HAMILTON COUNTY

INTERDEPARTMENTAL CORRESPONDENCE

FROM LRG/GH

TO TNT/JES/WWS

AT

DATE 7/15/88

SUBJECT Valley Asphalt #17 Plant
Preliminary Test Results

Test results from 6/6/88 show that an average of 85% of 350 TPH throughput was achieved. This is under the 90% minimum test requirement. Emissions were at .0135 gr/dscf. Visible emissions averaged zero percent.

Plant personnel were informed of the > than 90% throughput requirement at the pretest meeting. During the second run Mr. Howard reminded them of that requirement.

It is recommended that either the throughput be limited to that during testing (294 TPH) with appropriate record keeping as vertification, or testing to establish a higher throughput be done.

6

APPENDIX K

OEPA STACK TEST REVIEW SUMMARY FORM

APPLICATION NUMBER: 1431400140 P903

FACILITY NAME: Valley Asphalt Corp.

SOURCE DESCRIPTION (OR SCC CODE): Drum Mix Asphalt Plant

CONTROL EQUIPMENT: Fabric Filter Baghouse

DATE(S) OF TEST: 6/6/88

FINAL TEST REPORT RECEIVED ON: 7/7/88

POLLUTANT(S) TESTED: Mass particulate emissions

TEST METHOD: USEPA reference method 5

TEST FIRM: Ramcon Environmental Corporate

EMISSION RATES*:

ACTUAL ~~XXXXXXXXXX~~ gr/dscf: 0.0135 ALLOWABLE**: 0.040

OPERATING RATES*:

DURING TEST**: 297 tons/hr. MAXIMUM**: 350 tons/hr.

EMISSION FACTOR***:

COMMENTS: ** grains per dry standard cubic foot

I HEREBY VERIFY THAT THE INFORMATION CONTAINED WITHIN THE STACK TEST REPORT HAS BEEN REVIEWED AND IT HAS BEEN DETERMINED THAT THE TEST PROCEDURES, ANALYSES AND CALCULATIONS ARE;

[X] AN ACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

[ ] AN UNACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

July 18, 1988
DATE OF REVIEW

REVIEWED BY
G. L. Howard, Environmental Technician

* BASED ON [illegible] RUN AVERAGE
** SPECIFY APPLICABLE UNITS
*** SPECIFY IN UNITS OF MASS/INPUT

OBSERVER'S REPORT
Particulate Emissions (All sizes)
at
Valley Asphalt Plant #17

Test Date: June 6, 1988

Application # 1431400140 P903
Test Contractor: Ramcon, Inc.

Southwestern Ohio Air Pollution Control Agency

Valley Asphalt Company operates a Barber-Greene drum mix asphalt plant, located in Camp Denison, Ohio. The facility has a maximum production rate of 350 tons asphalt per hour. OAC rules 3745-17-07 (visible emissions) 3745-31-05 (BAT, NSPS) and the Performance Standards specified in 40 CFR Part 60, Subpart I establish emission limits and control requirements for this source. Best Available Technology (BAT) for this source is satisfied by a fabric filter baghouse. Allowable Mass Emission Rate is 0.04 grains (particulate) per dry standard cubic foot (dscf). Visible emissions may not exceed 20% opacity.

On June 6, 1988, emission tests were performed on this source to determine mass particulate emission rate. USEPA reference methods were employed (methods 1-3, 5). Visible emissions were measured by certified observers. The test contractor was Ramcon, Inc., of Memphis, Tenn. 404 mix asphalt was run for the test. No recycled asphalt was used. The plant operated at an average production rate of 297. tons asphalt per hour (283, 297, and 313 tons/hr. for runs 1, 2, and 3. This is less than the required 90% of maximum rate.

Results of tests show an average particulate emission rate of 0.0135 grains/d.s.c.f. (0.014, 0.014, and 0.0126 for run 1, 2, and 3, respectively). Isokinetic rates and sampling technique were adequate. Calculations were checked and found to be correct. Calibration data was included in the report. No blank data was given.

Visible emissions were well below 20% opacity.

Some fugitive emissions were noted, at the top of the asphalt hopper.

Due to the low production rate during tests, it is recommended that retesting be performed at greater than 90% of 350 tons per hour, or that any permit written reflect the lowered maximum production limit of 297 tons per hour.

Prepared by: G. L. Howard

OHIO EPA VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Valley Asphalt #17

START TIME: 8:16 **STOP TIME:** 8:46

ADDRESS: Rt 126 CAMP Denison

COUNTY: **ZIP CODE:** **TELEPHONE:**

SOURCE ID NUMBER: 1431400140

OBSERVATION DATE: 6-6-88

PROCESS: Asphalt Plant

OPERATING MODE: 280T/hr

CONTROL EQUIPMENT: Baghouse

OPERATING MODE:

DESCRIBE EMISSION POINT: Stack

DISTANCE FROM OBSERVER: 100'

DIRECTION FROM OBSERVER: NW

HEIGHT ABOVE GROUND LEVEL: 25'

HEIGHT RELATIVE TO OBSERVER: 35 H.

DESCRIBE EMISSIONS: Particulate

EMISSION COLOR: Gray-Brown

PLUME TYPE: INTERMITTENT ☒ CONTINUOUS ☐ FUGITIVE ☐

WATER DROPLETS PRESENT: YES ☐ NO ☒

IF YES, IS PLUME: ATTACHED ☒ DETACHED ☐

AT WHAT POINT WAS OPACITY DETERMINED: 5' above stack outlet

DESCRIBE BACKGROUND: Sky

BACKGROUND COLOR: Blue

SKY CONDITIONS: clear

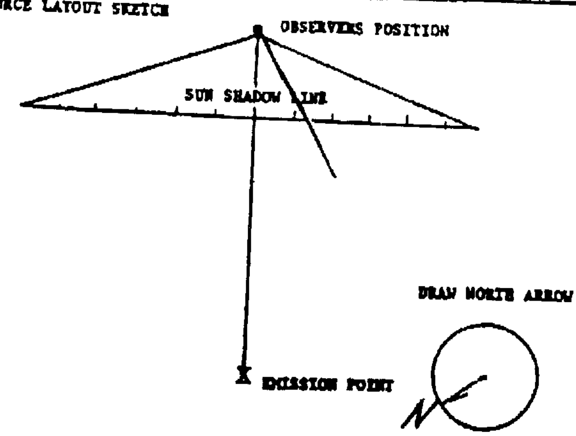
WIND SPEED: calm

WIND DIRECTION:

AMBIENT TEMPERATURE: ~70°

RELATIVE HUMIDITY:

SOURCE LAYOUT SKETCH



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

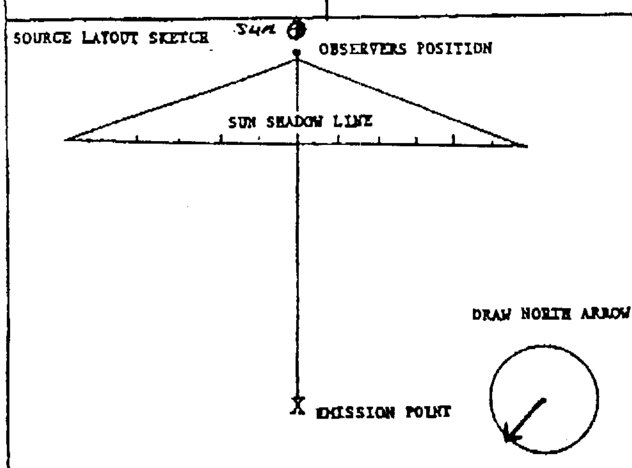
Observer's Signature [signature]

3 min/6 min Running Average Requested

OHIO EPA VISIBLE EMISSION OBSERVATION FORM

Field	Entry
SOURCE NAME	Valley Asphalt Plant #17
ADDRESS	Rt 126 CAMP Denison
COUNTY	
ZIP CODE	
TELEPHONE	
SOURCE ID NUMBER	1431400140 P903
OBSERVATION DATE	6-6-88
PROCESS	Asphalt/Hot mix
OPERATING MODE	280 Tons/hr
CONTROL EQUIPMENT	Baghouse
OPERATING MODE	
DESCRIBE EMISSION POINT	Asphalt Plant stack
DISTANCE FROM OBSERVER	100'
DIRECTION FROM OBSERVER	NW
HEIGHT ABOVE GROUND LEVEL	25'
HEIGHT RELATIVE TO OBSERVER	20' above
DESCRIBE EMISSIONS	Particulate
EMISSION COLOR	Light brown
PLUME TYPE	INTERMITTENT ☒ CONTINUOUS ☐ FUGITIVE ☐
WATER DROPLETS PRESENT	YES ☐ NO ☒
IF YES, IS PLUME	ATTACHED ☒ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED	5' above stack
DESCRIBE BACKGROUND	Blue Sky
BACKGROUND COLOR	Blue
SKY CONDITIONS	Sunny
WIND SPEED	
WIND DIRECTION	
AMBIENT TEMPERATURE	
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH



START TIME 10:15 STOP TIME 11:15

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

[illegible]

EPA METHOD 5 STACK TEST ANALYSIS

FACILITY NAME: VALLEY ASPHALT #17
PREMISE #: 1431400140
SOURCE DESCRIPTION: HOT MIX ASPHALT PLANT (P903)

REVIEWER: G.L. HOWARD
TEST DATE: 6/6/88
PRINTED: 07-19-1988

INPUT DATA:	RUN #1	RUN #2	RUN #3
METER VOLUME (ACF)	54.458	54.261	52.4
METER CORRECTION	.972	.972	.972
BAROMETRIC PRESSURE (IN HG)	29.95	29.95	29.95
ORIFICE PRESSURE (IN H2O)	2.38	2.16	1.96
METER TEMPERATURE (F)	93	101	111
VOLUME WATER (ML H2O)	243	280	262
CO2 IN STACK GAS (%)	4	4	4.5
O2 IN STACK GAS (%)	15.5	15.5	14.8
N2 IN STACK GAS (%)	80.5	80.5	80.7
CO IN STACK GAS (%)	0	0	0
PITOT COEFFICIENT	.83	.83	.83
AVERAGE SQUARE ROOT VELOCITY PRESS	1.08	1.02	.98
STACK TEMPERATURE (F)	204	206	209
STACK PRESSURE (IN HG)	29.95	29.95	29.95
STACK WIDTH/LENGTH (IN)	28 / 75.5	28 / 75.5	28 / 75.5
STACK AREA (SQ FT)	14.68056	14.68056	14.68056
PARTICULATE CATCH (MG)	47.1	45.4	38.6
NOZZLE DIAMETER (IN)	.23	.23	.23
NOZZLE AREA (SQ FT)	0.000289	0.000289	0.000289
TEST LENGTH (MIN)	70	70	70

TEST RESULTS:			
METER VOLUME @STP (DSCF)	51.8029	49.9325	47.3524
VOLUME OF WATER VAPOR @STP (CF)	%11.438010	%13.179600	%12.332340
MOLE FRACTION OF WATER IN STACK GAS	0.180864	0.208828	0.206625
DRY MOLECULAR WEIGHT OF STACK GAS	29.2600	29.2600	29.3120
MOLECULAR WEIGHT OF STACK GAS	27.2235	26.9086	26.9747
STACK GAS VELOCITY (FT/SEC)	69.1562	65.7941	63.2785
STACK GAS FLOW (DRY STD CF/HR)	%2383049.0	%2183219.0	%2096152.0
PARTICULATE CONCENTRATION (GR/DSCF)	0.014029	0.014029	0.012578
ISOKINETIC RATIO	94.8475	99.7916	98.5658
MASS RATE OF EMISSION (LB/HR)	4.7760	4.3756	3.7665

STACK TEST COMMENTS:

MAX. PROCESS RATE=350 T/hr

Valley Asphalt #17

Process Rate Averages

Run 1

time 7:51 = 7.85 RATE $\overline{TPH}$ = 282.8

9:04 = 9.07 (283)

80.8% of max.

Run 2 297.5

RATE $\overline{TPH}$ (297)

84.8% of max.

Run 3 313

RATE $\overline{TPH}$ (313)

89.4% max.

~~87.8~~ $\overline{85}$ %

29~~6~~.6

(330) max calculated rate for 90% (297.6) compliance.

$\overline{E}$ = 0.0135 gr/dscf

RAMCON

ENVIRONMENTAL CORPORATION

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
VALLEY ASPHALT CORPORATION
CAMP DENNISON, OHIO
June 6, 1988

Paul Prottengeier
Valley Asphalt Corp.

G. Sumner Buck, III
President

Allen Turner
Team Leader

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

RAMCON
ENVIRONMENTAL CORPORATION

June 20, 1988

Mr. Paul Prottengeier
Valley Asphalt
11641 Mosteller Road
Cincinnati, OH 45241

Re: Particulate Emissions Test - Camp Dennison, Ohio

Dear Mr. Prottengeier:

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

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

Mr. Lee Gruber
Southwest Ohio A.P.C.
P. O. Box 972
Dayton, OH 45422

You will need to keep one copy of the report at the plant.

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

Sincerely,

G. Sumner Buck, III
President

GSBIII:kr

Enclosures

RAMCON BUILDING, 223 SCOTT STREET, MEMPHIS, TENNESSEE 38112

TABLE OF CONTENTS

I. INTRODUCTION

On June 6, 1988, personnel from RAMCON Environmental Corporation (REC) conducted a source emissions test for particulate emissions compliance at Valley Asphalt's Barber-Greene drum mix asphalt plant #17 located in Camp Dennison, Ohio. RAMCON personnel conducting the test were Allen Turner, Team Leader, and Murphy O'Neal. Kim Rea was responsible for the laboratory analysis including taring the beakers and filters and recording final data in the laboratory record books. Custody of the samples was limited to Mr. Turner and Ms. 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) is below the allowable N.S.P.S. limits set by EPA and the State of Ohio.

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 N.S.P.S. particulate emissions for EPA and the State of Ohio is .04 gr/dscf.

TABLE I

SUMMARY OF TEST RESULTS
June 6, 1988

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	07:51 to 09:04	0.0140 gr/DSCF	94.7%	4.8 lbs/hr
2	10:08 to 11:21	0.0140 gr/DSCF	99.6%	4.4 lbs/hr
3	11:50 to 13:03	0.0126 gr/DSCF	98.4%	3.8 lbs/hr
	Average:	0.0135 gr/DSCF		4.3 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 Ohio. Therefore, the plant is operating in compliance with State and Federal Standards.

III. TEST PROCEDURES

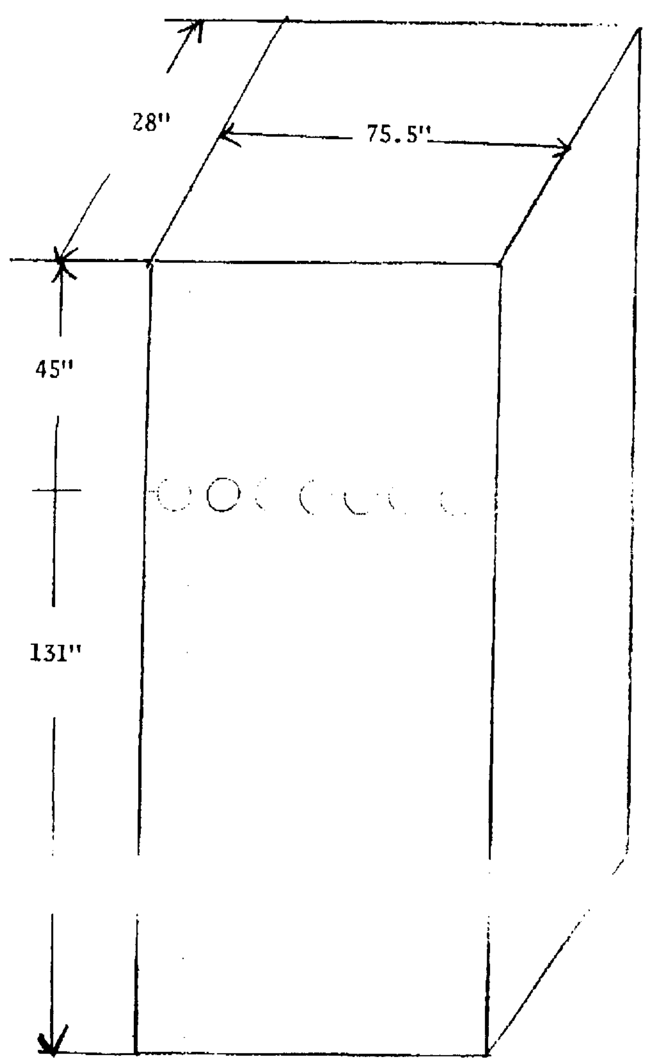
A. Method Used: The source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

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

C. **Sampling Site:** The emissions test was conducted after a baghouse on a rectangular stack measuring 28" x 75.5" with an equivalent diameter of 40.9". Seven sampling ports were placed 45" down (1.1 diameters upstream) from the top of the stack and 131" up (3.2 diameters downstream) from the last flow disturbance. Thirty-five points were sampled, seven through each port for two minutes each for a total test time of seventy minutes per test run.

Points on a Diameter	Probe Mark
1	*7.8"
2	13.4"
3	19.0"
4	24.6"
5	30.2"

*Measurements include a 5.0" standoff.



IV. THE SOURCE

IV. THE SOURCE

Valley Asphalt Corp. employs a Barber-Greene 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 burner fuel 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 exhaust gasses pass through a baghouse. The baghouse is manufactured by Barber-Greene. The exhaust gasses are drawn through the baghouse and discharged to the atmosphere through a 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.

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 into the drum where it is blended with the aggregate. Mixing continues in a coater located at the end of the drum.

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.

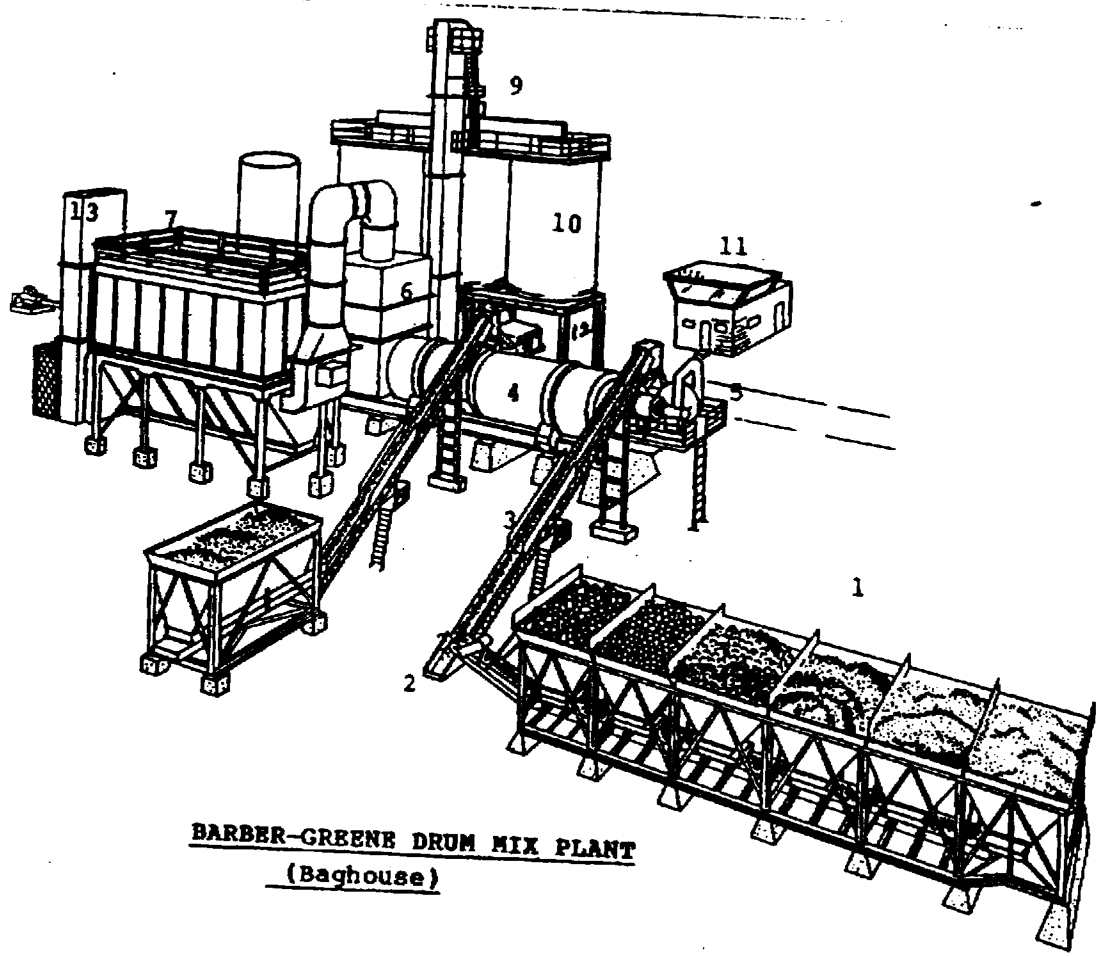
10. Surge/Storage bin: The asphaltic cement is dumped into this surge bin and metered out to dump trucks which pull underneath a slide gate at the bottom of the bin.

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



BARBER-GREENE DRUM MIX PLANT
(Baghouse)

DATA SUMMARY

Plant

1. Manufacturer of plant BarBer Greene.
2. Designed maximum operating capacity 350 TPH @ 3 % moisture.
3. Actual operation rate ______ TPH @ 3 % moisture.
4. Startup date ______.
5. Type of fuel used in dryer #2 Burnner Fuel.
6. Quanity of fuel consumption ______.

Aggregate

7. Name/type of mix 846 TYPE II.
8. Percent asphalt in mix 4.7 %.
9. Temperature of asphalt 290°.
10. Sieve/Screening analysis: % Passing;

1"	100	3/8"	62	#50	
3/4"	94	#4	47	#100	
1/2"	70	#8	41	#200	

Baghouse

11. Manufacturer ______.
12. No. of bags 800. Type of bags 14 oz Beta Nomex
13. Air to cloth ratio ______. Designed ACFM 54,000.
14. Square feet of bags ______.
15. Type of cleaning; pulse jet ______, reverse air ______, plenum pulse YES, other ______.
16. Cleaning cycle time ______.
17. Interval between cleaning cycle ______.
18. Pressure drop across baghouse ______ psi.
19. Pulse pressure on cleaning cycle ______ psi.

COMPANY NAME ______ DATE ______

COMPANY REPRESENTATIVE ______ Form #REC-03

PLANT DATA

COMPANY NAME Valley Asphalt Corp.
COMPANY REP. Fred Brenner DATE 6/6/88 PHONE # 513-831-5676
DATA SOURCE
PLANT LOCATION Camp Dennison Ohio
PLANT MFG. Barber Green PLANT MODEL # DM66 X 365 PLANT TYPE Drum Mixer
MIX SPECIFICATION # OIL SPECIFICATION # 2 Burner Fuel

Time 24 Hour	__ Fuel Oil __ Nat. Gas __ Propane __ Coal __	Burner Setting	Aggregate TPH	Recycle TPH	Liquid Asphalt TPH	Mix Temp. °F	__ Venturi __ Baghouse Pressure Drop Inches Water
7:45 am	#2 Fuel	50%	286	0	14.8	300	4½
8:00 am	"	45%	281	"	14.4	290	5½
8:15 a.m.	"	45%	280	"	14.3	290	6
8:30 am	"	45%	283	"	14.4	285	5½
8:45 am	"	40%	284	"	14.4	290	5½
9:00 am	"	45%	283	"	14.4	285	6
10:05	"	50%	281	"	14.3	300	5½
10:20	"	45%	284	"	14.8	290	6
10:35	"	55%	301	"	15.5	285	6
10:50	"	55%	302	"	15.5	290	6½
11:05	"	50%	310	"	15.6	290	6½
11:20	"	55%	307	"	15.5	290	6
11:43	"	52%	315	"	16.1	290	6½
12:02	"	50%	310	"	16.0	290	6½
12:17	"	52%	315	"	16.1	290	6
12:32	"	52%	310	"	15.9	295	6½
12:47	"	50%	308	"	15.9	300	6½
1:02	"	52%	320	"	16.3	300	6½

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 petri dishes. In the lab, the dishes are opened and placed into a dessicator for at least 24 hours. Then, the filters are weighed continuously every 6 hours until a constant weight is achieved. All data is recorded on the laboratory forms that will be bound in the test report.

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

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

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

E. **ACETONE:** Conduct a blank analysis of acetone from the one 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 REC#8

SAMPLE ANALYTICAL DATA FORM

Plant Location Valley Asphalt #17 Relative humidity in lab 49-45 %

Sample Location hot mix asphalt plant Density of Acetone (p_a) .7853 mg/ml

Blank volume (V_a) 200 ml

Date/Time wt. blank 6/13/88

Date/Time wt. blank 6/14/88

Gross wt. 93.1045 mg

Gross wt. 93.1044 mg

Ave. Gross wt. 93.1045 mg

Tare wt. 93.1039 mg

Weight of blank (m_{ab}) .0006 mg

Acetone blank residue concentration (C_a) $(C_a) = (M_{ab}) / (V_a)(p_a)$ = (.0000038 mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} p_a$ = (.0000036)(200)(.7853) = (.0006)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	200	200	200
Date/Time of wt 6/13/88 9:10AM Gross wt	g	159.6320	129.2057	154.4571
Date/Time of wt 6/14/88 3:45pm Gross wt	g	159.6315	129.2053	154.4570
Average Gross wt	g	159.6318	129.2055	154.4571
Tare wt	g	159.6102	129.1810	154.4426
Less acetone blank wt (W_a)	g	.0006	.0006	.0006
Wt of particulate in acetone rinse (m_a)	g	.0210	.0239	.0139

Filter Numbers	#	SG-2512	SG-2508	SG-2509
Date/Time of wt 6/13/88 9:10AM Gross wt	g	.5528	.5484	.5509
Date/Time of wt 6/14/88 3:45pm Gross wt	g	.5530	.5481	.5506
Average Gross wt	g	.5529	.5483	.5507
Tare wt	g	.5268	.5268	.5260

Weight of particulate on filters(s) (m_f)	g	.0261	.0215	.0247
Weight of particulate in acetone rinse	g	.0210	.0239	.0139
Total weight of particulate (m_n)	g	.0471	.0454	.0386

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 [signature]

Form REC#8

SAMPLE ANALYTICAL DATA FORM Back-Half

Plant Location Valley #17 Relative humidity in lab ______ %

Sample Location ______ Density of Acetone (pa) .78 mg/ml

Blank volume (V_a) ______ ml

Date/Time wt. blank ______ Gross wt. ______ mg

Date/Time wt. blank ______ Gross wt. ______ mg

Ave. Gross wt. ______ mg

Tare wt. ______ mg

Weight of blank (m_{ab}) ______ mg

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

Weight of residue in acetone wash: $W_a = C_a V_{aw} P_a$ = ( )( )( ) = ( )

		Run # 1	Run # 2	Run #3
Acetone rinse volume (V_{aw})	ml	230	265	250
Date/Time of wt ______ Gross wt	g	138.5378	134.2465	159.6242
Date/Time of wt ______ Gross wt	g	138.5377	134.2460	159.6240
Average Gross wt	g	138.5378	134.2463	159.6241
Tare wt	g	138.5197	134.2029	159.5984
Less ~~acetone~~ water blank wt (W_a)	g	—	—	—
Wt of particulate in acetone rinse (m_a)	g	.0181	.0434	.0249

Filter Numbers	#			
Date/Time of wt ______ Gross wt	g			
Date/Time of wt ______ Gross wt	g			
Average Gross wt	g			
Tare wt	g			

Weight of particulate on filters(s) (m_f)	g			
Weight of particulate in ~~acetone~~ water rinse	g	.0181	.0434	.0249
Total weight of particulate (m_n)	g			

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 ______

VII. CALCULATIONS

VALLEY ASPHALT #17
CAMP DENNISON, OHIO
6\6\88

SUMMARY OF TEST DATA

		RUN #1	RUN #2	RUN #3
SAMPLING TRAIN DATA				
	start	07:51	10:08	11:50
	finish	09:04	11:21	13:03
1. Sampling time, minutes	Θ	70.0	70.0	70.0
2. Sampling nozzle diameter, in.	D_n	.2300	.2300	.2300
3. Sampling nozzle cross-sect. area, ft^2	A_n	.000289	.000289	.000289
4. Isokinetic variation	I	94.7	99.6	98.4
5. Sample gas volume - meter cond., cf.	V_m	54.458	54.261	52.400
6. Average meter temperature, ^oR	T_m	543	561	571
7. Avg. oriface pressure drop, in. H_2O	dH	2.38	2.16	1.96
8. Total particulate collected, mg.	M_n	47.10	45.40	38.60
VELOCITY TRAVERSE DATA				
9. Stack area, ft^2	A	14.70	14.70	14.70
10. Absolute stack gas pressure, in. Hg.	P_s	29.95	29.95	29.95
11. Barometric pressure, in. Hg.	P_{bar}	29.95	29.95	29.95
12. Avg. absolute stack temperature, R^o	T_s	664	666	669
13. Average $-\sqrt{\text{vel. head}}$, (C_p= .83)	$-\sqrt{dP}$	1.08	1.02	0.98
14. Average stack gas velocity, ft./sec.	V_s	69.15	65.79	63.30
STACK MOISTURE CONTENT				
15. Total water collected by train, ml.	V_{ic}	243.00	280.00	262.00
16. Moisture in stack gas, %	B_{ws}	18.04	20.91	20.75
EMISSIONS DATA				
17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	2387	2185	2097
18. Stack gas flow rate, cfm	acfm	60990	58027	55831
19. Particulate concentration, gr/dscf	C_s	0.0140	0.0140	0.0126
20. Particulate concentration, lb/hr	E	4.77	4.37	3.78
21. Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000
ORSAT DATA				
22. Percent CO_2 by volume	CO_2	4.00	4.00	4.50
23. Percent O_2 by volume	O_2	15.50	15.50	14.80
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	80.50	80.50	80.70

Format: summryR3

NAME: VALLEY ASPHALT #17
LOCATION: CAMP DENNISON, OHIO (16)
TEST DATE: 6\6\88

Dry Gas Volume

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

Where:

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

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

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

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

T_m = Absolute temperature at meter ^oR.

T_{std} = Standard absolute temperature (528^oR).

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

Y = Dry gas meter calibration factor.

13.6 = Inches water per inches Hg.

RUN 1:

$$V_{m(std)} = (17.64)(.972)(54.458) \left[\frac{(29.95) + \frac{2.38}{13.6}}{543} \right] = 51.803 \text{ dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(.972)(54.261) \left[\frac{(29.95) + \frac{2.16}{13.6}}{561} \right] = 49.933 \text{ dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(.972)(52.400) \left[\frac{(29.95) + \frac{1.96}{13.6}}{571} \right] = 47.352 \text{ dscf}$$

NAME: VALLEY ASPHALT #17 (17)
LOCATION: CAMP DENNISON, OHIO
TEST DATE: 6\6\88

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:

$$c_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{47.10}{51.803}\right] = 0.0140 \text{ gr./dscf.}$$

Run 2:

$$c_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{45.40}{49.933}\right] = 0.0140 \text{ gr./dscf.}$$

Run 3:

$$c_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{38.60}{47.352}\right] = 0.0126 \text{ gr./dscf.}$$

Format: csR3

NAME: VALLEY ASPHALT #17
LOCATION: CAMP DENNISON, OHIO
TEST DATE: 6\6\88

Water Vapor Condensed

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

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

Where:

0.04707 = Conversion factor, $ft.^3/ml.$

0.04715 = Conversion factor, $ft.^3/g.$

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

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

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

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

p_w = Density of water, 0.002201 lb/ml.

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

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

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

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

Run 1:

$V_{wc(std)}$ = (0.04707) (230.0) = 10.8 cu.ft
$V_{wsg(std)}$ = (0.04715) (13.0) = 0.6 cu.ft

Run 2:

$V_{wc(std)}$ = (0.04707) (265.0) = 12.5 cu.ft
$V_{wsg(std)}$ = (0.04715) (15.0) = 0.7 cu.ft

Run 3:

$V_{wc(std)}$ = (0.04707) (250.0) = 11.8 cu.ft
$V_{wsg(std)}$ = (0.04715) (12.0) = 0.6 cu.ft

Format: vaporR3

NAME: VALLEY ASPHALT #17
LOCATION: CAMP DENNISON, OHIO
TEST DATE: 6\6\88

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:

$$M_d = 0.44(\ 4.00\%) + 0.32(15.50\%) + 0.28(\ .00\% + 80.50\%) = 29.26 \ \frac{lb}{lb\text{-}mole}$$

Run 2:

$$M_d = 0.44(\ 4.00\%) + 0.32(15.50\%) + 0.28(\ .00\% + 80.50\%) = 29.26 \ \frac{lb}{lb\text{-}mole}$$

Run 3:

$$M_d = 0.44(\ 4.50\%) + 0.32(14.80\%) + 0.28(\ .00\% + 80.70\%) = 29.31 \ \frac{lb}{lb\text{-}mole}$$

Format: mdR3

NAME: VALLEY ASPHALT #17
LOCATION: CAMP DENNISON, OHIO
TEST DATE: 6\6\88

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:

$$B_{ws} = \frac{10.8 + 0.6}{10.8 + 0.6 + 51.803} \times 100 = 18.04\ \%$$

Run 2:

$$B_{ws} = \frac{12.5 + 0.7}{12.5 + 0.7 + 49.933} \times 100 = 20.91\ \%$$

Run 3:

$$B_{ws} = \frac{11.8 + 0.6}{11.8 + 0.6 + 47.352} \times 100 = 20.75\ \%$$

Format: bwsR3

NAME: VALLEY ASPHALT #17 (21)
LOCATION: CAMP DENNISON, OHIO
TEST DATE: 6\6\88

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 = 29.26 (1 - 18.04) + 18 (18.04) = 27.23 (lb./lb.-mole)

Run 2:

M_s = 29.26 (1 - 20.91) + 18 (20.91) = 26.91 (lb./lb.-mole)

Run 3:

M_s = 29.31 (1 - 20.75) + 18 (20.75) = 26.96 (lb./lb.-mole)

Format: msR3

NAME: VALLEY ASPHALT #17 (22)
LOCATION: CAMP DENNISON, OHIO
TEST DATE: 6\6\88

Stack Gas Velocity

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

Where:

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

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

C_p = Pitot tube coefficient, (dimensionless).

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

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

P_g = Stack static pressure, (in. Hg).

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

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

t_s = Stack temperature, (^{o}f).

T_s = Absolute stack temperature, (^{o}R). = 460 + t_s.

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

Run 1:

$$V = (85.49)\ (\ .83)\ (\ 1.08)\ \sqrt{\frac{664}{(29.95)(27.23)}} = 69.15 \text{ ft/sec.}$$

Run 2:

$$V = (85.49)\ (\ .83)\ (\ 1.02)\ \sqrt{\frac{666}{(29.95)(26.91)}} = 65.79 \text{ ft/sec.}$$

Run 3:

$$V = (85.49)\ (\ .83)\ (\ 0.98)\ \sqrt{\frac{669}{(29.95)(26.96)}} = 63.30 \text{ ft/sec.}$$

Format: vsR3

NAME: VALLEY ASPHALT #17 (23)
LOCATION: CAMP DENNISON, OHIO
TEST DATE: 6\6\88

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, (^oF).
- T_s = Absolute stack temperature, (^oR).
- T_{std} = Standard absolute temperature, (528^oR).
- 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:

$$Q_{sd} = 3600(1- .1804)(69.15)(14.70)\left[\frac{528}{664}\right]\left[\frac{29.95}{29.92}\right] = 2387344.3 \; \frac{dscf}{hr}$$

Run 2:

$$Q_{sd} = 3600(1- .2091)(65.79)(14.70)\left[\frac{528}{666}\right]\left[\frac{29.95}{29.92}\right] = 2185225.3 \; \frac{dscf}{hr}$$

Run 3:

$$Q_{sd} = 3600(1- .2075)(63.30)(14.70)\left[\frac{528}{669}\right]\left[\frac{29.95}{29.92}\right] = 2097325.6 \; \frac{dscf}{hr}$$

Format: qR3

NAME: VALLEY ASPHALT #17
LOCATION: CAMP DENNISON, OHIO
TEST DATE: 6\6\88

Emissions Rate from Stack

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

Where:

E = Emissions rate, lb./hr.

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

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

Run 1:

$$E = \frac{(0.0140)(2387344.3)}{7000} = 4.77 \text{ lb. / hr.}$$

Run 2:

$$E = \frac{(0.0140)(2185225.3)}{7000} = 4.37 \text{ lb. / hr.}$$

Run 3:

$$E = \frac{(0.0126)(2097325.6)}{7000} = 3.78 \text{ lb. / hr.}$$

Format: eR3

NAME: VALLEY ASPHALT #17 (25)
LOCATION: CAMP DENNISON, OHIO
TEST DATE: 6\6\88

Isokinetic Variation

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

Where:

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

Run 1:

$$I = (100)(\ 664\ ) \left[\frac{(0.002669)(243.00) + \frac{54.458}{543} \left[29.95 + \frac{2.38}{13.6} \right]}{60\ (\ 70.0\ )\ (\ 69.15\ )\ (\ 29.95\ )\ (\ .000289\ )} \right] = 94.7\%$$

Run 2:

$$I = (100)(\ 666\ ) \left[\frac{(0.002669)(280.00) + \frac{54.261}{561} \left[29.95 + \frac{2.16}{13.6} \right]}{60\ (\ 70.0\ )\ (\ 65.79\ )\ (\ 29.95\ )\ (\ .000289\ )} \right] = 99.6\%$$

Run 3:

$$I = (100)(\ 669\ ) \left[\frac{(0.002669)(262.00) + \frac{52.400}{571} \left[29.95 + \frac{1.96}{13.6} \right]}{60\ (\ 70.0\ )\ (\ 63.30\ )\ (\ 29.95\ )\ (\ .000289\ )} \right] = 98.4\%$$

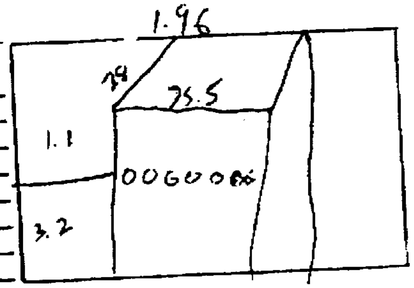
Format: iR3

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant [illegible]

Location [illegible] Ohio
Operator [illegible]
Date 6-6-88
Run No. 1
Sample Box No. 1
Meter Box No. 004
Meter H @ 2.1
C Factor .472
Pitot Tube Coefficient Cp .829



Schematic of Stack Cross Section

Ambient Temperature 60
Barometric Pressure 29.75
Assumed Moisture, % 16
Probe Length, m(ft) 3
Nozzle Identification No. .000 2885
Avg. Calibrated Nozzle Dia., (in.) .230/.230/.230
Probe Heater Setting 2.5
Leak Rate, m^3/min. (cfm) .003 at 2 inches
Probe Liner Material [illegible]
Static Pressure, mm Hg (in. Hg) .05
Filter No. SG-2512

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	430	525
INITIAL	200	512
DIFFERENCE	230	13

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A-1	7:51 / 7:53	5	207	1.9	3.7	599.5 / 601.5	70	62	250	60
2	7:55	5	207	1.8	3.5	603.5	74	62	250	60
3	7:57	5	206	1.8	3.5	605.3	80	64	250	60
4	7:59	6	204	2.0	3.9	607.5	84	64	250	60
5	8:01	6	205	2.0	3.9	609.5	84	64	250	50
B-1	8:01:30 / 8:03:30	3	205	.60	1.2	610.8	84	64	250	50
2	8:05:30	3	203	.60	1.2	612.1	86	64	250	50
3	8:07:30	3	206	.60	1.2	613.1	86	64	250	50
4	8:09:30	3	208	.90	1.8	614.7	90	66	250	50
5	8:11:30	4	205	1.2	2.4	616.2	90	68	250	50
C-1	8:12 / 8:14	2	203	.40	.80	617.2	90	70	250	50
2	8:16	2	204	.40	.80	618.2	90	70	250	50
3	8:18	2	204	.40	.80	619.0	90	70	250	

CO_2 = 4.0%? CO_2 = 3.5% O_2 = 15.5 O_2 = 15.5

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-6-88 LOCATION Camp Dennison Ohio 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)
4	8:20	2	201	.40	.80	620.0	90	70	260	55
5	8:22	2	200	.50	.98	621.2	90	70	260	55
D-1	8:22-30 / 8:24-30	3	201	.60	1.1	622.2	92	72	260	55
2	8:26-30	3	201	.60	1.1	623.6	92	72	260	55
3	8:28-30	3	201	.60	1.1	624.6	92	72	260	55
4	8:30-30	3	203	.70	1.4	625.7	96	74	255	60
5	8:32-30	3	205	.80	1.6	627.2	96	74	255	60
E-1	8:33 / 8:35	3	200	.80	1.6	628.5	96	74	255	60
2	8:37	3	203	.90	1.8	629.9	96	74	255	60
3	8:39	4	203	1.0	2.0	631.3	100	76	255	60
4	8:41	4	202	1.1	2.2	633.0	100	76	250	60
5	8:43	4	202	1.2	2.4	634.6	100	76	250	60
F-1	8:43-46 / 8:45-30	4	203	1.4	2.7	636.4	100	76	250	60
2	8:47-30	4	204	1.4	2.7	638.2	100	76	250	60
3	8:49-30	4	203	1.4	2.7	639.7	100	76	250	60
4	8:51-30	5	206	1.5	2.9	641.6	100	76	250	60
5	8:53-30	5	203	1.6	3.1	643.4	100	76	250	60
G-1	8:54 / 8:56	5	201	1.6	3.1	645.2	100	76	265	60
2	8:58	5	202	1.6	3.1	647.1	100	78	265	60
[illegible]	[illegible]	5	205	1.7	3.3	648.8	102	78	265	60

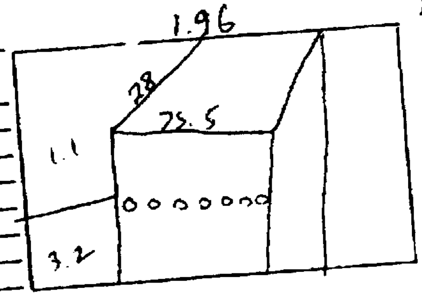
Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-6-88 LOCATION Coat [illegible] 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)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
4	9:02	5	204	1.7	3.3	651.0	104	78	265	60
5	9:04	5	203	1.7	3.3	652.958	104	80	265	60

RAMCON ENVIRONMENTAL CORPORATION

Plant [illegible]
Location [illegible]
Operator [illegible]
Date 6-5-88
Run No. 2
Sample Box No. 1
Meter Box No. 004
Meter H @ 2.1
C Factor .972
Pitot Tube Coefficient Cp .829



Schematic of Stack Cross Section

Ambient Temperature 90
Barometric Pressure 29.95
Assumed Moisture, % 18
Probe Length, m(ft) 3
Nozzle Identification No. .000 2985
Avg. Calibrated Nozzle Dia., (in.) .250/.250
Probe Heater Setting 2.5
Leak Rate, m^3/min. (cfm) [illegible]
Probe Liner Material [illegible]
Static Pressure, mm Hg (in. Hg) .05
Filter No. 56-2508

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	465	530
INITIAL	200	515
DIFFERENCE	265	15

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H20	PRESSURE DIFF. ORF. MTR in H20	GAS SAMPLE VOLUME ft3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
1	10:08 / 10:10	5	200	2.1	4.1	653.2 / 655.3	90	86	255	60
2	10:12	5	200	1.9	3.2	657.0	94	94	255	60
3	10:14	5	195	1.9	3.2	659.5	94	84	255	60
4	10:16	5	202	1.8	3.5	661.3	102	84	255	60
5	10:18	5	202	1.8	3.5	663.5	102	84	255	60
1	10:20-30 / 10:20-30	4	200	1.2	2.4	665.2	102	84	250	60
2	10:22-30	4	204	1.1	2.2	666.9	106	84	250	60
3	10:24-30	4	207	1.1	2.2	668.4	106	84	250	60
4	10:26-30	4	206	1.4	2.7	670.1	106	84	250	60
5	10:28-30	4	205	1.5	2.9	672.0	110	84	250	60
1	10:29 / 10:31	4	204	.70	1.4	673.4	108	88	250	60
2	10:33	3	205	.60	1.6	674.8	108	88	250	60
3	10:35	4	205	1.1	2.2	676.4	110	88	260	60

CO_2 = 4.0% CO_2 = 4.0% O_2 = 15.5 O_2 = 15.5

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-6-88 LOCATION [illegible] TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	10 37	4	208	1.2	2.4	678.6	110	88	260	60
5	10 39	4	208	1.3	2.5	679.8	110	88	260	60
1	10 40 / 10 42	3	208	.60	1.2	681.0	110	88	260	60
2	10 44	3	208	.60	1.2	682.3	110	88	260	60
3	10 46	3	208	.60	1.2	683.5	110	88	260	60
4	10 48	3	209	.80	1.6	684.8	110	90	260	60
5	10 50	3	209	.80	1.6	686.3	110	90	255	60
1	10 [illegible]:30 / 10 [illegible]2:30	2	208	.50	.98	687.4	110	90	250	60
2	10 54:30	2	212	.50	.98	688.4	110	90	250	60
3	10 55:30	2	211	.50	.98	689.5	110	90	250	60
4	10 57:30	2	210	.60	1.2	690.8	110	90	250	60
5	11 00:30	2	208	.60	1.2	691.9	110	90	250	55
1	11 31 / 11.03	3	207	.70	1.4	693.1	110	90	250	55
2	11.05	3	206	.70	1.4	694.3	110	90	260	55
3	11 07	3	204	.80	1.6	695.6	110	90	260	55
4	11 09	3	204	.80	1.6	697.0	110	90	260	55
5	11 11	3	207	.80	1.6	698.5	110	90	260	55
1	[illegible] / 11 13:30	4	203	1.6	3.1	700.2	112	92	265	60
2	11 15:30	4	207	1.5	2.9	701.8	112	92	265	60
3	11 [illegible]:30	4	20[illegible]	1.5	2.9	70[illegible]	112	92	265	60

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-6-88 LOCATION [illegible] TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	[illegible]:30	4	208	1.5	2.9	705.3	112	92	265	60
5	[illegible]:30	4	207	1.5	2.9	707.461	112	92	265	60

RAMCON ENVIRONMENTAL CORPORATION

Plant Valley Asphalt
Location Camp Dennison Stack
Operator [illegible]
Date 6-5-88
Run No. 3
Sample Box No. 1
Meter Box No. 004
Meter H @ 2.1
C Factor .972
Pitot Tube Coefficient Cp .829

1.96

Ambient Temperature 90
Barometric Pressure 29.95
Assumed Moisture, % 18
Probe Length, m(ft) 3
Nozzle Identification No. 000 1885
Avg. Calibrated Nozzle Dia., (in.) .230/.230/.230
Probe Heater Setting 25
Leak Rate, m³/min. (cfm) .001 at 6 inches
Probe Liner Material stainless steel
Static Pressure, mm Hg (in. Hg) .05
Filter No. 56-2509

	IMPINGER VOLUME ml	SILICA GEL WEIGHT g
FINAL	450	536
INITIAL	200	524
DIFFERENCE	250	12

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °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	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
1	11:50-30 / 11:52-30	4	200	1.5	2.9	707.6 / 709.6	104	100	230	60
2	11:54-30	4	200	1.5	2.9	710.9	104	100	230	60
3	11:56-30	4	203	1.5	2.9	713.0	104	100	230	60
4	58-30	4	212	1.6	3.1	714.8	110	98	230	60
5	12:00-30	5	213	1.7	3.3	716.7	116	98	230	60
1	12:01 / 12:03	3	215	.70	1.4	718.3	116	98	240	60
2	12:05	3	210	.70	1.4	719.5	116	98	240	60
3	12:07	3	210	.70	1.4	720.8	118	98	240	60
4	12:09	3	210	1.0	2.0	722.6	118	98	240	60
5	12:11	3	210	1.0	2.0	723.9	118	98	240	60
1	12:11-30 / 12:13-30	3	204	.50	1.0	725.2	118	98	240	60
2	12:15-30	3	204	.50	1.0	726.3	118	98	245	60
3	12:17-30	3	205	.50	1.0	727.4	118	98	245	60

CO_2 = 4.0 CO_2 = 4.5% O_2 = 14.8 O_2 = 14.8

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-6-84 LOCATION Camp Dayton Ohio 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 Vm (ft.^{3})	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	12:[illegible]-30	3	205	.60	1.2	728.6	118	98	250	60
5	12:[illegible]-30	3	204	.60	1.2	729.7	120	98	250	65
1	12:22 / 12:24	3	204	.60	1.2	730.8	118	98	250	65
2	12:26	3	207	.70	1.4	731.9	120	98	230	65
3	12:28	3	207	.70	1.4	733.4	120	98	230	65
4	12:30	3	208	.80	1.6	734.7	120	100	250	65
5	12:32	3	209	.80	1.6	736.2	120	100	250	65
1	12:[illegible]30 / 12:34-30	3	206	.60	1.2	737.4	120	100	250	65
2	12:36-30	3	207	.70	1.4	738.8	120	100	270	65
3	12:38-30	3	210	.80	1.6	740.1	120	100	270	65
4	12:40-30	4	212	1.2	2.4	741.8	120	100	270	65
5	12:42-30	4	214	1.2	2.4	743.5	120	100	270	65
1	12:43 / [illegible]:45	4	212	1.0	2.0	745.0	120	100	260	65
2	12:47	4	212	1.0	2.0	746.6	120	100	260	65
3	12:49	4	214	1.1	2.2	748.1	120	100	260	65
4	12:51	4	216	1.2	2.4	749.8	120	100	260	65
5	12:53	4	216	1.2	2.4	751.5	120	100	260	65
1	12:[illegible]30 / [illegible]:55-30	4	214	1.2	2.4	753.0	120	100	260	65
2	[illegible]:7-30	4	216	1.3	2.5	754.7	120	100	260	65
3	[illegible]-30	5	213	1.4	2.7	756.3	120	100	260	65

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-6-88 LOCATION [illegible] TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	1:01-30	4	213	1.3	2.5	258.1	125	106	250	60
5	1:03-30	4	214	1.4	2.2	260.0	125	100	250	60

IX. CALIBRATIONS

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Meter box number 004\638809

Date 6\18\88 Calibrated by [signature]

Barometric pressure, P_b = 29.99 in. Hg

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	041.00 / 046.21	75°	94° / 102°	80° / 82°	90°	13:38	.985	2.04
1.0	5	047.00 / 52.72	75°	96° / 104°	80° / 82°	91°	9:27	.984	1.96
1.5	10	053.00 / 063.49	75°	96° / 107°	82° / 86°	91°	15:32	.982	1.99
2.0	10								
3.0	10								
4.0	10						Avg	.984	2.00

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.

Quality Assurance Handbook M4-2.3A (front side)

Form #REC-02

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 5-31-88 Meter box number 009/[illegible]

Barometric pressure, P_b = 20.11 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								
1.0	5	351.9 / 363.226	75	99 / 101	81 / 81	90.5	9.63	.982	2.0
1.5	10								
2.0	10	349.[illegible] / [illegible].469	75	101 / 104	82 / 83	92.25	13.87	.966	2.1
3.0	10	336.6[illegible] / 347.203	75	105 / 105	83 / 82	93.75	11.36	.974	2.1
4.0	10								
							Avg	.972	2.1

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.

Quality Assurance Handbook M4-2.3A (front side)

Form #REC-02

RAMCON ENVIRONMENTAL CORPORATION

Date 2-10-88 Thermocouple number Outlet

Ambient temperature 55°F °C Barometric pressure 29.96 in. Hg

Calibrator S. Greenwood 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 BATH	33° F	32° F	.03%
B	OVEN	152°F	150°F	.01%
C	OVEN	175°F	175°F	0%
D	Ambient	55°F	55°F	0%
	6-6-88	60°F	60°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.

RAMCON ENVIRONMENTAL CORPORATION

Date 2-10-88 Thermocouple number Inlet

Ambient temperature 55°F °C Barometric pressure 29.96 in. Hg

Calibrator S. Greenwood 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 BATH	33°F	33°F	0%
B	OVEN	150°F	151°F	.007%
C	OVEN	175°F	173°F	.01%
D	AMBIENT	55°F	54°F	.02%
	6-6-88	6-6-88 80°F	80°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.

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. 34 Date 2-5-88

Calibrated by: Gary T. Turner

"A" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp (s) cm H_2O (in. H_2O)	$C_p(s)$	DEVIATION $C_p(s)-\bar{C}_p(A)$
1	1.05	1.5	.836	.007
2	.87	1.3	.818	.011
3	.58	0.83	.835	.006
		$\bar{C}_p$ (SIDE A)	.829	

"B" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp(s) cm H_2O in. H_2O)	$C_p(s)$	DEVIATION $C_p(s)-\bar{C}_p(B)$
1	1.05	1.51	.833	.009
2	.87	1.32	.812	.012
3	.58	0.85	.826	.002
		$\bar{C}_p$ (SIDE B)	.824	

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

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

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

Form No. EED-17-1

RAMCON

Lear Siegler Stack Sampler

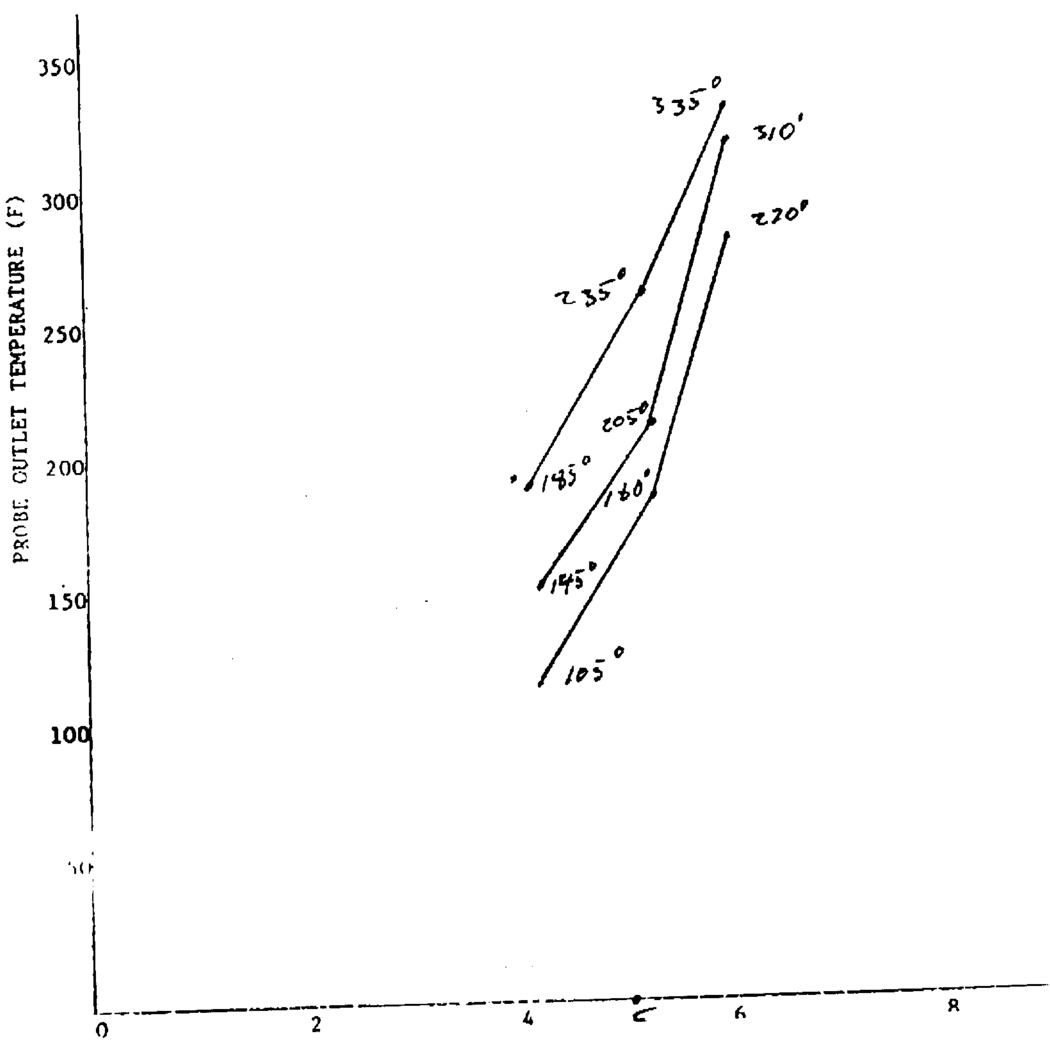
Heating Probe Calibration

Probe No. 34 Probe Length 3 ft

Date of Calibration 2/21/88 Signature S Buck

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



STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 2/9/88 Thermocouple number 34

Ambient temperature 55 °F Barometric pressure 29.95 in. Hg

Calibrator G. Greenwood Reference: mercury-in-glass ✓

other ______

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	Ice water	32°F	31°F	.03%
B	Boiling water	212°F	212°F	0%
C	Boiling oil	381°F	377°F	.01%
D	Ambient 6-6-88	60°F	60°F	0%

[a]Type of calibration system used.

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

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.

Allen Turner - Team Leader

Allen Turner has been employed by RAMCON for three years. He has undergone extensive training in Methods 1 through 9. He is qualified as a team leader and is currently certified as a V.E. reader.