]

LOCATION: INDIANA, PENNSYLVANIA

			date	5/29/86	5/29/86	5/29/86
	SUMMARY OF TEST DATA			RUN # 1	RUN # 2	RUN # 3
	SAMPLING TRAIN DATA		start	07:34	09:36	11:50
			finish	09:51	11:00	13:08
1	Sampling time, minutes		θ	72	72	72
2	Sampling nozzle diameter, in.		Dn	.350	.350	.350
3	Sampling nozzle cross-sectional area, ft^2		An	.000668	.000668	.000668
4	Isokinetic variation		I	95	95	93
5	Sample gas volume - meter conditions, c^f.		Vm	53.10	54.40	55.10
6	Average meter temperature, °R		Tm	546	559	570
7	Average orifice pressure drop, in. H_2O		ΔH	1.80	1.83	1.84
8	Total particulate collected mg.		Mn	117.3	142.1	124.4
	VELOCITY TRAVERSE DATA					
9	Stack area, ft^2		A	10.1	10.1	10.1
10	Absolute stack gas pressure, in. Hg.		Ps	29.33	29.33	29.33
11	Barometric pressure, in. Hg.		Pbar	29.33	29.33	29.33
12	Average absolute stack temperature, °R		Ts	679	682	676
13	Average $\sqrt{\text{velocity head}}$, (Cp= .82)		$\sqrt{\Delta P}$	.45	.45	.45
14	Average stack gas velocity ft. / sec.		Vs	29	29	29
	STACK MOISTURE CONTENT					
15	Total water collected by train, ml.		Vlc	210.0	209.0	193.0
16	Moisture in stack gas, %		Bws	16.1	15.9	15.1
	EMISSIONS DATA:					
17	Stack gas flow rate, dscf/hr. (000's)		Qsd	672	672	680
18	Total particulate concentration, gr/dscf		Cs	.0350	.0423	.0373
19	Total particulate concentration, lbs/hr		E	3.4	4.1	3.6
20	Total particulate concentration, lbs/mbtu		E'	.0000	.0000	.0000
	ORSAT DATA					
21	Percent CO2 by volume		CO2	3.0	3.0	3.0
22	Percent O2 by volume		O2	14.7	15.0	15.0
23	Percent CO by volume		CO	0	.0	.0
24	Percent N2 by volume		N2	82.3	82.0	82.0

Buzzycalc

Dry Gas Volume :

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

Where:

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

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

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

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

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

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

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

Y = Dry gas meter calibration factor

13.6 = Inches water per inches Hg.

Run # 1 $V_{m(std)} = 17.64 \quad (1.02)(53.10) \left[\frac{(29.33) + \frac{1.80}{13.6}}{546} \right] = 51.66$ dscf

Run # 2 $V_{m(std)} = 17.64 \quad (1.02)(54.40) \left[\frac{(29.33) + \frac{1.83}{13.6}}{559} \right] = 51.69$ dscf

Run # 3 $V_{m(std)} = 17.64 \quad (1.02)(55.10) \left[\frac{(29.33) + \frac{1.84}{13.6}}{570} \right] = 51.35$ dscf

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, c.f.t.

Run # 1: $C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{117.3}{51.66} \right] = .0350$ gr./dscf

Run # 2: $C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{142.1}{51.69} \right] = .0423$ gr./dscf.

Run # 3: $C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{124.4}{51.35} \right] = .0373$ gr /dscf.

Dry molecular weight:

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

Where:

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

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

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

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

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

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

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

0.32 = Molecular weight of O_2 divided by 100.

0.44 = Molecular weight of CO_2 divided by 100.

Run # 1: $M_d = 0.44(3.0\%) + 0.32(14.7\%) + 0.28(.0\% + 82.3\%) = 29.1$ lb./lb.-mole

Run # 2: $M_d = 0.44(3.0\%) + 0.32(15.0\%) + 0.28(.0\% + 82.0\%) = 29.1$ lb./lb.-mole

Run # 3: $M_d = 0.44(3.0\%) + 0.32(15.0\%) + 0.28(.0\% + 82.0\%) = 29.1$ lb./lb -mole

Water vapor condensed : (18)

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

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

Where:

0.04707 = Conversion factor ft^3/ml.

0.04715 = Conversion factor ft^3/g.

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

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

V_f = Final volume of impinger contents, ml.

V_i = Initial volume of impinger contents

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

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

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

T_{std} = Absolute temperature at standard conditions, 528°R.

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

Run # 1: $V_{wc(std)}$ = (0.04707) (200.0) = 9.4 cu.ft
$V_{wsg(std)}$ = (0.04715) (10.0) = .5 cu.ft

Run # 2: $V_{wc(std)}$ = (0.04707) (198.0) = 9.3 cu.ft
$V_{wsg(std)}$ = (0.04715) (11.0) = .5 cu.ft

Run # 3: $V_{wc(std)}$ = (0.04707) (185.0) = 8.7 cu.ft
$V_{wsg(std)}$ = (0.04715) (8.0) = .4 cu.ft

Moisture content of stack gases: $$B_{ws} = \frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{wc_{std}} + V_{wsg_{std}} + V_{m_{std}}} \times 100$$

Where:

B_{ws} = Proportion of water vapor, by volume, in the gas stream.

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

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

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

Run # 1: $$B_{ws} = \frac{9.4 + .5}{9.4 + .5 + 51.66} \times 100 = 16.1\ \%$$

Run # 2: $$B_{ws} = \frac{9.3 + .5}{9.3 + .5 + 51.69} \times 100 = 15.9\ \%$$

Run # 3: $$B_{ws} = \frac{8.7 + .4}{8.7 + .4 + 51.35} \times 100 = 15.1\ \%$$

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

Where:

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

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

Run # 1: $M_s = 29.1\ (1-\ .161\ ) + 18\ (\ .161\ ) = 27.3$ (lb./lb.-mole).

Run # 2: $M_s = 29.1\ (1-\ .159\ ) + 18\ (\ .159\ ) = 27.3$ (lb./lb.-mole).

Run # 3: $M_s = 29.1\ (1-\ .151\ ) + 18\ (\ .151\ ) = 27.4$ (lb./lb.-mole).

Stack gas velocity:

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

Where:

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

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

C_p = Pitot tube coefficient, (dimensionless).

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

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

P_g = Stack static pressure (in.Hg).

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

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

t_s = Stack temperature, ($^\circ$f).

T_s = Absolute stack temperature, ($^\circ$R), = 460 + t_s.

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

Run # 1: $V = (85.49)(.82)(.45)\sqrt{\frac{679}{(29.33)(27.31)}} = 28.90$ ft/sec.

Run # 2: $V = (85.49)(.82)(.45)\sqrt{\frac{682}{(29.33)(27.34)}} = 28.95$ ft/sec

Run # 3: $V = (85.49)(.82)(.45)\sqrt{\frac{676}{(29.33)(27.42)}} = 28.78$ ft/sec

Stack gas flow rate:

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

Where:

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

A = Cross sectional area of stack $(ft.)^2$

3600 = Conversion factor, sec./hr.

t_s = Stack temperature ($^{\circ}$f).

T_s = Absolute stack temperature, ($^{\circ}$R).

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

$$Q_{sd} = 3600\ (1-.161)\ (\ 28.90)\ (\ \ 10.1) \left[\frac{528}{679}\right] \left[\frac{29.33}{29.92}\right] = 672045 \text{ dscf/h}$$

Run # 2:

$$Q_{sd} = 3600\ (1-.159)\ (\ 28.95)\ (\ \ 10.1) \left[\frac{528}{682}\right] \left[\frac{29.33}{29.92}\right] = 671844 \text{ dscf/h}$$

Run # 3:

$$Q_{sd} = 3600\ (1-.151)\ (\ 28.75)\ (\ \ 10.1) \left[\frac{528}{676}\right] \left[\frac{29.33}{29.92}\right] = 680237 \text{ dscf/h}$$

Emissions rate from stack:

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

Where:

E = Emissions rate, lb./hr.

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

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

Run # 1: $E = \frac{(.0350)(672045)}{7000} = 3.4$ lb./hr.

Run # 2: $E = \frac{(.0423)(671844)}{7000} = 4.1$ lb./hr.

Run # 3: $E = \frac{(.0373)(680237)}{7000} = 3.6$ lb./hr.

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

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.

Run # 1:

$$I = 100 \times 679 \left[\frac{(0.002669)(210.0) + \frac{53.1}{546}\left[29.33 + \frac{1.80}{13.6}\right]}{60\ (\ 72\ )\ (\ 28.90\ )\ (29.33\ )\ (\ .000668\ )} \right] = 95\ \%$$

Run # 2:

$$I = 100 \times 682 \left[\frac{(0.002669)(209.0) + \frac{54.4}{559}\left[29.33 + \frac{1.83}{13.6}\right]}{60\ (\ 72\ )\ (\ 28.95\ )\ (29.33\ )\ (\ .000668\ )} \right] = 95\ \%$$

Run # 3:

$$I = 100 \times 676 \left[\frac{(0.002669)(193.0) + \frac{55.1}{570}\left[29.33 + \frac{1.84}{13.6}\right]}{60\ (\ 72\ )\ (\ 28.78\ )\ (29.33\ )\ (\ .000668\ )} \right] = 93\ \%$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Sharon Quarry & Road Tapes

Location Indiana Pa.
Operator Sam Turner
Date 5-24-96
Run No. 1
Sample Box No. 1
Meter Box No. 670705
Meter H @ 1.96
C Factor 1.0002
Pitot Tube Coefficient Cp .816

.64 ft	43"	34"
—	0	—
3.9 ft		165"

Ambient Temperature 61
Barometric Pressure 29.33 mm
Assumed Moisture, % 10
Probe Length, m(ft) 4' dimensions

	Pitot	Meter
	400	317
	206	507
	260	10

Nozzle Identification No. .0900 (68)
Avg. Calibrated Nozzle Dia., (in.) .35/.35/.35
Probe Heater Setting 4
Leak Rate, m³/min. (cfm) .009 @ 5 in Hg
Probe Liner Material Stainless Steel
Static Pressure, mm Hg (in.Hg) +.15
Filter No. ST-1435 (6899)

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (ΔPs) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	°F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	7:35 ~~7:37~~	2	202	.11	96	~~371.3~~ 381.30	74	62	250	160
2	7:40	3	225	.14	1.2	383.00	84	62	250	50
3	7:43	3	232	.17	1.5	385.40	98	62	250	50
4	7:46	4	220	.18	1.6	387.60	92	64	250	50
5	7:49	4	215	.22	1.9	389.30	96	65	250	40
6	7:52	5	215	.25	2.2	392.00	98	66	250	40
7	7:55	5	210	.25	2.2	394.20	106	68	250	40
8	7:58	5	210	.23	2.0	396.40	102	69	250	40
9	8:01	4	210	.20	1.8	398.10	102	70	250	40
10	8:04	4	212	.20	1.8	399.10	104	70	245	50
11	8:07	4	210	.18	1.6	363.20	104	72	245	50
12	8:10	4	211	.18	1.6	365.50	106	72	250	56
B 1	8:15 ~~8:18~~	4	198	.19	1.7	367.60	92	74	250	40

CO2: 3 %
O2: 14.9 %

CO2: 3.0
O2: 15.0

CO2: 3.0
O2: 15.0

Form #RRC-05

RAMCON emissions test log sheet, cont. DATE 5-29-96 LOCATION Inbound #2 TEST NO. 1

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORIFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
2	8:21	5	205	.23	2.0	309.70	104	74	250	40
3	8:24	5	210	.25	2.2	312.30	106	74	250	40
4	8:27	5	213	.25	2.2	314.90	106	74	255	40
5	8:30	5	203	.25	2.2	317.30	108	76	250	40
6	8:33	5	236	.25	2.2	319.60	107	76	250	40
7	8:36	5	238	.25	2.2	322.10	108	76	250	40
8	8:39	4	240	.20	1.9	324.90	108	77	245	40
9	8:42	4	235	.19	1.7	326.40	110	78	245	40
10	8:45	4	232	.19	1.7	328.70	110	78	240	50
11	8:48	4	227	.17	1.5	330.70	110	79	240	50
12	8:51	3.5	224	.17	1.5	332.79	110	78	245	50

RAMCON ENVIRONMENTAL CORPORATION

Plant Sharpo Excavating + Black Top

Location Indiana Pa
Operator Sam Tuner
Date 5-29-86
Run No. 2
Sample Box No. 2
Meter Box No. 670715
Meter H @ 1.96
C Factor 1.022
Pitot Tube Coefficient Cp .816

Ambient Temperature 71
Barometric Pressure 29.33
Assumed Moisture, % 20
Probe Length, m(ft) 4'
Nozzle Identification No. .000681
Avg. Calibrated Nozzle Dia., (in.) .35/.35/.35
Probe Heater Setting 4
Leak Rate, m³/min. (cfm) .005 at 5 in Vac
Probe Liner Material Stainless Steel
Static Pressure, mm Hg (in. Hg) 7.015
Filter No. ST-1439 (.6885)

	397	326
	200	311
	197	11

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 ft³	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	9:36 / 9:39	2	210	.14	1.2	330.10 / 335.10	78	78	260	55
2	9:46 / 9:49	2	211	.16	1.4	337.00	100	78	260	55
3	9:52	3	217	.17	1.5	339.20	104	79	255	55
4	9:55	3	223	.20	1.8	341.40	108	80	255	55
5	9:58	4	229	.22	2.0	343.70	110	80	255	55
6	10:01	4	231	.22	2.0	346.10	110	80	265	55
7	10:04	4	236	.24	2.1	348.40	112	82	265	55
8	10:07	4	234	.22	2.0	351.00	114	82	265	60
9	10:10	4	235	.22	2.0	353.10	114	83	265	60
10	10:13	3	228	.19	1.7	355.50	116	84	265	60
11	10:16	3	232	.17	1.5	357.70	116	84	265	60
12	10:19	3	237	.15	1.3	359.41	116	85	250	60
1	10:23 / 10:26	3	195	.16	1.4	361.40	100	85	250	60

CO_2 = 3.0 % CO_2 = 3.0 % CO_2 = 70
O_2 = 16.0 % O_2 = 16.0 % O_2 = 60

Form #RHC-05

RAMCON emissions test log sheet, cont. DATE 5-29-96 LOCATION Incinerator A 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)	ORIFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
2	10:29	4	205	.20	1.9	363.80	114	96	265	60
3	10:33	4	212	.22	2.0	366.60	112	96	270	60
4	10:36	5	217	.23	2.4	368.80	119	96	270	60
5	10:39	5	218	.20	2.4	371.20	118	98	270	60
6	10:42	5	220	.21	2.4	373.90	119	98	270	60
7	10:45	5	220	.22	2.4	376.50	120	98	265	60
8	10:48	4	224	.22	2.0	378.90	120	99	260	60
9	10:51	3	224	.20	1.8	381.10	120	90	260	60
10	10:54	3	221	.20	1.8	383.40	121	90	260	60
11	10:57	3	224	.17	1.5	385.60	122	90	265	50
12	11:00	3	228	.17	1.5	387.625	118	90	265	50

RAMCON ENVIRONMENTAL CORPORATION

Plant Sharp Corporation Plant Two

Location Indianapolis, IN
Operator Sam Turner
Date 5-29-96
Run No. 2
Sample Box No. 3
Meter Box No. 670 D.S
Meter H @ 1.96
C Factor 1.022
Pitot Tube Coefficient Cp .816

Ambient Temperature 75
Barometric Pressure 29.39 mm
Assumed Moisture, % 16 mm
Probe Length, m(ft) 4 mm
Nozzle Identification No. Ser#69
Avg. Calibrated Nozzle Dia., (in.) .33/.35/.35
Probe Heater Setting 4
Leak Rate, m³/min.(cfm) .01 @ 6 in Vac
Probe Liner Material Stainless Steel
Static Pressure, mm Hg(in.Hg) 4.815
Filter No. SF-1440 (.6762)

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft³	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	11:60 / 11:63	2	198	.13	1.2	389.60 / 393.00	92	90	260	60
2	11:56	2	205	.17	1.5	392.00	110	92	260	60
3	11:59	2	205	.17	1.5	394.30	118	92	255	60
4	12:02	3	210	.20	1.8	396.20	120	92	270	60
5	12:65	3	210	.20	1.8	398.60	122	92	270	60
6	12:08	4	210	.24	2.1	401.30	123	93	265	60
7	12:11	4	212	.26	2.3	403.60	124	94	265	60
8	12:14	3	216	.22	2.0	405.90	126	94	250	60
9	12:17	3	210	.22	2.0	408.50	126	94	250	60
10	12:20	3	218	.19	1.7	410.70	120	95	255	60
11	12:23	3	214	.19	1.7	412.90	128	96	250	60
12	12:26	2	214	.16	1.4	414.90	128	96	250	60
B 1	12:32 / 12:35	3	200	.17	1.5	416.60	108	96	245	60

Form 4BTC-05

FORM #REC-08

RAMCON emissions test log sheet, cont. DATE 5-29-96 LOCATION Ludlow Ky 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)	ORIFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
2	10:38	3	210	.20	1.8	419.50	125	96	250	60
3	11:41	3	217	.22	2.0	421.60	127	96	255	60
4	12:44	4	218	.24	2.1	424.00	128	98	265	60
5	12:47	4	222	.20	2.4	426.90	129	98	265	60
6	12:50	4	225	.27	2.4	429.30	130	98	260	60
7	12:53	4	226	.27	2.4	432.10	130	99	260	60
8	12:56	4	228	.20	2.0	434.40	131	99	255	60
9	12:59	3	226	.19	1.7	436.60	132	100	260	60
10	13:02	3	228	.19	1.7	438.80	132	100	260	60
11	13:05	3	225	.19	1.7	441.00	132	100	260	60
12	13:08	3	230	.17	1.5	443.18	132	100	260	60

IX. CALIBRATIONS

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 6-8-96 Meter box number 670775

Barometric pressure, P_b = 29.22 in. Hg Calibrated by Shan T. Zeeman

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Avg[a] (t_d), °F	Time (θ), min	Y_i	$\Delta H@_i$, in. H_2O
0.5	5	460.79 / 465.94	78	87 / 96	81 / 82	84.25	10.48	1.019	1.23
1.0	5	465.94 / 471.21	78	96 / 102	79 / 82	91	8.90	1.019	1.27
1.5	10								
2.0	10								
3.0	10.5	446.95 / 457.12	77	90 / 98	76 / 79	88.25	10.82	1.016	1.79
4.0	10								
							Avg	1.018	1.76

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

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

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 5-23-96 Meter box number 670775

Barometric pressure, P_b = 29.98 in. Hg Calibrated by Scott Grubbs

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Avg (t_d), °F	Time (θ), min	Y_i	$\Delta H@_i$, in. H_2O
0.5	5	101.10 / 106.07	76	95 / 103	73 / 74	84.25	12.15	1.024	1.93
1.0	5	100.30 / 106.96	76	91 / 108	72 / 73	84.50	9.03	1.022	1.83
1.5	10								
2.0	10								
3.0	10	91.60 / 101.32	76	73 / 100	70 / 72	78.75	10.33	1.023	1.91
4.0	10								
							Avg	1.022	1.89

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

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

RAMCON ENVIRONMENTAL CORPORATION

Date 5-16-86 Thermocouple number Std Dry

Ambient temperature 23 °C Barometric pressure 29.93 in. Hg

Calibrator Sam Gnesa. References: mercury-in-glass ✓

other

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
A	boiling H2O	98 °C	100 °C	2 %
B	Ambient	23 °C	23.8 °C	< 1 %
	Ambient 5-29-86	67 °C	67 °C	0 %

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

[b] Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.

RADIAN ENVIRONMENTAL CORPORATION

Date 5-16-86 Thermocouple number inlet/outlet

Ambient temperature 23 °C Barometric pressure 30.03 in. Hg

Calibrator S&T Reference: mercury-in-glass ✓

other _____

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
A	inlet Ambient	73 °F	73 °F	0.0 %
B	outlet Ambient	73 °F	73 °F	0.0 %
C	Ambient 5-25-86	67 °F	67 °F	0 %

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

[b]Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.50.$

Figure 2.5 stack temperature sensor calibration data form.

RAMCON ENVIRONMENTAL CORPORATION

Lear Siegler Stack Sampler

Nozzle Diameter Calibration

Date _____ Signature _____

Nozzle No.	Average Diameter	Nozzle No.	Average Diameter
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

Pitot Tube Calibration (S Type)

Pitot Tube Identification No. 41 Date 5-14-86

Calibrated by: Sam Tang

"A" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp (a) cm H_2O (in. H_2O)	$C_p(a)$	DEVIATION $C_p(a)-\bar{C}_p(A)$
1	.40	.60	.84	.00
2	.60	.90	.84	.00
3	.90	1.35	.84	.00
		$\bar{C}_p$ (SIDE A)	.84	

"B" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	$\Delta p(a)$ cm H_2O in. H_2O)	$C_p(a)$	DEVIATION $C_p(a)-\bar{C}_p(B)$
1	.40	.60	.84	.00
2	.60	.90	.84	.00
3	.90	1.35	.84	.00
		$\bar{C}_p$ (SIDE B)	.84	

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

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

$$C_p(a) = C_p(\text{std})\sqrt{\frac{\Delta p\ \text{std}}{\Delta p_a}}$$

Form No. EED-17-1

RAMCON

Lear Siegler Stack Sampler

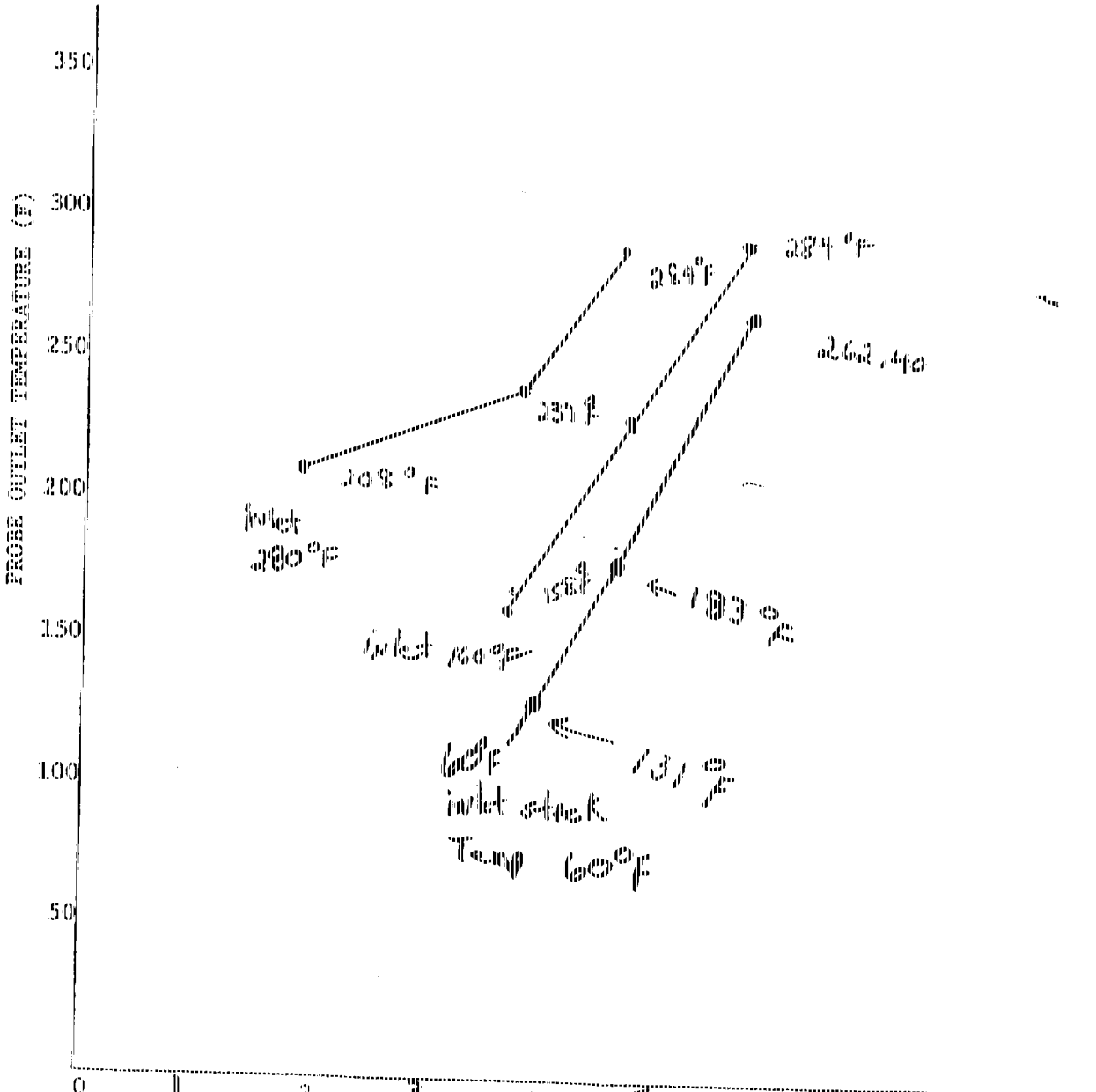
Heating Probe Calibration

Probe No. 41 Probe Length 4'

Date of Calibration 3-21-86 Signature Sam T. Cooney

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



RAMCON ENVIRONMENTAL CORPORATION

Date 5-14-86 Thermocouple number 41

Ambient temperature 93 °C Barometric pressure 30.03 in. Hg

Calibrator Sam Tsang, 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 H2O	32°F	32°F	0 %
B	Boiling H2O	210°F	212°F	0 %
C	Boiling oil	405°F	410.2	1.03 %
D	Ambient 5-25-86	67°F	67°F	0 %

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

[b] Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.

K. RAMCON PERSONNEL

RAMCON Environmental Stack Test Team

Summer Buck - President

Summer Buck is the President of RAMCON Environmental. He is a graduate of the EPA 450 "Source Sampling for Particulate Pollutants" course and the 474 "Continuous Emissions Monitoring" course all given at RTP. Mr. Buck is a qualified V.E. reader with current certification. Mr. Buck has personally sampled over 400 stacks including over 300 asphalt plants. He is 42 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 - Field Supervisor

Sam Turner has five years experience in the Air Division and is our field supervisor. He has sampled over 30 large boiler stacks and approximately 200 asphalt plants. 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.