AP42 Section: 11.1

Reference Number: 294

Title: *Source Sampling For Particulate Emissions, Stabler Construction Co., Dupont, PA,*

Ramcon Environmental Corp., Memphis, TN,

June 8, 1987.

AP-42 Section 11.1
Reference
Report Sect. 4
Reference ~~293~~ 294

Commonwealth of Pennsylvania
Environmental Resources
August 6, 1987

Subject: Stack Test Review

To: Data File
Stabler Construction Company
Jenkins Township, Luzerne County

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

Through: Chief, Source Testing and Monitoring Section

Stabler Construction Company operates a CMI drum mix asphalt plant rated at 450 tons per hour at the aforementioned location. The exhaust from the dryer is drawn through a CMI baghouse before being discharged to the atmosphere through a 52 inch X 39 inch 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	6/8/87	6/8/87	6/8/87
Test run no.	1	2	3
Process designed maximum capacity (tons/hr.)	450	450	450
Normal process operating rate (tons/hr.)	200	200	200
Process rate during test (tons/hr.)	265	270	270
Material produced during test	Binder	Binder	Binder
Percent passing through 200 mesh	4.8	4.8	4.8
Volumetric flow rate (dscfm)	21,500	21,600	21,700
Particulate emission concentration (gr./dscf)	0.0045	0.0144	0.0071

Particulate emission rate (lb./hr.)	0.8	2.7	1.3
Allowable particulate emission concentration (gr./dscf) (per NSPS)	0.04	0.04	0.04

cc: Jim Parette, Region II, Wilkes-Barre
File No. 40-303-016
EPA/BSL
Reading File
Doug Lesher

JP:gjm

REGIONAL DIRECTOR

JUL 8 1 19 PM '87

DEPT. OF ENV. RES.
OFFICE
SOURCE REGION

RAMCON

Environmental Corporation

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

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
STABLER CONSTRUCTION COMPANY
DUPONT, PENNSYLVANIA
June 8, 1987

David Schaper
Stabler Construction

G. Sumner Buck, III
President

Ken Allmendinger
Team Leader

RAMCON ENVIRONMENTAL CORPORATION

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

June 17, 1987

Mr. David Schaper
Stabler Construction Company
635 Lucknow Lane
Harrisburg, PA 17110

Re: Particulate Emissions Test - Dupont, Pennsylvania
Permit #40-303-016

Dear Mr. Schaper:

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 Federal and State Standards.

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

Mr. John Wilkes
Bureau of Air Quality Control
90 East Union Street - 2nd Floor
Wilkes Barre, PA 18701-3296

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 June 8, 1987, personnel from RAMCON Environmental Corporation (REC) conducted a source emissions test for particulate emissions compliance at Stabler Construction Company's (Permit #40-303-016) CMI drum mix asphalt plant located in Dupont, Pennsylvania. RAMCON personnel conducting the test were Ken Allmendinger, Team Leader and Allen Turner. Kim Rea was responsible for the final particulate laboratory analysis including taring the beakers and filters and recording final data in the laboratory record books. Custody of the samples was limited to Mr. Allmendinger and Ms. Rea.

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

II. TEST RESULTS

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

TABLE I

SUMMARY OF TEST RESULTS
June 8, 1987

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	07:59 to 09:15	0.0045 gr/DSCF	103%	0.8 lbs/hr
3	09:47 to 11:07	0.0144 gr/DSCF	105%	2.7 lbs/hr
4	11:34 to 12:50	0.0071 gr/DSCF	104%	1.3 lbs/hr
	Average:	0.0087 gr/DSCF		1.4 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 EPA and the State of Pennsylvania. Therefore, the plant is operating in compliance with Federal and State Standards.

III. TEST PROCEDURES

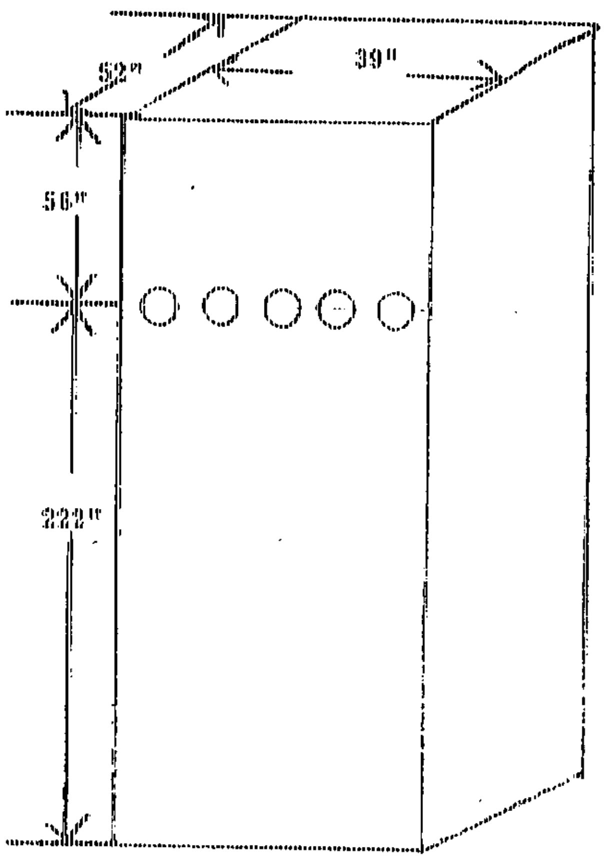
A. Method Used: The source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

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

C. Sampling Site: The emissions test was conducted after a baghouse on a rectangular stack measuring 52" x 39" with an equivalent diameter of 44.6". Five sampling ports were placed 56" down (1.3 diameters upstream) from the top of the stack and 222" up (5.0 diameters downstream) from the last flow disturbance. Thirty points were sampled, six through each port for 1.5 minutes each.

Points on a Diameter	Probe Mark
1	*7.3"
2	16.0"
3	24.6"
4	33.2"
5	41.9"
6	50.5"

*Measurements include a 3" standoff.

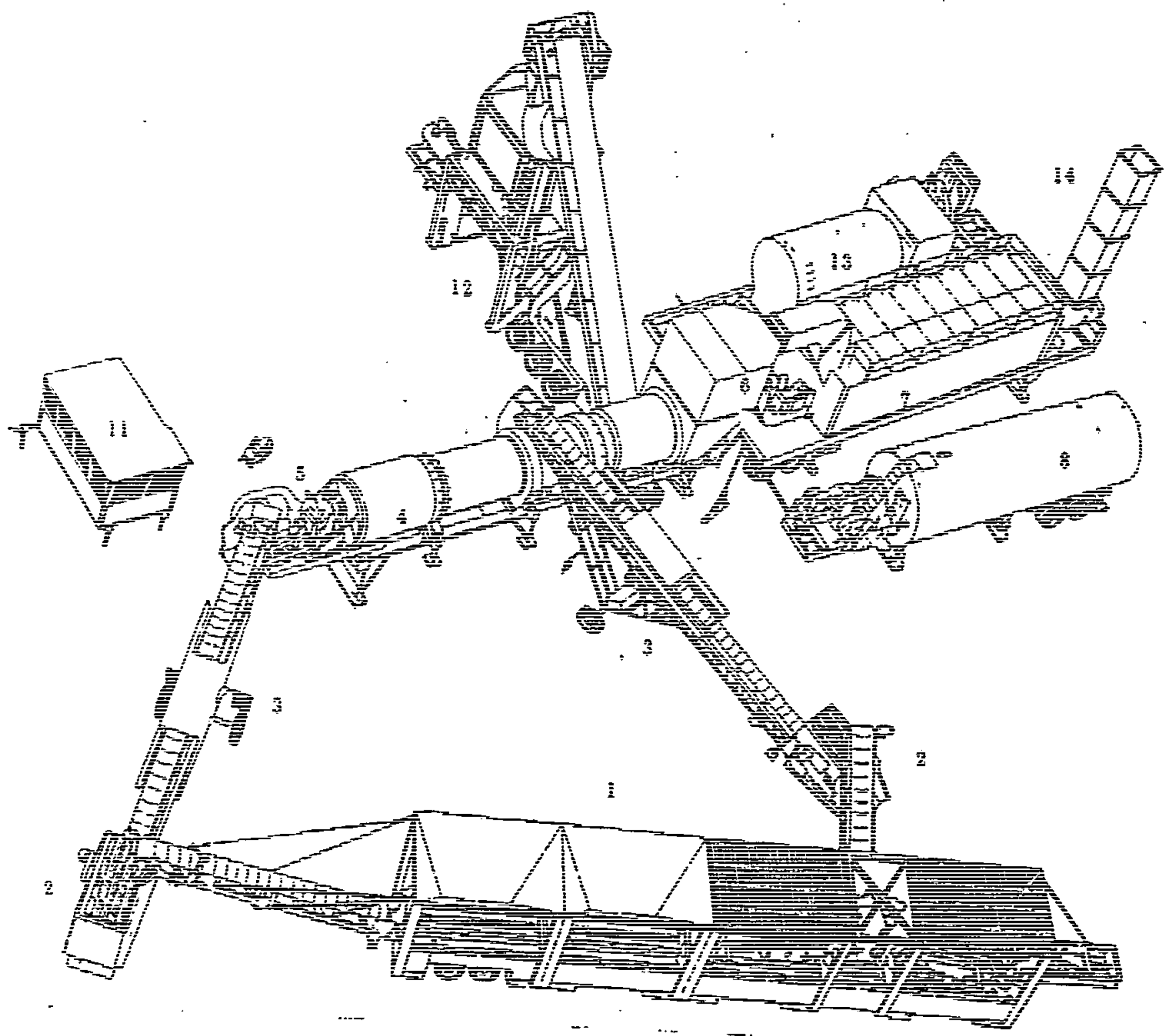


IV. THE SOURCE

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

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

The drum mixer uses a burner fired with #2 fuel oil to heat air to dry the aggregate, and the motion of the rotating drum to blend the aggregate and hot asphalt oil thoroughly. The air is drawn into the system via an exhaust fan. After passing through the burner and the mixing drum, the air passes through a 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 1 - 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 Corp.
2. Designed maximum operating capacity 452 TPH @ 5 % moisture.
3. Actual operation rate 225 TPH @ 6 % moisture.
4. Startup date 6-1-87.
5. Type of fuel used in dryer #2.
6. Quanity of fuel consumption 1.5 gal per ton

Aggregate

7. Name/type of mix Binder.
8. Percent asphalt in mix 4.8 %.
9. Temperature of asphalt 320 °.
10. Sieve/Screening analysis: % Passing:

1"	92.3	3/8"	—	#50	8.0
3/4"	80.1	# 8	39.0	#100	6.0
1/2"	56.2	#30	11.9	#200	4.8

Baghouse

11. Manufacturer CMI Corp.
12. No. of bags 280. Type of bags Nomex Glass 6X7'6".
13. Air to cloth ratio ______. Designed ACFM 50292.
14. Square feet of bags 8482.
15. Type of cleaning: pulse jet ✓, reverse air ______, plenum pulse ______, other ______.
16. Cleaning cycle time ______.
17. Interval between cleaning cycle 28 Sec.
18. Pressure drop across baghouse 3 psi.
19. Pulse pressure on cleaning cycle 80 psi.

COMPANY NAME Stabler Const. Co. DATE 6-8-87

COMPANY REPRESENTATIVE ______

Form #REC-83

PLANT DATA

(8)

COMPANY NAME Stiller Const. Co.
COMPANY REP. DATE 6-8-87 Phone #
DATA SOURCE
PLANT LOCATION Hebert Pa.
PLANT MANUFACTURER CMI Corp. PLANT MODEL NO. PVM 2000 PLANT TYPE Drum mix
MIX SPECIFICATION NO. Binder OIL SPECIFICATION NO. #2

TIME: START 800 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
800		47 %	254	NA	4.8 %	290°	3
815		47 %	265	NA	4.8 %	295°	3.2
830		44 %	258	"	4.8 %	285°	3.2
845		49 %	261	"	4.8 %	287°	3.4
900	First test	50 %	272	"	4.8 %	290°	3.4
915		50 %	270	"	4.8 %	288°	3.4
930		47 %	267	"	4.8 %	292°	3.3
945	Start 2nd Test	46 %	272	"	4.8 %	292°	3.3
1000		46 %	270	"	4.8 %	292°	3.4
1015		46 %	269	"	4.8 %	293°	3.4
1030		46 %	272	"	4.8 %	293	3.4
1045		42 %	270	"	4.8 %	290	3.3
1100		42 %	270	"	4.8 %	291	3.4
1115		40 %	265	"	4.8 %	290	3.4
1130		39 %	267	"	4.8 %	290	3.4
1145		39 %	270	"	4.8 %	287	3.4
1200		40 %	272	"	4.8 %	286	3.4

REMARKS:

Form #REC-04

PLANT DATA (9)

COMPANY NAME Stoller Const. Co.

COMPANY REP. ______ DATE 6-8-87 Phone # ______

DATA SOURCE ______

PLANT LOCATION Dupont Pa.

PLANT MANUFACTURER CMI Corp PLANT MODEL NO. UVM 2000 PLANT TYPE ______

MIX SPECIFICATION NO. Binder OIL SPECIFICATION NO. #2

TIME: START ______ 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
12:15		44%	220	N/A	4.8%	283	3.4
12:30		45%	211	N/A	4.8%	287	3.4
12:45		45%	223	N/A	4.8%	298	3.4
1300		45%	229	N/A	4.8%	300	3.5

REMARKS:

Form #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 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 REC48

SAMPLE ANALYTICAL DATA FORM

Plant Location Stabler Const. Co   Relative humidity in lab 48 %

Sample Location hot mix stack   Density of Acetone (pa) .7853 mg/ml

Blank volume (V_a) 200 ml

Date/Time wt. blank 6/11   Gross wt. 96.0237 mg

Date/Time wt. blank 6/12   Gross wt. 96.0235 mg

Ave. Gross wt. 96.0236 mg

Tare wt. 96.0234 mg

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

Acetone blank residue concentration (C_a) $(C_a) = (M_{ab}) / (V_a)(P_a)$ = (.00001? mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} P_a$ = (.00001?)(200)(.785?) = (.000?)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	200	200	200
Date/Time of wt 6/11 3:30 pm Gross wt	g	101.5069	97.9020	101.4195
Date/Time of wt 6/12 9:10 am Gross wt	g	101.5068	97.9017	101.4193
Average Gross wt	g	101.5069	97.9019	101.4194
Tare wt	g	101.4967	97.8738	101.4075
Less acetone blank wt (W_a)	g	.0002	.0002	.0002
Wt of particulate in acetone rinse (m_a)	g	.0100	.0279	.0117

Filter Numbers	#	SG-2070	SG-1967	SG-1968
Date/Time of wt 6/11 3:30 pm Gross wt	g	.5445	.5496	.5413
Date/Time of wt 6/12 9:10 Am Gross wt	g	.5441	.5494	.5410
Average Gross wt	g	.5443	.5495	.5412
Tare wt	g	.5403	.5320	.5306
Plus back half filter		.0003	.0015	.0007
Weight of particulate on filters(s) (m_f)	g	.0040	.0175	.0106
Weight of particulate in acetone rinse	g	.0100	.0279	.0117
Total weight of particulate (m_n)	g	.0143	.0469	.0230

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

Remarks

Signature of analyst Kim Rea   Signature of reviewer

(15)

COMPANY NAME Stabler Const.

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

Relative humidity in lab 48 %

			RUN 1	RUN 2	RUN 3
Impinger rinse volume (Filterable Extraction)		ml	410	450	462
Date/Time of wt. 6/16	Gross wt.	g	.0317	.0337	.0317
Date/Time of wt. 6/17	Gross wt.	g	.0316	.0335	.0317
Filter Avg.	Gross wt.	g	.0317	.0336	.0317
	Tare wt.	g	.0314	.0321	.0310
Weight of insoluble particulate impinger rinse		g	.0003	.0015	.0007
Water evaporation		#	Imp 1	Imp 2	Imp 3
Date/Time of wt. 6/16	Gross wt.	g	136.9045	143.4167	147.5607
Date/Time of wt. 6/17	Gross wt.	g	136.9043	143.4163	147.5606
Beaker Avg.	Gross wt.	g	136.9044	143.4165	147.5607
	Tare wt.	g	136.8548	143.3836	147.5371
Weight of soluble particulate from water		g	.0496	.0329	.0236
Total weight of particulate (m_n)		g	.0499	.0344	.0243

Remarks

Signature of Analyst Kim Rea

Signature of Reviewer [signature]

VII. CALCULATIONS

NAME: STABLER CONSTRUCTION COMPANY

LOCATION: DUPONT, PENNSYLVANIA

		date	6/08/87	6/08/87	6/08/8
	SUMMARY OF TEST DATA		RUN # 1	RUN # 2	RUN #
	SAMPLING TRAIN DATA	start	07:59	09:47	11:34
		finish	09:15	11:07	12:50
1	Sampling time, minutes	0	75	75	75
2	Sampling nozzle diameter, in.	Dn	.275	.275	.275
3	Sampling nozzle cross-sectional area, ft^2	An	.000413	.000413	.000413
4	Isokinetic variation	I	103	105	104
5	Sample gas volume - meter conditions, cf.	Vm	53.42	56.31	55.79
6	Average meter temperature, °R	Tm	566	578	578
7	Average oriface pressure drop, in.H_2O	ΔH	1.53	1.56	1.61
8	Total particulate collected mg.	Mn	14.3	46.9	23.0
	VELOCITY TRAVERSE DATA				
9	Stack area, ft^2	A	14.0	14.0	14.0
10	Absolute stack gas pressure, in. Hg.	Ps	29.20	29.20	29.20
11	Barometric pressure, in. Hg.	Pbar	29.20	29.20	29.20
12	Average absolute stack temperature, °R	Ts	782	789	786
13	Average "$\sqrt{\text{velocity head}}$" , (Cp= .79)	"$\sqrt{\Delta P}$"	.80	.82	.83
14	Average stack gas velocity ft. / sec.	Vs	55	57	57
	STACK MOISTURE CONTENT				
15	Total water collected by train, ml.	Vlc	422.0	464.0	474.0
16	Moisture in stack gas, %	Bws	29.1	30.4	31.0
	EMISSIONS DATA:				
17	Stack gas flow rate, dscf/hr. (000's)	Qsd	1,289	1,295	1,304
18	Total particulate concentration, gr/dscf	Cs	.0085	.0144	.0071
19	Total particulate concentration, lbs/hr	E	.8	2.7	1.3
20	Total particulate concentration, lbs/mbtu	E'	.0000	.0000	.0000
	ORSAT DATA				
21	Percent CO2 by volume	CO2	5.0	5.5	5.0
22	Percent O2 by volume	O2	14.2	13.5	14.2
23	Percent CO by volume	CO	.0	.0	.0
24	Percent N2 by volume	N2	80.8	81.0	80.8

Buzzycalc

Dry Gas Volume :

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

Where:

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

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

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

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

T_m = Absolute temperature at meter °R

T_{std} = Standard absolute temperature (520°R)

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

Y = Dry gas meter calibration factor

13.6 = Inches water per inches Hg.

Run # 1 $V_{m(std)} = 17.64 \; (.99)(53.42) \left[\frac{(29.20) + \frac{1.53}{13.6}}{566} \right] = 48.54$ dsc

Run # 2 $V_{m(std)} = 17.64 \; (.99)(56.31) \left[\frac{(29.20) + \frac{1.56}{13.6}}{578} \right] = 50.11$ dsc

Run # 3 $V_{m(std)} = 17.64 \; (.99)(55.79) \left[\frac{(29.20) + \frac{1.61}{13.6}}{578} \right] = 49.65$ dsc

Total contaminants by weight: 'GRAIN LOADING'

Particulate concentration C_s' gr./dscf.

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

Where:

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

M_n = Total amount of particulate matter collected, mg.

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

Run # 1: $$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{14.3}{48.54} \right] = .0045 \text{ gr./dscf.}$$

Run # 2: $$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{46.9}{50.11} \right] = .0144 \text{ gr./dscf.}$$

Run # 3: $$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{23.0}{49.65} \right] = .0071 \text{ gr./dscf.}$$

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: $M_d = 0.44(\ 5.0\%\ ) + 0.32(14.2\%\ ) + 0.28(\ \ .0\% + 80.8\%\ ) =\ 29.4$ lb./lb.-mole

Run # 2: $M_d = 0.44(\ 5.5\%\ ) + 0.32(13.5\%\ ) + 0.28(\ \ .0\% + 81.0\%\ ) =\ 29.4$ lb./lb.-mole

Run # 3: $M_d = 0.44(\ 5.0\%\ ) + 0.32(14.2\%\ ) + 0.28(\ \ .0\% + 80.8\%\ ) =\ 29.4$ lb./lb.-mole

Water vapor condensed :

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

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

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)(°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) (410.0) =	19.3	cu.ft
	$V_{wsg(std)}$	= (0.04715) (12.0) =	.6	cu.ft
Run # 2:	$V_{wc(std)}$	= (0.04707) (450.0) =	21.2	cu.ft
	$V_{wsg(std)}$	= (0.04715) (14.0) =	.7	cu.ft
Run # 3:	$V_{wc(std)}$	= (0.04707) (462.0) =	21.7	cu.ft
	$V_{wsg(std)}$	= (0.04715) (12.0) =	.6	cu.ft

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

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: $B_{ws} = \dfrac{19.3 + .6}{19.3 + .6 + 48.54} \times 100 = 29.1\ \%$

Run # 2: $B_{ws} = \dfrac{21.2 + .7}{21.2 + .7 + 50.11} \times 100 = 30.4\ \%$

Run # 3: $B_{ws} = \dfrac{21.7 + .6}{21.7 + .6 + 49.65} \times 100 = 31.0\ \%$

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 = 29.4 (1- .291) + 18 (.291) = 26.1 (lb./lb.-mole).

Run # 2: M_s = 29.4 (1- .304) + 18 (.304) = 25.9 (lb./lb.-mole).

Run # 3: M_s = 29.4 (1- .310) + 18 (.310) = 25.9 (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 $\left[(g/g\text{-mole})\text{-}(mm\ Hg) / (^{\circ}K)(mm\ H_2O)\right]^{1/2}$
C_p	=	Pitot tube coefficient, (dimensionless).
ΔP	=	Velocity head of stack gas, in. H_2O.
P_{bar}	=	Barometric pressure at measurement site, (in.Hg).
P_g	=	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: $V = (85.49)(\ .79)(\ .80) \sqrt{\dfrac{782}{(29.20)(26.08)}} = 54.75$ ft/se

Run # 2: $V = (85.49)(\ .79)(\ .82) \sqrt{\dfrac{789}{(29.20)(25.93)}} = 56.53$ ft/se

Run # 3: $V = (85.49)(\ .79)(\ .83) \sqrt{\dfrac{786}{(29.20)(25.87)}} = 57.18$ ft/se

Stack gas flow rate:

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

Where:

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

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

3600 = Conversion factor, sec./hr.

t_s = Stack temperature (°F).

T_s = Absolute stack temperature, (°R).

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

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

P_g = 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:

$$Q_{sd} = 3600\ (1-.291)\ (\ 54.75)\ (\ 14.0) \left[\frac{528}{782}\right] \left[\frac{29.20}{29.92}\right] = 1289167 \text{ dscf/}$$

Run # 2:

$$Q_{sd} = 3600\ (1-.304)\ (\ 56.53)\ (\ 14.0) \left[\frac{528}{789}\right] \left[\frac{29.20}{29.92}\right] = 1295081 \text{ dscf/}$$

Run # 3:

$$Q_{sd} = 3600\ (1-.310)\ (\ 57.18)\ (\ 14.0) \left[\frac{528}{786}\right] \left[\frac{29.20}{29.92}\right] = 1303636 \text{ dscf/}$$

Emissions rate from stack:

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

Where:

E = Emissions rate, lb./hr.

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

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

Run # 1: $E = \frac{(.0045)(1289167)}{7000} = .8$ lb. / hr.

Run # 2: $E = \frac{(.0144)(1295081)}{7000} = 2.7$ lb. / hr.

Run # 3: $E = \frac{(.0071)(1303636)}{7000} = 1.3$ lb. / hr.

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

Where:

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

Run # 1:

$$I = 100 \times 782 \left[\frac{(0.002669)(422.0) + \frac{53.4}{566}\left[29.20 + \frac{1.53}{13.6}\right]}{60\ (\ 75\ )\ (\ 54.75\ )\ (29.20\ )\ (\ .000413\ )} \right] = 103\ \%$$

Run # 2:

$$I = 100 \times 789 \left[\frac{(0.002669)(464.0) + \frac{56.3}{578}\left[29.20 + \frac{1.56}{13.6}\right]}{60\ (\ 75\ )\ (\ 56.53\ )\ (29.20\ )\ (\ .000413\ )} \right] = 105\ \%$$

Run # 3:

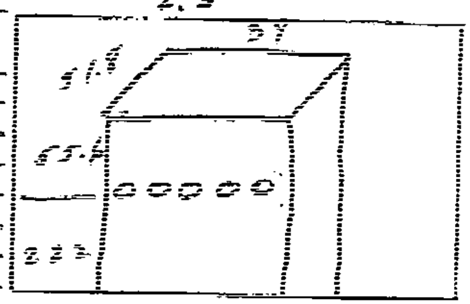
$$I = 100 \times 786 \left[\frac{(0.002669)(474.0) + \frac{55.8}{578}\left[29.20 + \frac{1.61}{13.6}\right]}{60\ (\ 75\ )\ (\ 57.18\ )\ (29.20\ )\ (\ .000413\ )} \right] = 104\ \%$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Stabler Const.

Location Scranton Pa.
Operator R. Allmendinger
Date 6-8-87
Run No. 1
Sample Box No. 1
Meter Box No. 646882
Meter H @ 1.67
C Factor .9942
Pitot Tube Coefficient Cp .79



Schematic of Stack Cross Section

Ambient Temperature 75
Barometric Pressure 29.2
Assumed Moisture, % 25
Probe Length, m(ft) 7'
Nozzle Identification No. ...
Avg. Calibrated Nozzle Dia., (in.) .275/.275/.27
Probe Heater Setting 4.0
Leak Rate, m³/min.(cfm) 0.012
Probe Liner Material 316 SS
Static Pressure, mm Hg(in.Hg) .01
Filter No. 56-2070

	Water Vol. ml	Final wt. g
	610	914
	200	300
	410	12

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	7:57:30 / 8:01:...	5	310	1.0	2.3	225.69 / 228.00	95	80	250	60
2	8:04:30	5	315	1.0	2.3	230.29	105	85	255	60
3	8:07	5	320	.90	2.1	232.36	110	85	255	55
4	8:09:30	4	320	.68	1.6	234.18	110	85	250	55
5	8:12	3	320	.45	1.0	235.67	110	90	250	55
6	8:14:30	3	320	.45	1.0	237.135	115	90	250	55
B) 1	8:17:...	5	325	.95	2.2	239.22	115	90	250	55
2	8:19:50	5	325	.90	2.1	241.33	115	90	250	55
3	8:22:20	5	330	.88	2.0	243.36	120	90	250	55
4	8:24:50	4	325	.75	1.7	245.28	120	90	250	55
5	8:27:20	3	320	.50	1.2	246.95	120	90	250	55
6	8:29:50	3	320	.50	1.2	248.525	120	95	250	55
C) 1	8:30:... / 8:32:...	5	320	.87	2.0	252.53	120	95	245	56

CO_2 = 5.0 ... 6.0

... 4.0

Form #RED ...

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 4-5-87 LOCATION Scrubber 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)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	8:35:10	5	325	.54	2.1	252.62	120	95	250	55
3	8:37:40	5	325	.77	1.8	254.58	120	95	254	55
4	8:40:10	3	325	.63	1.4	256.30	120	95	250	55
5	8:42:40	3	325	.48	1.1	257.85	120	95	250	55
6	8:45:10	3	325	.48	1.1	259.456	120	95	245	55
D) 1	~~8:45:50~~ 8:48	5	320	.85	2.0	261.48	120	95	245	55
2	8:50:30	5	325	.78	1.8	263.48	125	95	250	55
3	8:53	4	325	.65	1.5	265.27	125	95	250	55
4	8:55:30	3	325	.45	1.0	266.80	125	95	250	55
5	8:58	3	325	.40	.92	268.24	125	95	250	55
6	9:00:30	3	325	.40	.92	269.63	125	95	250	55
E) 1	~~9:00:42~~ 9:03:15	5	320	.75	1.7	271.51	125	95	250	55
2	9:05:45	4	320	.70	1.6	273.35	125	95	250	55
3	9:08:15	4	320	.63	1.4	275.15	125	95	250	55
4	9:10:45	3	320	.46	1.1	276.48	125	95	250	55
5	9:13:15	3	315	.35	.81	278.04	125	100	250	55
6	9:15:45	3	320	.35	.81	279.375	125	140	250	55
							117	93		
			320	(.68	1.5		106			

RAMCON ENVIRONMENTAL CORPORATION

Plant [illegible]
Location [illegible] Pa.
Operator [illegible]
Date 6-9-87
Run No. 2
Sample Box No. [illegible] 2
Meter Box No. [illegible]
Meter H @ 1.69
C Factor .9992
Pitot Tube Coefficient Cp .79

Schematic of Stack Cross Section

Ambient Temperature 85
Barometric Pressure 29.2
Assumed Moisture, % 25
Probe Length, m(ft) 4
Nozzle Identification No. .666 [illegible]
Avg. Calibrated Nozzle Dia., (in.) [illegible]
Probe Heater Setting 4.0
Leak Rate, m³/min.(cfm) ±0.02
Probe Liner Material [illegible]
Static Pressure, mm Hg(in.Hg) .01
Filter No. 56-1562

	[illegible]	[illegible]
[illegible]	450	5.2
[illegible]	400	[illegible]
[illegible]	450	14

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 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	9:47 / 9:49:30	2	310	.65	1.5	274.5 / 291.4	120	110	240	55
2	9:52	2	310	.60	1.4	293.2	120	110	240	55
3	9:54:30	3	310	.65	1.5	295	120	110	240	60
4	9:57	3	310	.60	1.4	286.3	120	110	240	60
5	9:59:30	3	315	.60	1.4	298.5	120	110	240	60
6	10:02	3	315	.50	1.1	240.1	120	110	250	60
B 1	10:03 / 10:05:30	3	315	.35	1.2	242.1	120	110	250	60
2	10:08	3	315	.75	1.7	244.1	120	110	250	60
3	10:10:30	3	315	.75	1.7	246.7	120	110	250	60
4	10:13	3	310	.54	1.2	248.5	120	110	250	60
5	10:15:30	3	310	.44	1.0	299.5	120	110	245	60
6	10:18	3	325	.46	1.1	301.5	120	110	245	60
C 1	10:18:30 / 10:21	3	325	.70	1.6	303.1	120	110	250	60

CO_2 = 5.5 CO_2 = 5.5
O_2 = 13 O_2 = 13

Form ERRC-06

- 30 -

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-4-(?) LOCATION [illegible] TEST NO. 5

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)
2	10:25-30	4	335	.61	1.9	305.5	130	110	250	60
3	10:26	4	335	.25	1.2	307.1	130	110	250	60
4	10:28-30	4	340	.20	1.6	309.1	130	110	250	60
5	10:31	4	340	.20	1.6	311.0	130	110	250	60
6	10:33-30	4	340	.66	1.5	312.8	130	110	250	60
(D) 1	10:34-30 / 10:37	4	340	.66	1.5	314.5	130	110	250	60
2	10:38-30	4	340	.91	1.9	316.4	130	110	250	60
3	10:42	4	340	.91	1.9	318.5	130	110	240	60
4	10:44-30	4	340	.80	1.8	320.5	130	110	240	60
5	10:47	4	340	.77	1.8	322.8	130	110 / 120	245	60
6	10:49-30	4	340	.77	1.7	324.6	130	110	245	60
(E) 1	10:52 / 10:54-30	4	340	.70	1.6	326.7	130	110	245	60
2	10:57	4	340	.84	2.0	328.4	130	110	250	60
3	10:59-30	4	340	.80	1.8	330.4	130	110	250	60
4	11:02	4	340	.60	1.4	332.3	130	110	250	60
5	11:04-30	4	340	.55	1.3	334.2	130	110	250	60
6	11:07	4	340	.55	1.3	335.914	130	110	250	60

RAMCON ENVIRONMENTAL CORPORATION

Plant Scalise Const.

Location Scranton PA.
Operator K. Allmendinger
Date 6-8-87
Run No. 3
Sample Box No. 3
Meter Box No. 646882
Meter H @ 1.69
C Factor .9964
Pitot Tube Coefficient Cp .79

Ambient Temperature 85
Barometric Pressure 29.2
Assumed Moisture, % 25
Probe Length, m(ft) 6
Nozzle Identification No. .000412.5
Avg. Calibrated Nozzle Dia., (in.) .275/.275/.275
Probe Heater Setting 40
Leak Rate, m3/min. (cfm) .005
Probe Liner Material 316 Sta. L.
Static Pressure, mm Hg (in. Hg) .81
Filter No. SS-1984

	Before	After
final	463	311
initial	200	255
difference	463	12

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	11:34:45 / 11:37:15	4	300	.79	2.0	336.36 / 338.45	115	110	230	60
2	11:39:45	5	325	.95	2.2	340.41	125	105	240	60
3	11:42:15	5	355	.95	2.2	342.33	120	105	245	55
4	11:44:45	5	330	.75	1.7	344.35	120	105	250	55
5	11:47:15	4	330	.65	1.5	346.22	120	105	250	55
6	11:49:45	4	325	.53	1.2	347.885	125	105	255	55
B) 1	11:50:25 / 11:52:55	5	320	.93	2.1	349.93	130	105	255	55
2	11:55:25	5	330	.85	2.0	352.01	130	105	260	55
3	11:57:55	5	330	.80	1.8	354.04	130	105	260	55
4	12:00:25	4	325	.73	1.7	355.89	135	105	260	55
5	12:02:55	4	325	.65	1.5	357.85	155	105	255	55
6	12:05:25	4	320	.57	1.3	359.58	135	105	255	55
C) 1	12:05:55 / 12:08:25	5	315	.87	2.0	361.62	135	105	255	55

CO_2 = 8.0 5.0

Form #REC-05

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-8-87 LOCATION Scranton 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 (ft³)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	12:10:15	5	315	.82	1.9	363.79	135	105	250	55
3	12:12:45	5	320	.75	1.7	365.41	135	105	250	55
4	12:15:15	4	320	.65	1.5	367.47	135	105	245	55
5	12:17:45	4	325	.60	1.4	369.29	135	105	245	55
6	12:20:15	3	330	.50	1.2	370.924	135	105	245	55
D) 1	12:23:00	5	325	.90	2.1	372.95	135	105	240	55
2	12:25:30	5	330	.85	2.0	375.02	135	105	240	55
3	12:28	4	335	.63	1.4	376.56	135	105	240	55
4	12:30:30	4	335	.58	1.3	378.66	135	105	245	55
5	12:33	3	335	.52	1.2	380.24	135	105	245	55
6	12:35:30	3	335	.45	1.0	381.820	135	105	250	55
E) 1	12:38:00	4	325	.88	[illegible]	383.50	130	105	250	55
2	12:40:45	5	330	.80	1.8	385.57	135	105	250	55
3	12:43:15	4	330	.65	1.5	387.42	135	105	250	55
4	12:45:45	4	330	.54	1.2	389.11	135	105	250	55
5	12:48:15	3	330	.48	1.1	390.72	135	105	250	55
6	12:50:45	3	325	.40	.92	392.15	135	105	250	55

IX. CALIBRATIONS

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 6-15-87 Meter box number 246882

Barometric pressure, P_b = 25.55 in. Hg Calibrated by [illegible]

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	570.07 / 565.72	78.8	100 / 105	80 / 85	92.5	11.5	1.008	1.72
1.0	5	577.11 / 582.15	78.8	110 / 110	85 / 85	97.5	8.46	1.009	1.695
1.5	10	593.54 / 586.64	78.8	115 / 115	85 / 90	101.25	11.5	1.015	1.71
2.0	10								
3.0	10								
4.0	10								
							Avg	1.001	1.71

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.

Form #REC-02

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 5-22-77 Meter box number [illegible]

Barometric pressure, P_b = 30.15 in. Hg Calibrated by [illegible]

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	6	[illegible] / [illegible]	72	104 / 108	84 / 85	95.25	[illegible]	.9925	1.65
1.0	5	[illegible] / [illegible]	72	110 / 112	84 / 86	98.25	[illegible]	.9959	1.70
1.5	10	[illegible] / [illegible]	72	110 / 115	86 / 86	99.25	10.30	.9964	1.71
2.0	10								
3.0	10								
4.0	10								
							Avg	.9949	1.69

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.

Form #REC-02

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-19-86 Thermocouple number inlet/outlet

Ambient temperature 23.9 °C Barometric pressure 30.1 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	inlet Ambient	75 °F	75 °F	0 %
B	outlet Ambient	75 °F	75 °F	0 %
C	Ambient 6-6-87	85 °F	85 °F	0 %

[a] Type of calibration system used.

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

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-15-86 Thermocouple number [illegible]

Ambient temperature 23 °C Barometric pressure 30.14 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	boiling water	100 °C	100 °C	0%
B	Ambient	23 °C	22.8 °C	< 1%
	6-8-87	85 °F	85 °F	0%

[a] Type of calibration system used.

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

RAMCON

Lear Siegler Stack Sampler

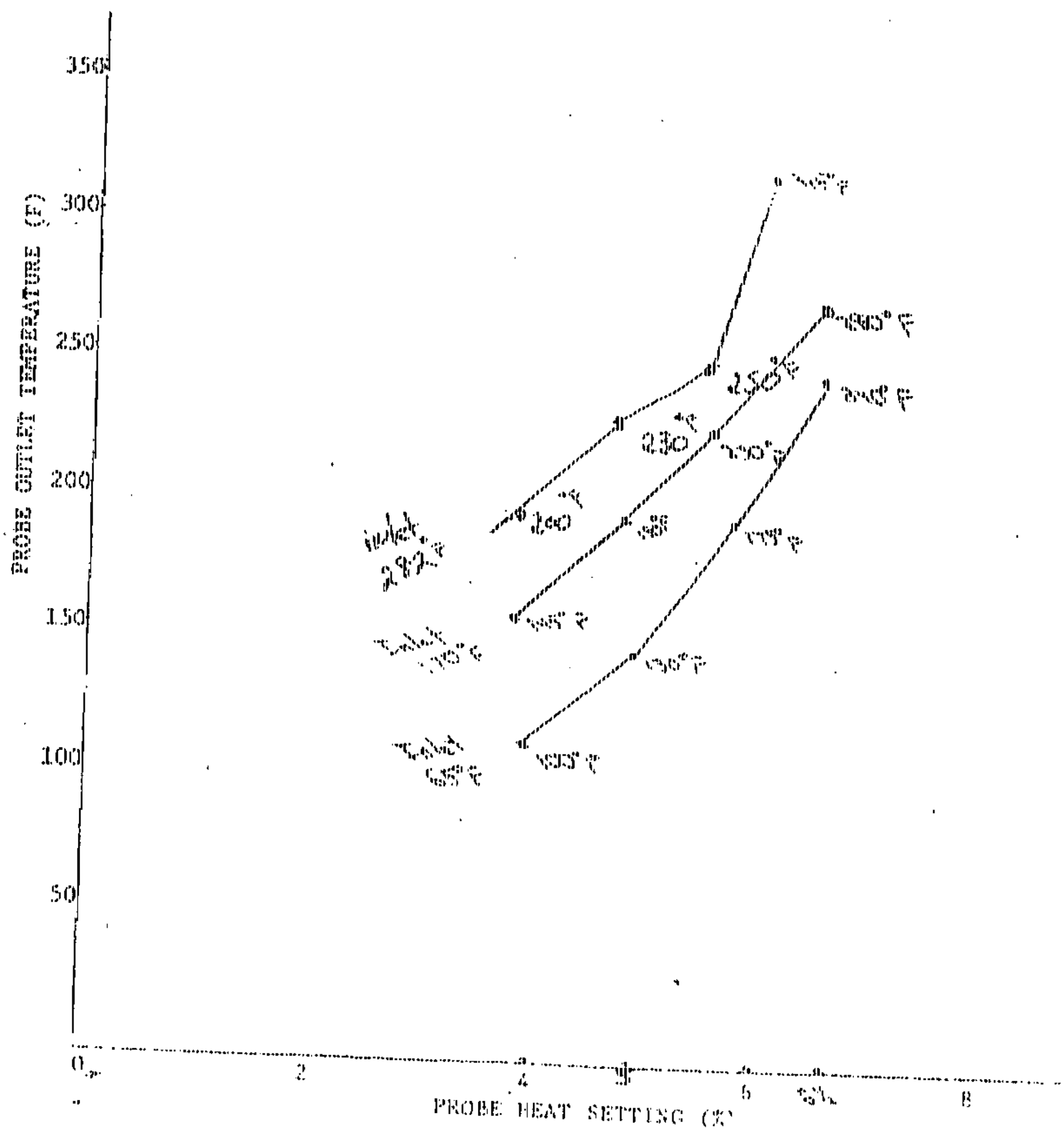
Heating Probe Calibration

Probe No. [illegible] Probe Length [illegible]

Date of Calibration [illegible] Signature [illegible]

Name of Company to be tested

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



PITOT TUBE CALIBRATION DATA

Calibration pitot tube: type S size (OD) 3/8 ID number 42

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

Calibration: date 1-4-87 performed by ________

A-Side Calibration

Δp_{std}, cm (in.) H_2O	Δp_s, cm (in.) H_2O	$C_{p(S)}$ [a]	DEV. [b]
.95	1.45	.81	.01
.75	1.2	.79	.01
.82	1.3	.79	.01
	Average	.79	

B-Side Calibration

Δp_{std}, cm (in.) H_2O	Δp_s, cm (in.) H_2O	$C_{p(S)}$ [a]	DEV. [b]
.95	1.45	.81	.01
.75	1.25	.79	.01
.82	1.3	.79	.01
	Average	.79	

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

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

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

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date [illegible] Thermocouple number [illegible]

Ambient temperature 65°F °C Barometric pressure [illegible] in. Hg

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

other

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] %
a	Ice water	32°F	32°F	0%
b	Boiling water	212°F	212°F	0%
c	Oil	410°F	413°F	.007%
d	Ambient	60°F	60°F	0%
	6-9-87	65°F	65°F	0%

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

[b] Type of calibration system used.

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

X. RAMCON PERSONNEL

RAMCON Environmental Stack Test Team

Sumner Buck - President

Sumner Buck is the President of RAMCON Environmental. He is a graduate of the EPA 450 "Source Sampling for Particulate Pollutants" course and the 474 "Continuous Emissions Monitoring" course all given at RTP. Mr. Buck is a qualified V.E. reader with current certification. Mr. Buck has personally sampled over 300 stacks including over 200 asphalt plants. He is 43 years old and a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis.

Ken Allmendinger - Team Leader

Ken Allmendinger has been employed with RAMCON for three years. He has sampled over 100 asphalt plants with extensive training in Methods 1 through 5. He is qualified as a team leader and has current certification as a V.E. reader.