5A

APPENDIX K

OEPA STACK TEST REVIEW SUMMARY FORM

APPLICATION NUMBER 1483110113 P902 (A2, NSPS)

FACILITY NAME Valley Asphalt

SOURCE DESCRIPTION (OR SCC CODE) Plant #5 Asphalt Plant

CONTROL EQUIPMENT Baghouse

DATE(S) OF TEST June 27, 1991

FINAL TEST REPORT RECEIVED ON July 25, 1991

POLLUTANT(S) TESTED Particulate Emissions (all size fractions)

TEST METHOD USEPA Reference Methods 1-5

TEST FIRM Ramcon (Memphis, Tennessee)

EMISSION RATES*: .03 grains/dscfm .04 grains/dscf

ACTUAL (lb(s)/Hr) 6.8 #/HR ALLOWABLE**

OPERATING RATES*:

DURING TEST** 300 TPH MAXIMUM** 300 TPH

EMISSION FACTOR***

COMMENTS:

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:

☒ AN ACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

☐ AN UNACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

August 5, 1991
DATE OF REVIEW

Prepared by: LeRoy R. Gruber, AQE
REVIEWED BY
L.R. Gruber

* BASED ON - RUN AVERAGE
** SPECIFY APPLICATION UNITS
*** SPECIFY IN UNITS OF MASS/INPUT

LRG/sal

OBSERVER'S REPORT

Testing

for

Particulate Emissions

Conducted On:	June 27, 1991
Source:	Valley Asphalt
Premise Number:	1483110113 P902 (A2, NSPS)
Testing Firm:	Ramcon Memphis, Tennessee
Prepared and Reviewed:	LeRoy R. Gruber, AQE
Date Prepared:	August 5, 1991

SOUTHWESTERN OHIO AIR POLLUTION CONTROL AGENCY
(S.W.O.A.P.C.A.)

Valley Asphalt
PN: 1483110113 P902
A2, NSPS

Testing for particulate emissions took place at Valley Asphalt Plant #5 in Morrow, Ohio on June 27, 1991. The plant is rated 300 TPH. A baghouse controls emissions. The Ohio Administrative Code (OAC) Rules 3745-17-07 (visible emissions) and 40 CFR 60 Subpart I (New Source Performance Standards) apply. An emission limit of 20% opacity and .04 grains/dscf is indicated. The plant was last tested in 1986. New bags were recently installed.

USEPA Reference Methods 1-5 were utilized. The five sample ports were sampled at six points each. The damper vanes had to be manually positioned in a vertical plane as serious cyclonic flow was found. <u>The average of three one-hour long test runs was .03 grains/dscf or 6.8 #/HR.</u> Normal run-to-run variation was seen.

The plant averaged near 300 TPH asphalt. Truck loading tickets were used to derive that number. A 404 surface coating job was run. This throughput represents worst case emission conditions. The baghouse ran between 3.2 and 3.5 inches pressure drop. The cleaning pulse was every nine seconds. A 70 psi air jet pulse was used.

Visible emissions were normally zero opacity. During each baghouse a puff of dust was seen. The puff lasted several seconds and had opacity of 5 to 15%. The duration of the puff increased throughout the day. Few fugitives were seen. The road was watered down during the day.

The stack volumetric flow was 30,500 dscfm at 28% moisture and 300 degrees F.

Quality assurance measures consisted of sampling and pitot line leak checks, proper filter handling and probe rinse technique, correct probe alignment, port sealing, manometer zero. DGM and thermocouple calibrations were properly documented. Emission rate and isokinetic sampling calculations were correct. In short proper methodology and procedures were observed for the entire test cycle.

In conclusion, data of sufficient accuracy and precision was obtained to determine compliance. At an emission rate at 65% of allowable, <u>retesting on a three year interval is recommended.</u> Proper maintenance and attention to stack visibles, baghouse pressure drop and pulsing pressure between test intervals would assure the determined emission rate is not exceeded.

<u>Prepared and Reviewed:</u> LeRoy R. Gruber, AQE
<u>Date Prepared:</u> August 5, 1991
LRG/sal

URCE NAME Valley Asphalt #5

DDRESS Stubbs Mills Rd Morrow OH

OUNTY WAR

ZIP CODE

TELEPHONE

OURCE ID NUMBER

OBSERVATION DATE 6·27·71

ROCESS Asphalt Plant 404 JOB

OPERATING MODE ~300TPH

OPERATING MODE ~Δp ·2.2" H2O

ONTROL EQUIPMENT Baghouse

DESCRIBE EMISSION POINT stack

DISTANCE FROM OBSERVER 8 stk hts

DIRECTION FROM OBSERVER

HEIGHT ABOVE GROUND LEVEL

HEIGHT RELATIVE TO OBSERVER

DESCRIBE EMISSIONS dust

EMISSION COLOR brown

PLUME TYPE CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT YES ☐ NO ☒

IF YES, IS PLUME ATTACHED ☐ DETACHED ☐

AT WHAT POINT WAS OPACITY DETERMINED 1 diam frm stk top

DESCRIBE BACKGROUND trees

BACKGROUND COLOR green

SKY CONDITIONS clr

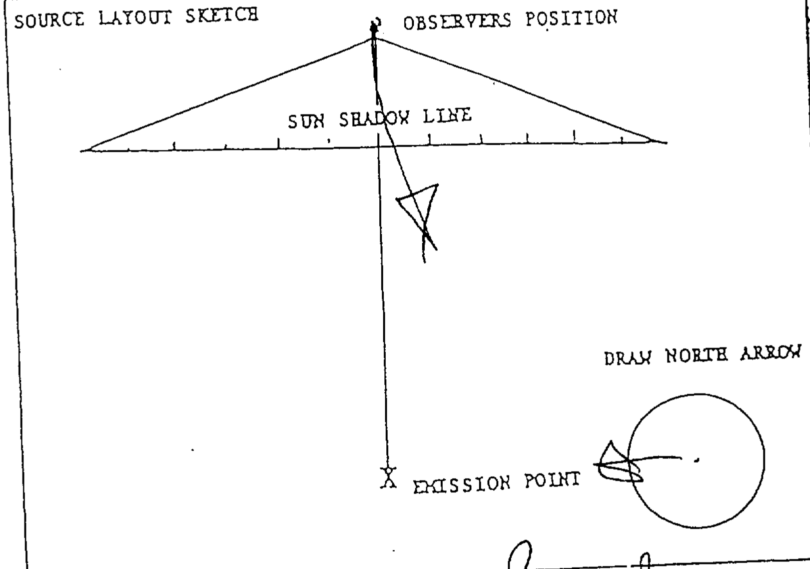
WIND SPEED

WIND DIRECTION

AMBIENT TEMPERATURE 90°

RELATIVE HUMIDITY

SOURCE LAYOUT SKETCH



Signature

1055

	0	15	30	45		0	15	30	45
1	0	0	0	0	31	0	0	5	10
2	0	5	0	0	32	0	0	0	0
3	0	0	0	0	33	0	10	0	0
4	0	5	0	0	34	0	0	0	0
1100 5	0	0	0	0	1130 35	0	0	10	0
6	0	0	0	0	36	0	0	0	10
7	0	5	10	5	37	0	0	0	0
8	0	0	0	0	38	0	0	0	5
9	0	0	0	0	39	0	15	6	0
1105 10	0	0	0	0	1135 40	10	0	0	0
11	0	0	0	0	41	0	15	0	0
12	5	0	0	0	42	0	20	0	0
13	0	0	5	0	43	10	0	0	0
14	0	0	0	5	44	0	10	0	0
1110 15	0	0	0	0	1140 45	0	10	0	5
16	5	0	0	10	46	0	0	0	0
17	0	0	0	0	47	5	0	0	0
18	10	0	0	0	48	0	0	0	0
19	0	0	5	0	49	0	10	0	0
1115 20	0	10	0	0	1145 50	15	0	0	5
21	10	0	0	10	51	0	15	0	0
22	0	0	0	0	52	0	10	0	0
23	0	10	0	0	53	10	0	0	0
24	0	10	0	0	54	0	5	0	10
1120 25	5	0	0	0	1150 55	0	10	0	10
26	0	5	0	0	56	0	0	0	0
27	10	5	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	5	0	0	59	0	5	0	0
1125 30	0	10	0	0	60	0	6	0	0

3 min/6 min Running Average Requested

RAMCON
ENVIRONMENTAL CORPORATION

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
VALLEY ASPHALT CORPORATION
VALLEY ASPHALT PLANT #5
MORROW, OHIO

June 27, 1991

Paul Prottengeier
Valley Asphalt Corporation

G. Sumner Buck, III
President

Billy Lockett

Billy Lockett
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

July 10, 1991

Mr. Paul Prottengeier
Valley Asphalt Corporation
11641 Mosteller Road
Cincinnati, Ohio 45421

Re: Particulate Emissions Test: Valley Asphalt Plant #5, Morrow, Ohio

Dear Mr. Prottengeier:

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

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

Mr. Lee R. Gruber
Air Quality Engineer
Southwestern Ohio Air Pollution Control Agency
1632 Central Parkway
Cincinnati, Ohio 45210

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

Sincerely,

G. Sumner Buck, III
President

GSBIII:djb

Enclosures

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

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I. INTRODUCTION

On June 27, 1991 personnel from RAMCON Environmental Corporation conducted a source emissions test for particulate emissions compliance at Valley Asphalt Corporation's (Plant #5) McCarter batch mix asphalt plant located in Morrow, Ohio, Premise # 1483110113. RAMCON personnel conducting the test were Billy Lockett, Team Leader, and Greg Cook. Paul Taverna 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. Lockett and Mr. Taverna.

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

II. TEST RESULTS

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

Mr. Lee R. Gruber of Southwestern Ohio Air Pollution Control Agency observed the testing conducted by RAMCON Environmental.

TABLE I

SUMMARY OF TEST RESULTS

June 27, 1991

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	11:10 to 12:33	0.0284 gr/DSCF	106.0%	7.5 lbs/hr
2	13:46 to 14:55	0.0257 gr/DSCF	98.1%	6.6 lbs/hr
3	15:52 to 17:00	0.0235 gr/DSCF	95.8%	6.2 lbs/hr
	Average:	0.0259 gr/DSCF		6.8 lbs/hr

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

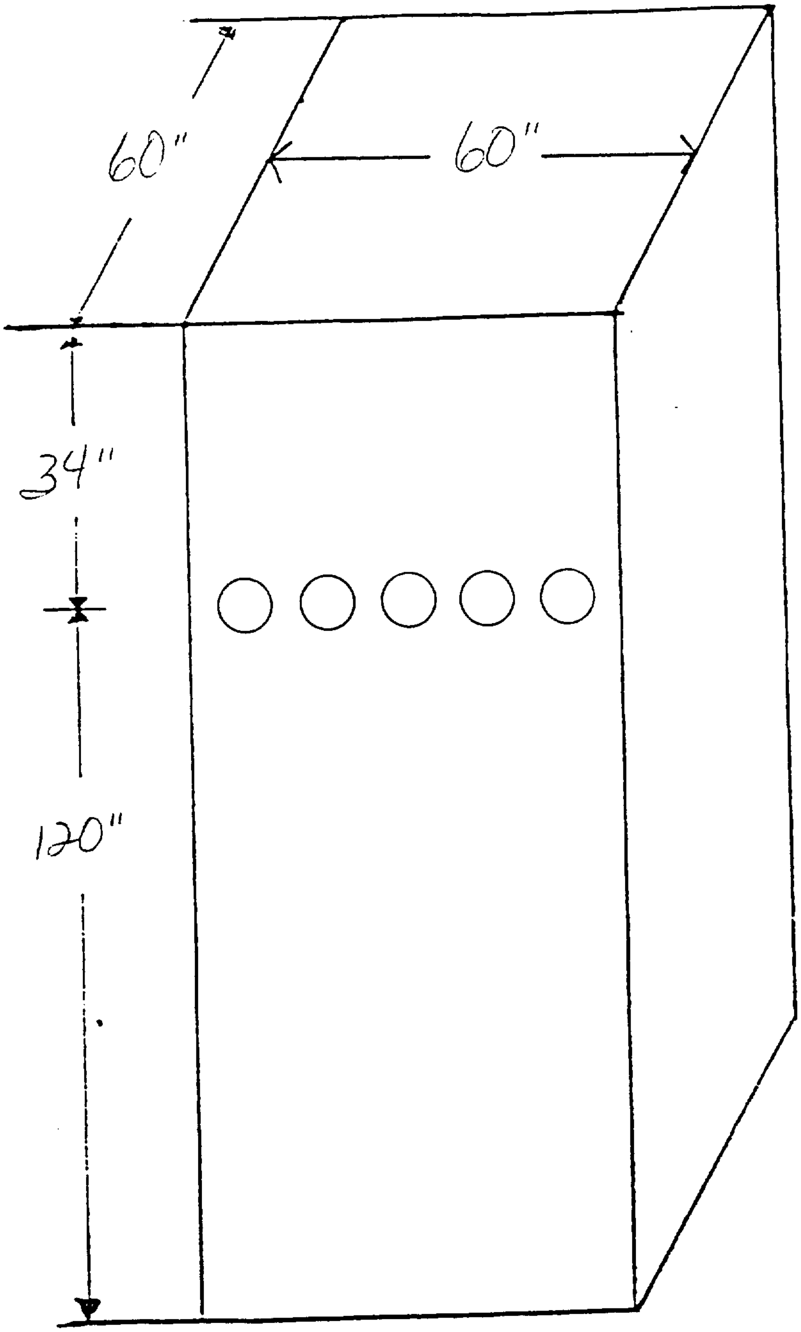
III. TEST PROCEDURES

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

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

C. Sampling Site: The emissions test was conducted after a baghouse on a square stack measuring 60.0" x 60.0" with an equivalent diameter of 60.0". Five sampling ports were placed 34.0" down (0.6 diameters upstream) from the top of the stack and 120.0" up (2.0 diameters downstream) from the last flow disturbance. The ports were evenly spaced on 12.0" centers. The two outside ports are 6.0" from the side walls of the stack. Thirty points were sampled, six through each port for 2.0 minutes each.

Points on a Diameter	Probe Mark
1	*5.0"
2	15.0"
3	25.0"
4	35.0"
5	45.0"
6	55.0"



IV. THE SOURCE

IV. THE SOURCE

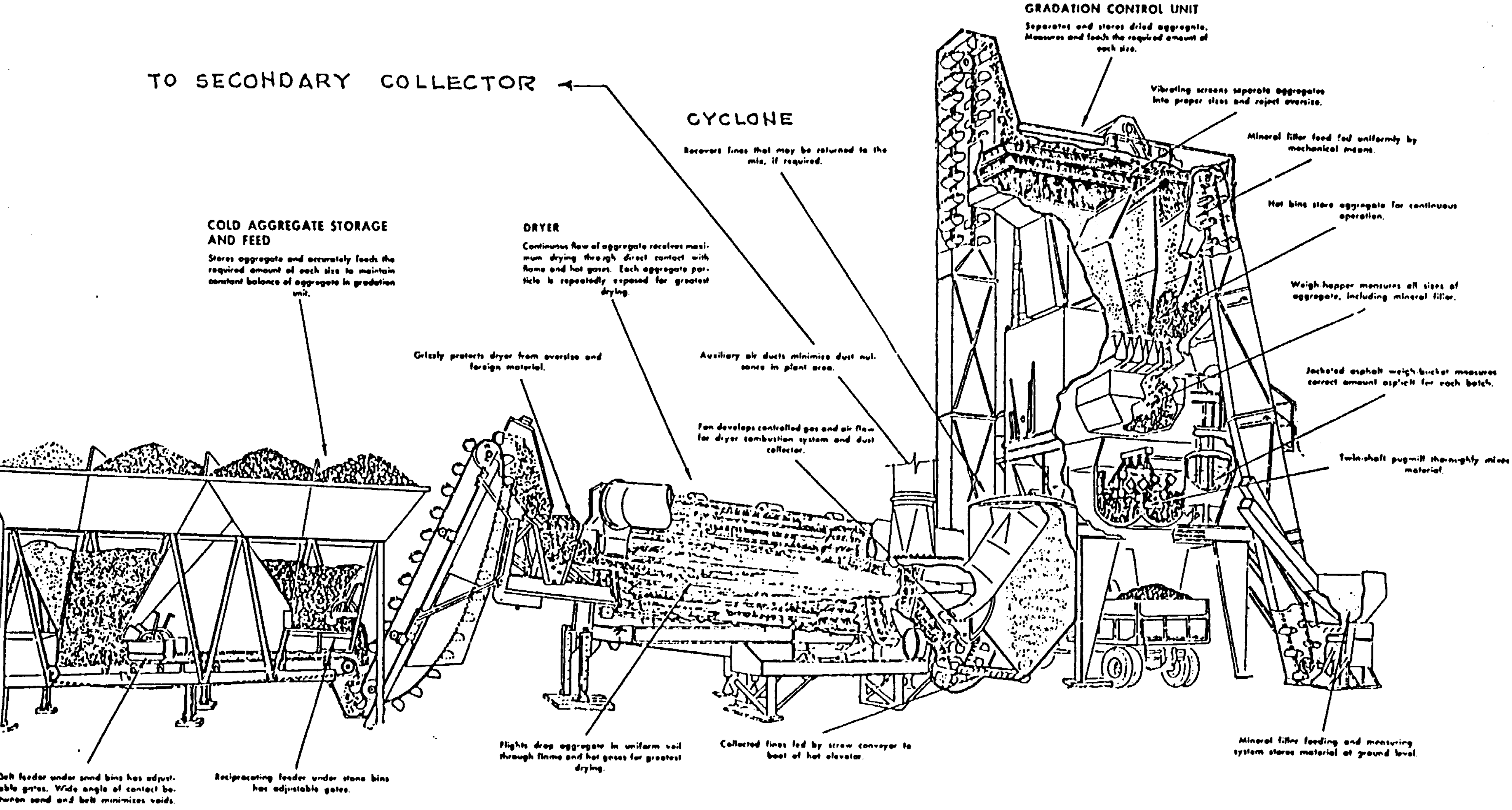
Valley Asphalt Corporation (Plant #5) employs a McCarter batch mix asphalt plant which is used to manufacture hot mix asphalt for road pavement. The process consists of blending prescribed portions of cold feed materials (sand, gravel, screenings, chips, etc.) uniformly and adding sufficient hot asphalt oil to bind the mixture together. After the hot asphalt mix is manufactured at the plant, it is transported to the location where it is to be applied. The hot asphalt mix is spread evenly over the surface with a paver then compacted with a heavy roller to produce the final product.

The following to a general description of the plant's manufacturing process: The cold feed materials (aggregate) are dumped into separate bins which in turn feed a common continuous conveyor. The aggregate is dispensed from the bins in accordance with the desired formulation onto the cold feed system conveyor, to an inclined weigh conveyor, then to a rotating drum for continuous mixing and drying at approximately 300°F. When recycled asphalt mix is used, it is added directly into the pugmill. The dried aggregate is pulled by a bucket elevator to the top of a gradation control unit which separates and stores the aggregate by size. The required amount of each aggregate is dispensed into a weigh-hopper and from there into a pugmill where the hot liquid asphalt pavement is mixed thoroughly with the aggregate. The hot asphalt mix is then discharged from the storage silo through a slide gate into waiting dump trucks which transports the material to a final destination for spreading. The rated capacity of the plant will vary with each aggregate mix and moisture content with a 5% surface moisture removal.

The mixer uses a burner fired with #2 Fuel Oil to heat air to dry the aggregate. The air is drawn into the system via an exhaust fan. After passing through the gas burner, the air passes through a baghouse. The baghouse is manufactured by McCarter. The exhaust gas is drawn through the baghouse and discharged to the atmosphere through the stack. The design pressure drop across the tube sheet is 2 - 6 inches of water. The particulate matter, which is removed by the baghouse, is reinjected into the pugmill.

Figure 4-1

ASPHALT BATCH MIX PLANT - AN EXPLODED VIEW



Source: Asphalt Plant Manual, The Asphalt Institute, 1967

1. Aggregate bins: Virgin aggregate is (6) fed individually into bins by type. It is metered onto a conveyor belt running under the bins to a shaker screen. The proportion to 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 an outer shell of this drum. Hot liquid asphalt is injected in the outer shell of the 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 baffling: A baffling 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 product.

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 lading 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 ON STACK BEING TESTED

AGGREGATE

1. Name/type of mix 404
2. Name/type of 2nd mix (if used) 301
3. Type/temperature of Liquid Asphalt ~~[illegible]~~ Shell / 350°F
4. Sieve/Screening analysis: ____________ % Passing;

	1st mix / 2nd mix		1st mix / 2nd mix		1st mix / 2nd mix
1"	1054 /	3/8"	/	#	/
3/4"	801 /	#200	/	#	/
1/2"	AC.105 /	#	/	#	/

CONTROL SYSTEM

Manufacturer ____________

A. **Baghouse:**

1. Type of bags NoMAx # of bags 756 Sq. ft. of bags 6" X 9'
2. Air to cloth ratio ____________ Designed ACFM ____________
3. Type of cleaning - pulse jet ✓ reverse air ______ plenum pulse ______ other ______
4. Cleaning cycle time ______ Interval between cleaning cycle ______
5. Pulse pressure on cleaning cycle 60 psi

B. **Scrubber:**

1. Type - Venturi ______ Wet Washer ______
   Spray Booth ______ Other ______
2. Gallons per minute through system ______
3. Water source ______ (i.e., pond, lagoon, etc.)
4. Number of spray nozzles ______

Company Name ____________ Date ______

DATA ON FACILITY BEING STACK TESTED

COMPANY NAME VALLEY ASPHALT COMPANY REP.

LOCATION OF FACILITY MORROW PLT. 5 / ORIGINAL START-UP DATE PHONE (513) 381-0652

OEM MODEL NO. DESIGNED CAPACITY

TYPE

AC TYPE

1 Time (24 HR) NOTE: check small box in column when moisture sample is taken	2 Fuel Use ☐ #Fuel Oil ☐ Nat. Gas ☐ Propane ☐ Coal ☐ other	3 Burner Setting	4 Blower Pressure	5 Production Rate ☐ Mix ☐ Aggregate TPH	5 Production Rate ☐ RAP TPH	6 Asphalt Cement %	7 Mix Temp. °F	8 Exhaust Gas Temp. °F	9 ☐ Venturi Scrubber ☐ Baghouse Pressure Drop in w.g.	9 Water Pressure psi	10 Ambient Temp. °F	11 Relative Humidity %	12 Exhaust Damper Position
	NAT. GAS	3.30											
11:00	"	"				5.34	320		3		78°		
11:15	"	"		294.49		5.37	"		3		80°		
[illegible]30	"	"		290.21		5.31	325		3		84°		
[illegible]15	"	"				5.30	330		3		86°		
[illegible]15	"	"				5.28	318		3		89°		
2:00	"	"				5.31	326		3.5		90°		
2:15	"	"				5.28	320		3.5		90°		
2:30	"	"				5.30	321		3.5		90°		
2:45	"	"				5.41	324		3.5		91°		
3:15	"	"		311.10		5.30	320		3.5		91°		
4:00	"	"				5.31	325		3.5		93°		
4:15	"	"				5.28	320		3.5		93°		
4:35	"	"				5.34	325		3.5		93°		
4:45	"	"				5.30	324		3.5		94°		
				300.04		5.29	330		3.5		93°		

V. EQUIPMENT USED

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Equipment used on conducting the particulate emissions test was:

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

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

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

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

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

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

VI. LABORATORY PROCEDURES & RESULTS

LABORATORY PROCEDURES FOR PARTICULATE SAMPLING

I. Field Preparation

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

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

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

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

II. Post - Testing Lab Analysis

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

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

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

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

E. ACETONE: A blank analysis of acetone is conducted from the one gallon glass container used in the field preparation. This acetone was used in the field for rinsing the probe, nozzle, and top half of the filter holder. A blank analysis is performed prior to testing on all new containers of acetone received from the manufacturer to insure that the quality of the acetone used will 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. this laboratory procedure is taught by EPA in the "Quality Assurance for Source Emissions Workshop" at Research Triangle Park and is approved by EPA.

WEIGHING PROCEDURE - SARTORIUS ANALYTICAL BALANCE

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

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

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

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

Form REC#8

(13)

SAMPLE ANALYTICAL DATA FORM

Plant Location Valley #5

Sample Location

Blank volume (V_a) 200 ml

Date/Time wt. blank 7-2-91 9:00AM

Date/Time wt. blank 7-2-91 4:30PM

Relative humidity in lab 43 %

Density of Acetone (pa) .7843 mg/ml

Gross wt. 172.2321 mg

Gross wt. 172.2316 mg

Ave. Gross wt. 172.2319 mg

Tare wt. 172,2313 mg

Weight of blank (m_{ab}) 0.0006 mg

Acetone blank residue concentration (C_a) $(C_a) = (M_{ab}) / (V_a) (p_a) = (3.8251 \times 10^{-6}$ mg/g$)$

Weight of residue in acetone wash: $W_a = C_a V_{aw} p_a = (3.8251 \times 10^{-6})(300)(.7843) = (0.0009)$

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	300	300	300
Date/Time of wt 7-2-91 9:00AM Gross wt	g	169.9878	173.3733	156.3691
Date/Time of wt 7-2-91 4:30PM Gross wt	g	169.9873	173.3730	156.3690
Average Gross wt	g	169.9876	173.3732	156.3691
Tare wt	g	169.9331	173.3311	156.3342
Less acetone blank wt (W_a)	g	0.0009	0.0009	0.0009
Wt of particulate in acetone rinse (m_a)	g	0.0536	0.0412	0.0340

Filter Numbers	#	PT.5092	BS 5039	BS 5035
Date/Time of wt 7-2-91 9:00AM Gross wt	g	0.5729	0.6010	0.6263
Date/Time of wt 7-2-91 4:00PM Gross wt	g	0.5729	0.6011	0.6268
Average Gross wt	g	0.5729	0.6011	0.6266
Tare wt	g	0.5583	0.5804	0.6045

Weight of particulate on filters(s) (m_f)	g	0.0146	0.0207	0.0221
Weight of particulate in acetone rinse	g	0.0536	0.0412	0.0340
Total weight of particulate (m_n)	g	0.0682	0.0619	0.0561

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

Signature of reviewer Bruce Shroder

Valley # 5
Company Name

6-27-91
Date

REFERENCE METHOD 3: GAS ANALYSIS BY FYRITE

FUEL	F_o FACTORS
WOOD	1.0540
BARK	1.0830
ANTHRACITE	1.0699
BITUMINOUS	1.1398
LIGNITE	1.0761
OIL	1.3465
GAS	1.7489
PROPANE	1.5095
BUTANE	1.4791

$O_2\% = 20.9 - [F_o \times CO_2\%]$

RUN #1: 17.4 = 20.9 - [1.7489 x 2]

RUN #2: 17.4 = 20.9 - [1.7489 x 2]

RUN #3 17.4 = 20.9 - [1.7489 x 2]

14:22

RUN 1:	$CO_{2\%}$	2	$CO_{2\%}$	2	$CO_{2\%}$	2	AVG.	2.0
	$O_{2\%}$		$O_{2\%}$		$O_{2\%}$		AVG.	17.4
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.6
RUN 2:	$CO_{2\%}$	2	$CO_{2\%}$	2	$CO_{2\%}$	2	AVG.	2
	$O_{2\%}$		$O_{2\%}$		$O_{2\%}$		AVG.	17.4
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.6
RUN 3:	$CO_{2\%}$	2	$CO_{2\%}$	2	$CO_{2\%}$	2	AVG.	2
	$O_{2\%}$		$O_{2\%}$		$O_{2\%}$		AVG.	17.4
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.6

OHIO BACK-HALF ANALYSIS

EVAPORATION

Plant Location Valley #5

Date 7-1-91

Sample Location

Relative Humidity in lab 44 %

Blank Volume (V_{wb}) 300 ml

Density of Water (ρ_w) = 1.0

Date/Time wt. blank 7-3-91 8:00AM

Gross wt. 126.5690 g

Date/Time wt. blank 7-8-91 9:00AM

Gross wt. 126.5692 g

Ave. Gross wt. 126.5691 g

Tare wt. 126.5690 g

Weight of blank (m_{wb}) 0.0001 g

Water blank residue concentration (C_w) $(C_w) = (M_{wb}) / (V_{wb}) (\rho_w) =$ (3.3333×10^{-7} mg/g)

Weight of blank residue in impinger rinse: $W_w = C_w V_w$

		Run # 1	Run # 2	Run # 3
Impinger rinse volume (V_w)	ml	515	510	495
Date/Time of wt 7-3-91 9:00AM Gross wt	g	174.4689	133.6714	173.4105
Date/Time of wt 7-8-91 9:00AM Gross wt	g	174.4694	133.6719	173.4110
Average Gross wt	g	174.4692	133.6717	173.4108
Tare wt	g	170.4570	133.6500	173.4099
Less Water blank wt (W_w)	g	0.0002	0.0002	0.0002
Wt of particulate in impinger rinse (m_w)	g	0.0120	0.0215	0.0007

Remarks:

Signature of Analyst

Signature of Reviewer Bruce Shrader

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VII. CALCULATIONS

VALLEY ASPHALT PLANT #5
MORROW, OHIO

SUMMARY OF TEST DATA

SAMPLING TRAIN DATA

		6-27-91 RUN #1	6-27-91 RUN #2	6-27-91 RUN #3
	start	11:10	13:46	15:52
	finish	12:33	14:55	17:00
1. Sampling time, minutes	Θ	60.0	60.0	60.0
2. Sampling nozzle diameter, in.	D_n	.2950	.3100	.3100
3. Sampling nozzle cross-sect. area, ft^2	A_n	.000475	.000524	.000524
4. Isokinetic variation	I	106.0	98.1	95.8
5. Sample gas volume - meter cond., cf.	V_m	39.050	39.680	40.500
6. Average meter temperature, ^{o}R	T_m	554	561	577
7. Avg. oriface pressure drop, in. H_2O	dH	1.27	1.27	1.29
8. Total particulate collected, mg.	M_n	68.20	61.90	56.10

VELOCITY TRAVERSE DATA

9. Stack area, ft^2.	A	25.00	25.00	25.00
10. Absolute stack gas pressure, in. Hg.	P_s	29.78	29.78	29.78
11. Barometric pressure, in. Hg.	P_{bar}	29.78	29.78	29.78
12. Avg. absolute stack temperature, R^{o}	T_s	766	768	763
13. Average $-\sqrt{\text{vel. head}}$, (C_p= .84)	$-\sqrt{dP}$	0.57	0.58	0.58
14. Average stack gas velocity, ft./sec.	V_s	40.67	41.69	41.45

STACK MOISTURE CONTENT

15. Total water collected by train, ml.	V_{ic}	289.00	333.30	313.90
16. Moisture in stack gas, %	B_{ws}	26.90	29.74	28.54

EMISSIONS DATA

17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	1835	1803	1836
18. Stack gas flow rate, cfm	acfm	61005	62535	62175
19. Particulate concentration, gr/dscf	C_s	0.0284	0.0257	0.0235
20. Particulate concentration, lb/hr	E	7.45	6.62	6.16
21. Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000

ORSAT DATA

22. Percent CO_2 by volume	CO_2	2.00	2.00	2.00
23. Percent O_2 by volume	O_2	17.40	17.40	17.40
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	80.60	80.60	80.60

Format: summryR3

Dry Gas Volume

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

Where:

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

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

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

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

T_m = Absolute temperature at meter ^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:

$$V_{m(std)} = (17.64)(\ .995)(\ 39.050)\left[\frac{(29.78) + \frac{1.27}{13.6}}{554}\right] = 36.959 \text{ dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(\ .995)(\ 39.680)\left[\frac{(29.78) + \frac{1.27}{13.6}}{561}\right] = 37.086 \text{ dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(\ .995)(\ 40.500)\left[\frac{(29.78) + \frac{1.29}{13.6}}{577}\right] = 36.805 \text{ dscf}$$

Total Contaminants by Weight: GRAIN LOADING

Particulate concentration C_s' gr./dscf.

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

Where:

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

M_n = Total amount of particulate matter collected, mg.

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

Run 1:

$$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{68.20}{36.959} \right] = 0.0284 \text{ gr./dscf.}$$

Run 2:

$$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{61.90}{37.086} \right] = 0.0257 \text{ gr./dscf.}$$

Run 3:

$$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{56.10}{36.805} \right] = 0.0235 \text{ gr./dscf.}$$

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:

$$M_d = 0.44(\ 2.00\%) + 0.32(17.40\%) + 0.28(\ .00\% + 80.60\%) = 29.02\ \frac{lb}{lb\text{-}mole}$$

Run 2:

$$M_d = 0.44(\ 2.00\%) + 0.32(17.40\%) + 0.28(\ .00\% + 80.60\%) = 29.02\ \frac{lb}{lb\text{-}mole}$$

Run 3:

$$M_d = 0.44(\ 2.00\%) + 0.32(17.40\%) + 0.28(\ .00\% + 80.60\%) = 29.02\ \frac{lb}{lb\text{-}mole}$$

Water Vapor Condensed

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

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

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) (275.0) = 12.9 cu.ft

$V_{wsg(std)}$ = (0.04715) (14.0) = 0.7 cu.ft

Run 2:

$V_{wc(std)}$ = (0.04707) (317.0) = 14.9 cu.ft

$V_{wsg(std)}$ = (0.04715) (16.3) = 0.8 cu.ft

Run 3:

$V_{wc(std)}$ = (0.04707) (296.0) = 13.9 cu.ft

$V_{wsg(std)}$ = (0.04715) (17.9) = 0.8 cu.ft

Moisture Content of Stack Gases

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

Where:

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

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

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

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

Run 1:

$$B_{ws} = \frac{12.9 + 0.7}{12.9 + 0.7 + 36.959} \times 100 = 26.90\ \%$$

Run 2:

$$B_{ws} = \frac{14.9 + 0.8}{14.9 + 0.8 + 37.086} \times 100 = 29.74\ \%$$

Run 3:

$$B_{ws} = \frac{13.9 + 0.8}{13.9 + 0.8 + 36.805} \times 100 = 28.54\ \%$$

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 = 29.02 (1 - 26.90) + 18 (26.90) = 26.06 (lb./lb.-mole)

Run 2:

M_s = 29.02 (1 - 29.74) + 18 (29.74) = 25.74 (lb./lb.-mole)

Run 3:

M_s = 29.02 (1 - 28.54) + 18 (28.54) = 25.87 (lb./lb.-mole)

Stack Gas Velocity

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

Where:

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

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

C_p = Pitot tube coefficient, (dimensionless).

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

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

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

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

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

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

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

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

Run 1:

$$V = (85.49)(\ .84)(\ 0.57) \sqrt{\frac{766}{(29.78)(26.06)}} = 40.67 \text{ ft/sec.}$$

Run 2:

$$V = (85.49)(\ .84)(\ 0.58) \sqrt{\frac{768}{(29.78)(25.74)}} = 41.69 \text{ ft/sec.}$$

Run 3:

$$V = (85.49)(\ .84)(\ 0.58) \sqrt{\frac{763}{(29.78)(25.87)}} = 41.45 \text{ ft/sec.}$$

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, ($^{\circ}$f).

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

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

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

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

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

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

Run 1:

$$Q_{sd}=3600(1- \; .2690 \;)(\; 40.67)(\; 25.00) \left[\frac{528}{766} \right] \left[\frac{29.78}{29.92} \right] = 1835702.6 \; \frac{dscf}{hr}$$

Run 2:

$$Q_{sd}=3600(1- \; .2974 \;)(\; 41.69)(\; 25.00) \left[\frac{528}{768} \right] \left[\frac{29.78}{29.92} \right] = 1803924.5 \; \frac{dscf}{hr}$$

Run 3:

$$Q_{sd}=3600(1- \; .2854 \;)(\; 41.45)(\; 25.00) \left[\frac{528}{763} \right] \left[\frac{29.78}{29.92} \right] = 1836126.3 \; \frac{dscf}{hr}$$

Emissions Rate from Stack

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

Where:

E = Emissions rate, lb/hr.

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

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

Run 1:

$$E = \frac{(0.0284)(1835702.6)}{7000} = 7.45 \text{ lb. / hr.}$$

Run 2:

$$E = \frac{(0.0257)(1803924.5)}{7000} = 6.62 \text{ lb. / hr.}$$

Run 3:

$$E = \frac{(0.0235)(1836126.3)}{7000} = 6.16 \text{ lb. / hr.}$$

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, °R.

0.002669 = Conversion factor, Hg - ft^3/ml - °R.

V_{ic} = Ttl vol of liquid collected in impingers and silica gel, ml.

T_m = Absolute average dry gas meter temperature, °R.

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

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:

$$I = (100)(\;766\;) \left[\frac{(0.002669)(289.00) + \frac{39.050}{554} \boxed{29.78 + \frac{1.27}{13.6}}}{60\;(\;60.0\;)\;(\;40.67\;)\;(\;29.78\;)\;(\;.000475\;)} \right] = 106.0\%$$

Run 2:

$$I = (100)(\;768\;) \left[\frac{(0.002669)(333.30) + \frac{39.680}{561} \boxed{29.78 + \frac{1.27}{13.6}}}{60\;(\;60.0\;)\;(\;41.69\;)\;(\;29.78\;)\;(\;.000524\;)} \right] = 98.1\%$$

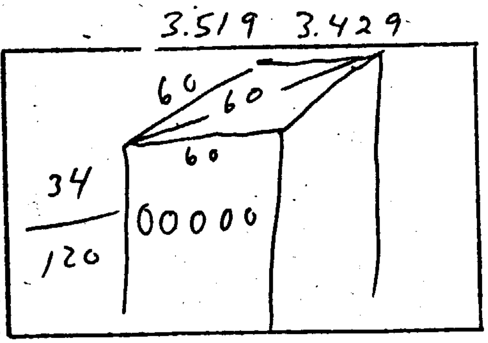
Run 3:

$$I = (100)(\;763\;) \left[\frac{(0.002669)(313.90) + \frac{40.500}{577} \boxed{29.78 + \frac{1.29}{13.6}}}{60\;(\;60.0\;)\;(\;41.45\;)\;(\;29.78\;)\;(\;.000524\;)} \right] = 95.8\%$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Valley #5
Location MORROW, OH
Operator W. J. LOCKETT
Date 6-27-91
Run No. 1
Sample Box No. ~~C-185~~ 1
Meter Box No. C-185
Meter H @ 1.538
C Factor .995
Pitot Tube Coefficient Cp .839



Schematic of Stack Cross Section

Ambient Temperature 80
Barometric Pressure 29.78
Assumed Moisture, % 20
Probe Length, m(ft) 5'

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	475	514
INITIAL	200	500.0
DIFFERENCE	275	14

Nozzle Identification No. .295-.0004746
Avg. Calibrated Nozzle Dia., (in.) .295/.295/.295
Probe Heater Setting 7
Leak Rate, m^3/min. (cfm) .007 @ 6"
Probe Liner Material 316SS
Static Pressure, mm Hg (in. Hg)
Filter No. PT5092

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H20	PRESSURE DIFF. ORF. MTR in H20	GAS SAMPLE VOLUME ft³	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	11:10 / 11:12	24	300	1.1	3.9	209.3 / 211.7	80	80	260	60
2	11:14	4	300	1.0	3.5	213.8	90	78	260	60
3	11:16	3	305	.82	2.9	215.9	94	78	260	55
4	11:18	2	305	.57	2.0	217.6	98	78	260	55
5	11:20	2	305	.38	1.3	219.0	102	80	260	55
6	11:22	2	305	.32	1.1	220.3	104	80	260	55
B 1	11:24 / 11:26	2	305	.87	3.1	222.4	104	80	260	55
2	11:28	2	310	.60	2.1	224.2	104	80	260	55
3	11:30	2	315	.45	1.6	225.7	108	80	260	55
4	11:32	2	320	.35	1.2	227.2	108	80	260	55
5	11:34	2	320	.30	1.0	228.3	108	80	260	50
6	11:36	2	315	.30	1.0	229.6	108	80	260	50

Form #REC-05

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-27-90 LOCATION Vally 5 TEST NO. 1

(28)

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		
C 1	11:38 / 11:40	2	315	.55	1.9	231.3	108	80	260	55
2	11:42	2	310	.37	1.3	232.7	108	80	260	55
3	11:44	2	305	.25	.87	233.8	110	80	260	55
4	11:46	2	305	.22	.76	235.0	110	80	260	55
5	11:48	2	305	.25	.86	236.0	110	80	260	55
6	11:50	2	305	.21	.73	237.1	112	80	260	55
D 7	11:52 / 11:54	2	305	.37	1.3	238.5	112	82	260	55
2	11:56	2	305	.28	.97	239.7	112	82	260	55
3	11:58	2	305	.18	.62	240.7	112	82	260	55
4	12:00	2	305	.15	.52	241.6	112	84	260	55
5	12:02	2	305	.12	.42	242.4	112	84	260	55
6	12:04	2	310	.10	.35	243.2	112	84	260	55
E 1	12:06 / 12:08	2	305	.27	.93	244.3	112	84	260	55
2	12:10	2	305	.22	.76	245.5	112	84	260	55
12:25 / 12:27 3	~~12:12~~	2	290	.15	.52	246.4	98	88	260	55
12:29 4	~~12:14~~	2	295	.10	.35	247.1	106	88	260	55
12:31 5	~~12:16~~	2	295	.06	.21	247.8	108	88	260	55
12:33 6	~~12:20~~	2	300	.05	.17	248.350	110	58	260	55

RAMCON ENVIRONMENTAL CORPORATION

Plant Valley #5

Location MORROW, OH

Operator W. J. LOCKETT

Date 6-27-91

Run No. 2

Sample Box No. 1

Meter Box No. C-165

Meter H @ 1.538

C Factor .995

Pitot Tube Coefficient Cp .839

3.416

Ambient Temperature 90°

Barometric Pressure 29.78

Assumed Moisture, % 30

Probe Length, m(ft) 5'

Nozzle Identification No. .000 5241

Avg. Calibrated Nozzle Dia., (in.) .310/.310/.310

Probe Heater Setting 7

Leak Rate, m³/min. (cfm) .015 @ 9"

Probe Liner Material S/S SS

Static Pressure, mm Hg (in. Hg)

Filter No. BS 5039

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	517	517.5
INITIAL	200	501.2
DIFFERENCE	317	16.3

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	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A	1	13:46 / 13:48	2	300	.30	1.0	249.4 / 250.6	88	88	260	55
	2	13:50	2	300	.22	.75	251.7	162	88	260	55
	3	13:52	2	305	.18	.61	252.6	108	88	260	55
	4	13:54	2	305	.10	.34	253.4	110	88	260	55
	5	13:56	2	300	.07	.24	254.0	110	88	260	55
	6	13:58	2	300	.07	.24	254.6	110	88	260	55
D	1	14:00 / 14:02	3	300	.42	1.4	255.9	110	88	260	55
	2	14:04	3	305	.30	1.0	257.3	110	88	260	55
	3	14:06	3	310	.19	.65	258.3	112	88	260	55
	4	14:08	3	305	.15	.51	259.2	112	88	260	55
	5	14:10	3	305	.13	.44	260.0	114	88	260	55
	6	14:12	3	305	.15	.51	260.9	114	88	260	55

Form #REC-06

RAMCON emissions test log sheet, cont. DATE C-27-91 LOCATION Valley #5 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 Vm (ft.^{3})	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
C 1	14:14 / 14:16	5	305	.74	2.5	262.8	114	88	260	55
2	14:18	3	310	.40	1.4	264.4	114	88	260	55
3	14:20	2	315	.30	1.0	265.6	114	88	260	55
4	14:22	2	315	.23	.79	266.7	116	88	260	55
5	14:24	2	310	.24	.82	267.8	116	88	260	55
6	14:26	2	310	.22	.75	269.0	116	88	260	55
D 1	14:29 / 14:31	6	310	1.1	3.8	271.3	116	88	260	55
2	14:33	6	305	.70	2.4	273.3	116	88	260	55
3	14:35	4	300	.55	1.9	274.9	116	88	260	55
4	14:37	4	300	.40	1.4	276.4	116	88	260	55
5	14:39	3	300	.35	1.2	277.8	116	88	260	55
6	14:41	2	305	.25	.85	279.0	118	88	260	55
E 1	14:43 / 14:45	7	310	.80	2.7	281.0	118	88	260	55
2	14:47	8	320	.85	2.9	283.1	118	88	260	55
3	14:49	6	320	.65	2.2	284.9	118	88	260	55
4	14:51	4	320	.45	1.5	286.4	118	88	260	55
5	14:53	3	320	.35	1.2	287.8	118	88	260	55
6	14:55	3	315	.28	.96	289.080	118	88	260	55

RAMCON ENVIRONMENTAL CORPORATION

Plant Valley # 5
Location Morrow, OH
Operator W. J. Lockett
Date 6-29-91
Run No. 3
Sample Box No. 1
Meter Box No. C-185
Meter H @ 1.538
C Factor .995
Pitot Tube Coefficient Cp .839

3.416

Schematic of Stack Cross Section

Ambient Temperature 91
Barometric Pressure 29.78
Assumed Moisture, % 30
Probe Length, m(ft) 5'
Nozzle Identification No. .005241
Avg. Calibrated Nozzle Dia., (in.) .310/.310/.310
Probe Heater Setting 7
Leak Rate, m3/min.(cfm) .0018 5"
Probe Liner Material 516 SS
Static Pressure, mm Hg(in.Hg)
Filter No. BS 5038

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	496	439.1
INITIAL	200	421.2
DIFFERENCE	296	17.9

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
A 1	15:52 / 15:54	2	305	.30	1.0	289.8 / 290.0	90	90	260	55
2	15:56	2	305	.25	.85	292.2	108	90	260	55
3	15:58	2	305	.17	.58	293.1	112	90	260	55
4	16:00	2	305	.10	.34	293.9	114	90	260	55
5	16:02	2	306	.10	.34	294.6	116	90	260	50
6	16:04	2	305	.07	.24	295.2	116	90	260	50
B 1	16:06 / 16:08	2	305	.55	1.9	296.9	116	90	260	50
2	16:10	2	300	.30	1.0	298.0	116	90	260	50
3	16:12	2	300	.15	.51	299.1	116	90	260	50
4	16:14	2	305	.14	.48	299.9	118	90	260	50
5	16:16	2	305	.14	.48	300.8	118	90	260	50
6	16:18	2	300	.14	.48	301.6	118	90	260	50

Form #REC-05

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-27-91 LOCATION Valley #5 TEST NO. 3

TRAVERSE POINT		SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft.^{3})	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
C	1	16:20 / 16:22	3	300	.65	2.2	303.5	118	90	260	55
	2	16:24	2	305	.50	1.7	305.1	118	90	260	55
	3	16:26	2	305	.29	.99	306.4	120	90	260	55
	4	16:28	2	305	.25	.85	307.5	120	90	260	55
	5	16:30	2	300	.24	.82	308.7	120	90	260	55
	6	16:32	2	300	.20	.68	309.7	120	90	260	55
D	1	16:34 / 16:36	4	300	1.0	3.4	312.0	120	90	260	55
	2	16:38	3	305	.67	2.3	313.8	120	90	260	55
	3	16:40	3	305	.42	1.4	316.6	120	90	260	55
	4	16:42	3	305	.35	1.2	316.[illegible]	120	90	260	55
	5	16:44	2	305	.32	1.1	317.2	120	90	260	55
	6	16:46	2	305	.30	1.0	319.5	120	90	260	55
E	1	16:48 / 16:50	3	305	.85	2.9	321.5	120	90	260	55
	2	16:52	3	300	.90	3.1	323.8	120	90	260	55
	3	16:54	3	300	.83	2.8	325.8	120	90	260	55
	4	16:56	2	295	.48	1.6	327.3	120	90	260	55
	5	16:58	2	295	.40	1.4	328.9	120	90	260	55
	6	17:00	2	295	.32	1.1	330.30	120	90	260	55

IX. CALIBRATION

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number ________ Date 7-15-91 Meter box number C-185 Plant ________

Barometric pressure, P_b = 30.13 in. Hg Dry gas meter number 638609 Pretest Y ________

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter						$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Average (t_d),[a] °F				
.5	~~10~~ 5	736.4 741.474	77	100 102	78 78	89.5	11.98	1	1.007	1.585
1	10	742.1 752.246	77	100 104	78 80	90.5	16.81	1	1.008	1.557
2	10	753.0 763.125	77	102 106	80 80	92	11.96	1	1.01	1.572
									Y = 1.008	1.571

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

where

V_w = Gas volume passing through the wet test meter, ft^3.
V_d = Gas volume passing through the dry gas meter, ft^3.
t_w = Temperature of the gas in the wet test meter, °F.
t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.
t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.
ΔH = Pressure differential across orifice, in. H_2O.
Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.
Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y $\pm 0.05Y$.
P_b = Barometric pressure, in. Hg.
θ = Time of calibration run, min.

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number ______ Date 6-23-91 Meter box number C-185 Plant ______

Barometric pressure, P_b = 29.97 in. Hg Dry gas meter number 638809 Pretest Y ______

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter						$\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Average[a] (t_d), °F				
.5	~~10~~ 5	906.7 911.885	75.2	98 100	82 82	90.5	11.767	1	.991	1.524
1	10	912.6 922.910	75.2	98 102	82 82	91	16.659	1	.996	1.526
2	10	923.7 933.965	75.2	100 104	82 92	91.5	11.933	1	.999	1.565
									Y = .995	1.538

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

where

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in. H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y $\pm 0.05Y$.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Quality Assurance Handbook M4-2.4A

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-7-89 Thermocouple number Hotbox

Ambient temperature 20 °C Barometric pressure 29.86 in. Hg

Calibrator Turner Reference: mercury-in-glass ✓

other

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	Ice Bath	32°F	32	0
B	Boiling water	212	212	0
C	Boiling oil	381	381	0
D	Ambient 6-27-91	80°F	80°F	0

[a] Type of calibration system used.

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

Quality Assurance Handbook M5-2.5

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-7-89 Thermocouple number inlet/outlet

Ambient temperature 20 °C Barometric pressure 29.88 in. Hg

Calibrator Turner Reference: mercury-in-glass ✓

other ____

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	Ice Bath	32	32	0
B.	Boiling water	212	212	0
C	Boiling oil	381	381	0
D	Ambient 6-27-91	80°F	80°F	0%

[a] Type of calibration system used.

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

Quality Assurance Handbook M5-2.5

RAMCON

Lear Siegler Stack Sampler

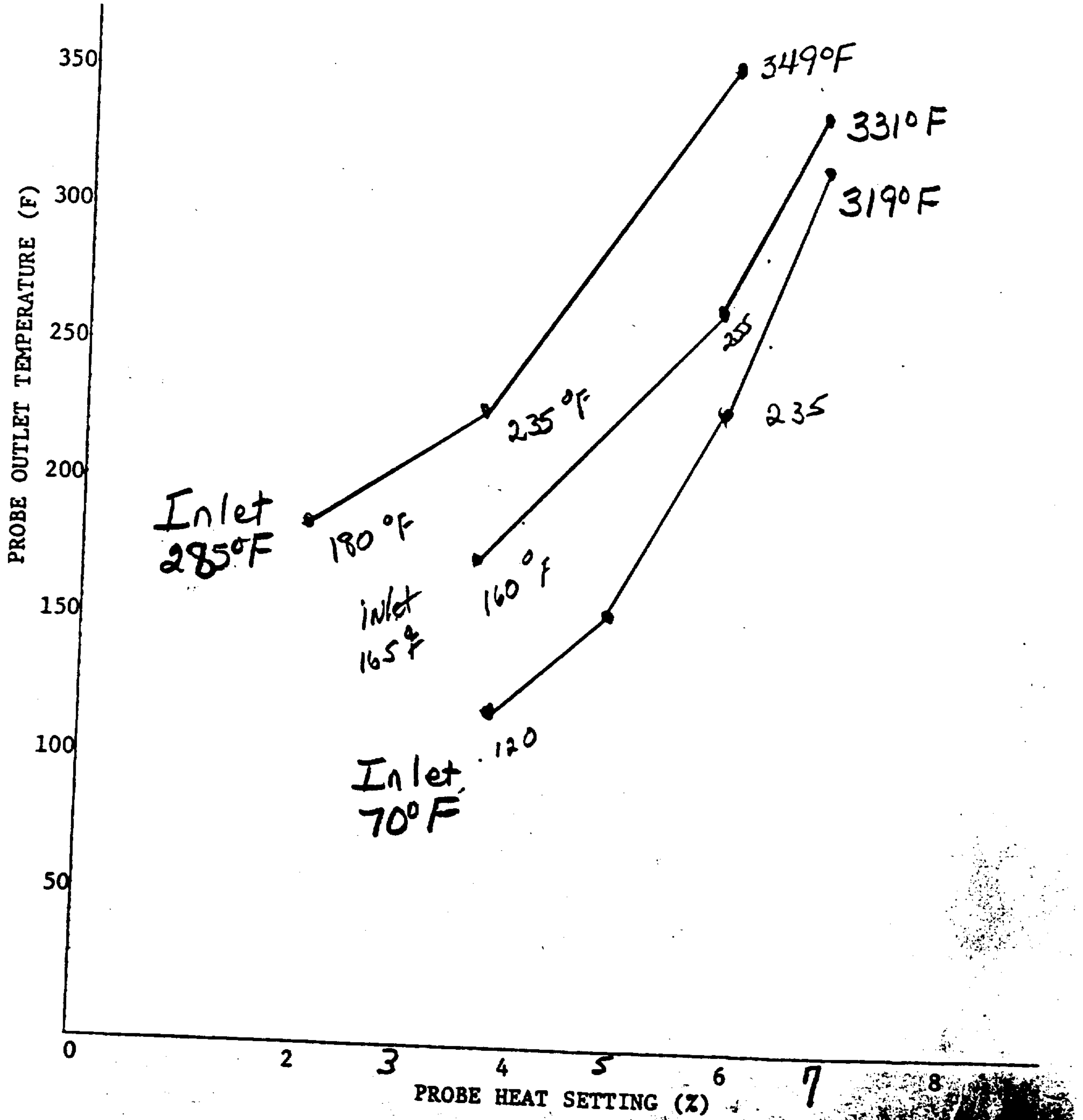
Heating Probe Calibration

Probe No. 51 Probe Length 5'

Date of Calibration 5-4-90 Signature Tom T. Terry

Name of Company to be tested

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



Form No. EED-17-2

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 4/1/91 Thermocouple number 51

Ambient temperature 70 °C Barometric pressure 30.15 in. Hg

Calibrator ______ Reference: mercury-in-glass ✓

other ______

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] %
A	Ice H_2O	32	32	
B	Boilg H_2O	212	212	
C	Boilg Oil	392	392	
D	Ambnt	70	70	
	6-27-91	80°F	80°F	0

---

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

[b] Type of calibration system used.

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

Pitot Tube Calibration (S Type)

Pitot Tube Identification No. 51 Date: 4-1-91

Calibrated by: Ray Jul

"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	.85	1.2	.841	.002
2	.52	.74	.838	.001
3	1.2	1.7	.840	.001
		$\bar{C}_p$ (SIDE A)	.839	

"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	.95	1.2	.841	.002
2	.52	.74	.838	.001
3	1.2	1.7	.840	.001
		$\bar{C}_p$ (SIDE B)	.839	

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

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

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

X. RAMCON PERSONNEL

Name: Mr. G. Sumner Buck, III
Title: President

Qualifications:

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

Project Duties:

Mr. Buck will be responsible for the overall supervision of the project. He provided supervision for the project preparation, testing schedules for each team on-site, and overall organization between the testing crews and facility.

Name: **Mr. Bruce Schrader**
Title: Senior Laboratory Technician

Qualifications:

Mr. Schrader has been serving as Laboratory Technician for 4 years. He is proficient in conducting many analysis procedures such as front and back-half particulate analysis, titrations, extractions, gas chromatography, etc. He received a associate degree in Chemical Engineering from State Technical Institute in Memphis. He also attended Memphis State University where he obtained a bachelor of science degree in Mechanical Engineering. He has experience in conducting isokinetic sampling as well as instrumentation methods.

Project Duties:

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

Name: **Mr. Paul Taverna**
Title: Assistant Laboratory Technician

Qualifications:

Mr. Taverna is currently serving as Assistant Laboratory Technician. He is proficient in conducting many analysis procedures such as front and back-half particulate analysis, titrations, extractions, etc. He is currently a senior at Memphis State University and is majoring in Biomedical Engineering with a minor in Chemistry.

Project Duties:

Mr. Taverna assists Bruce Shrader in conducting the laboratory analysis on the particulate samples. He is responsible for tare weighing the filters, performing the final weighing of the prepared samples and recording the analysis data in the laboratory record books.

Name: **Mr. Bill Lockett**
Title: Team Leader

Qualifications:

Mr. Lockett has been employed by RAMCON Environmental Corp. for three years. He has recently completed Team Leader training in isokinetic and proportional test methods. He currently is certified in conducting Method 9 for opacity. He has been involved in conducting tests on process stacks, incinerators, boilers, etc. He has served as a Field Technician for over two years, however he has recently been upgraded to Team Leader.

Project Duties:

Mr. Lockett is responsible for conducting isokinetic sampling procedures at the facility(s). He is responsible for preparation, calibration and cleaning of the necessary equipment for this testing. His duties on-site include assembling the sample train, leak checking the system, operation of the train and recording the test data on the field data forms.