AP42 Section: 11.1

Reference Number: 322

Title: Source Sampling For Particulate Emissions, Walls Bros. Asphalt & Manufacturing, Inc., Brookville, OH,

Ramcon Environmental Corp., Memphis, TN,

April 2, 1991.

AP-42 Section 11.1
Reference
Report Sect. 4
Reference 321 322

RECEI

MAY 0 3 1991

REGIONAL AIR POLLUTION CONTROL AGENCY

RAMCON

ENVIRONMENTAL CORPORATION

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
WALLS ASPHALT & MANUFACTURING, INC.
BROOKVILLE, OHIO
April 2, 1991

Jim Walls
Walls Asphalt & Manufacturing

G. Sumner Buck, III
President

Tommy Crook
Team Leader

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

APPENDIX K

OEPA STACK TEST REVIEW SUMMARY FORM

APPLICATION NUMBER 08-57711455

FACILITY NAME Walls Asphalt

SOURCE DESCRIPTION (OR SCC CODE)

Batch Mix Asphalt Plant

CONTROL EQUIPMENT Baghouse

DATE(S) OF TEST 4-2-91

FINAL TEST REPORT RECEIVED ON 5-3-91

POLLUTANT(S) TESTED PM & Pb

TEST METHOD Methods 5 & 12

TEST FIRM Ramcon Environmental Corp

EMISSION RATES*:

ACTUAL (lb(s)/hr) 0.0166 gr/DSCF ALLOWABLE** 0.04 gr/DSCF

OPERATING RATES*:

DURING TEST** 231 Tons MAXIMUM** 232 Tons

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:

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

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

6-5-91
DATE OF REVIEW

Jon Hiety
REVIEWED BY

* BASED ON 3 RUN AVERAGE

** SPECIFY APPLICABLE UNITS

***SPECIFY IN UNITS OF MASS/INPUT

==========

13:42:39 06-05-1991
PROGRAM: STACK.BAS, VERSION: 9-JAN-87

PARTICULATE EMISSION TEST DATA

FACILITY :walls bros asphalt
PROCESS/RUN NUMBER :1
SOURCE/RUN :
TEST DATE :4-2-91

****

VOLUME METERED AT STD. CONDITIONS = 43.49558086875246 DSCF

VOLUME WATER COLLECTED AT STP. = 14.883534 SCF
PERCENT MOISTURE BY VOLUME = 25.49462086477512 %

MOLECULAR WEIGHT OF STACK GAS = 26.38930569062632 LB/LB-MOL
PERCENT EXCESS AIR = 269.471488178025 %

AVERAGE STACK GAS VELOCITY = 40.91425394191616 FT/SEC
ABSOLUTE STACK PRESSURE = 29.77352941176471 IN. HG

STACK FLOW RATE AT ACTUAL COND. = 48193.71800326188 ACFM
STACK FLOW RATE AT STD. COND. = 28476.39410492174 DSCFM

STACK EMISSIONS = 22.49106645918576 GR/DSCF
= 3.213973397017645E-003 LB/DSCF

STACK EMISSION RATE = 5491.342385772512 LB/HR

ISOKINETIC VARIATION = 101.81931102896 %

****
SOURCE TYPE: NON-BOILER
LEAKAGE =UNDER 0.02 CFM
TIME OF TEST = 60 MIN
VOLUME METERED = 45.54 CU.FT
DRY GAS METER CALB. FACT. = .977
TEST BAR. PRESSURE = 29.7 IN HG
AVERAGE DELTA H = 1.57
AVG. METER TEMP. = 78 DEG. F
VOL. H2O (IMPINGERS) = 300 ML
WEIGHT GAIN OF SILICA GEL = 16.2 GM
%CO2 = 4 %
%CO = 0 %
%O2 = 15.5 %
%N2 = 80.5 %
STATIC P OF STACK = 1 IN. H2O
STACK TEMP. = 202.25 DEG. F
PITOT COEFFICIENT = .881
AVG. ROOT DELTA P = .5917
STACK DIAMETER = 60 IN.
MASS PARTICULATE = 63.4 MG
NOZZLE DIAMETER = .3 IN

==========

13:44:16 06-05-1991
PROGRAM: STACK.BAS, VERSION: 9-JAN-87

PARTICULATE EMISSION TEST DATA

FACILITY :walls bros asphalt
PROCESS/RUN NUMBER :2
SOURCE/RUN :
TEST DATE :4-2-91

****

VOLUME METERED AT STD. CONDITIONS = 43.74481872225334 DSCF

VOLUME WATER COLLECTED AT STP. = 14.158656 SCF
PERCENT MOISTURE BY VOLUME = 24.45216987048719 %

MOLECULAR WEIGHT OF STACK GAS = 26.47344462732616 LB/LB-MOL
PERCENT EXCESS AIR = 273.4539335296591 %

AVERAGE STACK GAS VELOCITY = 41.96956981299355 FT/SEC
ABSOLUTE STACK PRESSURE = 29.77352941176471 IN. HG

STACK FLOW RATE AT ACTUAL COND. = 49436.79567412136 ACFM
STACK FLOW RATE AT STD. COND. = 29685.04743336851 DSCFM

STACK EMISSIONS = 11.00509761068229 GR/DSCF
= 1.572628448566499E-003 LB/DSCF

STACK EMISSION RATE = 2801.013005445674 LB/HR

ISOKINETIC VARIATION = 98.23309204152997 % ✓

****

SOURCE TYPE: NON-BOILER
LEAKAGE =UNDER 0.02 CFM
TIME OF TEST = 60 MIN
VOLUME METERED = 45.936 CU.FT
DRY GAS METER CALB. FACT. = .977
TEST BAR. PRESSURE = 29.7 IN HG
AVERAGE DELTA H = .3779
AVG. METER TEMP. = 78 DEG. F
VOL. H2O (IMPINGERS) = 285 ML
WEIGHT GAIN OF SILICA GEL = 15.8 GM
%CO2 = 3.7 %
%CO = 0 %
%O2 = 15.6 %
%N2 = 80.7 %
STATIC P OF STACK = 1 IN. H2O
STACK TEMP. = 200.79 DEG. F
PITOT COEFFICIENT = .881
AVG. ROOT DELTA P = .6086
STACK DIAMETER = 60 IN.
MASS PARTICULATE = 31.2 MG
NOZZLE DIAMETER = .3 IN

13:45:45 06-05-1991
PROGRAM: STACK.BAS, VERSION: 9-JAN-87

PARTICULATE EMISSION TEST DATA

FACILITY :walls bros asphalt
PROCESS/RUN NUMBER :3
SOURCE/RUN :
TEST DATE :4-2-91

****

VOLUME METERED AT STD. CONDITIONS = 43.49558086875246 DSCF

VOLUME WATER COLLECTED AT STP. = 15.368355 SCF
PERCENT MOISTURE BY VOLUME = 26.10826947465162 %

MOLECULAR WEIGHT OF STACK GAS = 26.28769649572308 LB/LB-MOL
PERCENT EXCESS AIR = 273.4539335296591 %

AVERAGE STACK GAS VELOCITY = 41.47616562957153 FT/SEC
ABSOLUTE STACK PRESSURE = 29.77352941176471 IN. HG

STACK FLOW RATE AT ACTUAL COND. = 48855.6050183849 ACFM
STACK FLOW RATE AT STD. COND. = 28222.73739019087 DSCFM

STACK EMISSIONS = 15.11229386689769 GR/DSCF
= 2.159546793579679E-003 LB/DSCF

STACK EMISSION RATE = 3656.899322221682 LB/HR

ISOKINETIC VARIATION = 102.7345790906306 %

****
SOURCE TYPE: NON-BOILER
LEAKAGE =UNDER 0.02 CFM
TIME OF TEST = 60 MIN
VOLUME METERED = 45.54 CU.FT
DRY GAS METER CALB. FACT. = .977
TEST BAR. PRESSURE = 29.7 IN HG
AVERAGE DELTA H = 1.57
AVG. METER TEMP. = 78 DEG. F
VOL. H2O (IMPINGERS) = 312 ML
WEIGHT GAIN OF SILICA GEL = 14.5 GM
%CO2 = 3.7 %
%CO = 0 %
%O2 = 15.6 %
%N2 = 80.7 %
STATIC P OF STACK = 1 IN. H2O
STACK TEMP. = 211.8 DEG. F
PITOT COEFFICIENT = .881
AVG. ROOT DELTA P = .5944
STACK DIAMETER = 60 IN.
MASS PARTICULATE = 42.6 MG
NOZZLE DIAMETER = .3 IN

OFFICE 513-337-7721

PLANTS:
FT. JEFFERSON 513-548-7158
PHILLIPSBURG 513-832-2404

WALLS ASPHALT MFG., INC.

MANUFACTURERS & SUPPLIERS OF ASPHALTIC CONCRETE,
COLD PATCH MATERIALS AND LIQUID ASPHALT MATERIALS

10920 COLETOWN-LIGHTSVILLE ROAD

ANSONIA, OHIO 45303

May 20, 1991

Regional Air PollutionControl Agency
451 W. Third Street
Dayton, Ohio 45422

Attn: Mr. Curtis Marshall

Ref: Phillipsburg Lead Test Results

Dear Mr. Marshall

We have received the enclosed report from Ramcon concerning the lead test results which refers to our Phillipsburg plant test run on April 2, 1991.

With Kindest regards, we are

Yours very truly

WALLS ASPHALT MFG., INC.

James Walls
Sec. & Treas.

JW/cw

cc/ Dane Marsee
Enc.

RAMCON
ENVIRONMENTAL CORPORATION

May 13, 1991

Mr. Jim Walls
Walls Asphalt & Manufacturing
10920 Coletown-Lightsville
Ansonia, Ohio 45303

RE: Lead Emissions Determination: Brookville, Ohio

Dear Mr. Walls:

Enclosed are the lead emission values reported in lb/hr that were calculated based upon the lead analysis and air flow data for the April 2, 1991 testing that was conducted at your Brookville, Ohio facility. As we discussed, the lead analysis results were below the analysis detection limitation for each sample. However, these detection limitations were reported by the laboratory and the emission values have been calculated on that basis. This provides a maximum lb/hr value for the test.

If you have any questions or if I can be of further assistance in this matter, please contact me at your convenience. Thank you.

Sincerely,

G. Sumner Buck, III
President

GSBIII:djb
Enclosure

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

NAME: WALLS ASPHALT & MANUFACTURING DATE: APRIL 2, 1991

LEAD
EMISSIONS RATE FROM STACK

$$E = \frac{(C_S)\ (Q_{SD})}{7{,}000}$$

Where:

E = Emissions rate, lbs/hr.

C_S = Concentration of Lead 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: $E = \frac{(<3.31 \times 10^{-5})\ (1{,}683{,}682.0)}{7{,}000} = <0.008$ lbs/hr

Run #2: $E = \frac{(<2.83 \times 10^{-5})\ (1{,}766{,}908.2)}{7{,}000} = <0.007$ lbs/hr

Run #3: $E = \frac{(<2.17 \times 10^{-5})\ (1{,}666{,}845.0)}{7{,}000} = <0.005$ lbs/hr

NAME: WALLS ASPHALT & MANUFACTURING DATE: APRIL 2, 1991

TOTAL CONTAMINANTS BY WEIGHT

Lead Concentration: C_S gr/dscf

$$C_S = \left[\frac{0.0154\ gr}{mg}\right] \left[\frac{M_N}{V_{M(STD)}}\right]$$

Where:

C_S = Concentration of Lead in stack gas, dry basis, corrected to standard conditions, gr/dscf.

M_N = Total amount of Lead collected, mg.

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

Run #1: $C_S = (0.0154)\left[\frac{<0.09}{41.929}\right] = <3.31 \times 10^{-5}$ gr/dscf

Run #2: $C_S = (0.0154)\left[\frac{<0.08}{43.477}\right] = <2.83 \times 10^{-5}$ gr/dscf

Run #3: $C_S = (0.0154)\left[\frac{<0.06}{42.675}\right] = <2.17 \times 10^{-5}$ gr/dscf

RAMCON
ENVIRONMENTAL CORPORATION

April 24, 1991

Mr. Jim Walls
Walls Asphalt & Manufacturing
10920 Coletown-Lightsville
Ansonia, OH 45303

Re: Particulate Emissions Test: Brookville, Ohio

Dear Mr. Walls:

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. Jeffrey W. Adams
Regional A.P.C. Agency
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. Please let us know if we can be of further assistance.

Sincerely,

G. Sumner Buck, III
President

GSBIII:kh

Enclosures

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

TABLE OF CONTENTS

I. INTRODUCTION

On April 2, 1991 personnel from RAMCON Environmental Corporation conducted a source emissions test for particulate emissions compliance at Walls Asphalt Manufacturing Company's Barber-Greene batch mix asphalt plant located in Brookville, Ohio. RAMCON personnel conducting the test were Tommy Crook, Team Leader, and Billy Lockett. Heather Baldick 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 Ms. Baldick.

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. Jeffrey Adams of Ohio's Regional Air Pollution Control Agency observed the testing conducted by RAMCON Environmental.

TABLE I
SUMMARY OF TEST RESULTS

April 2, 1991

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	10:30 to 11:37	0.0233 gr/DSCF	99.4%	5.6 lbs/hr
2	13:50 to 14:57	0.0111 gr/DSCF	98.4%	2.8 lbs/hr
3	16:01 to 17:10	0.0154 gr/DSCF	102.2%	3.7 lbs/hr
	Average:	0.0166 gr/DSCF		4.0 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

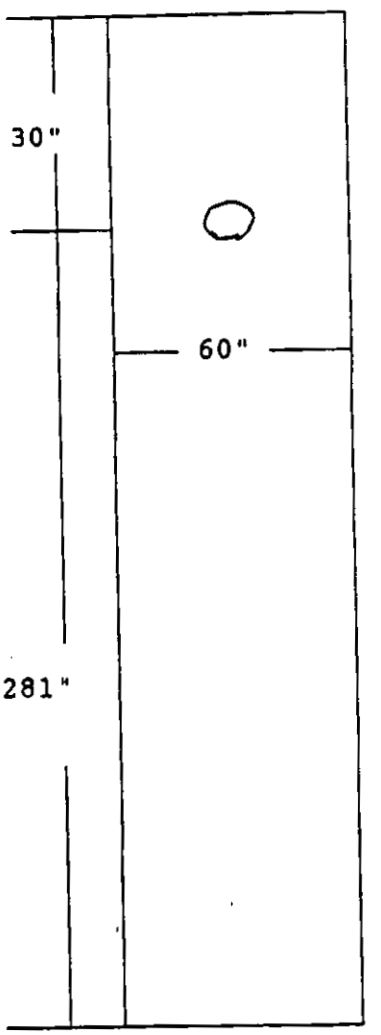
A. Method Used: Method 5 source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

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

C. Sampling Site: The emissions test was conducted after a baghouse on a round stack with a diameter of 60". The sampling ports were placed 30" down (0.5 diameters upstream) from the top of the stack and 281" up (4.7 diameters downstream) from the last flow disturbance. Twenty four points were sampled, twelve through each traverse for 2.5 minutes each for a total testing time of 60 minutes.

Points on a Diameter	Probe Mark
1	*7.3"
2	10.0"
3	13.1"
4	16.6"
5	21.0"
6	27.3"
7	44.7"
8	51.0"
9	55.4"
10	58.9"
11	62.0"
12	64.7"

Measurements include a 6" standoff



IV. THE SOURCE

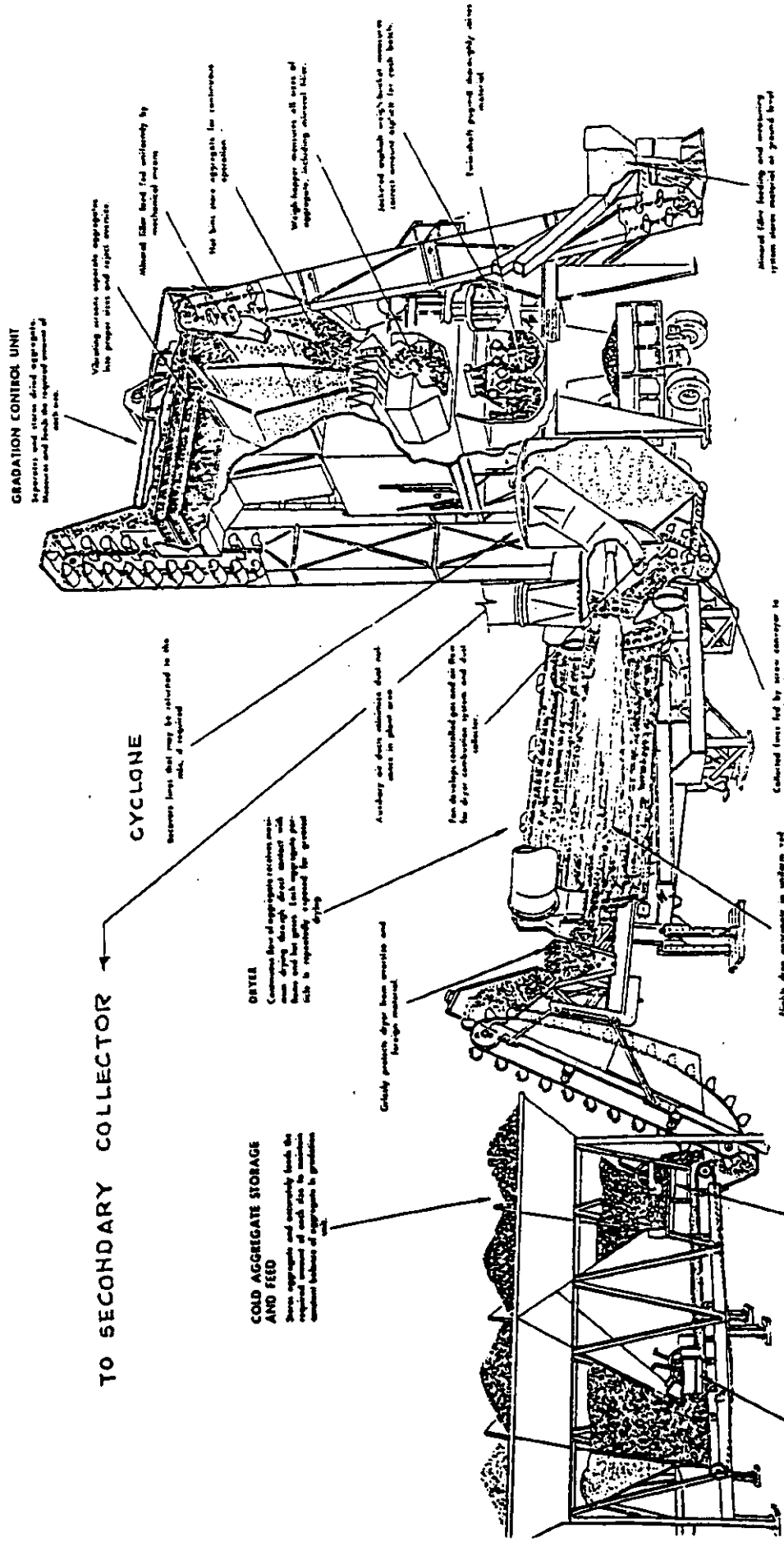
Walls Asphalt & Manufacturing employs a Gencor/H & B batch mix asphalt plant which is used to manufacture hot mix asphalt for road pavement. The process consists of blending prescribed portions of cold feed materials (sand, gravel, screenings, chips, etc.) uniformly and adding sufficient hot asphalt oil to bind the mixture together. After the hot asphalt mix is manufactured at the plant, it is transported to the location where it is to be applied. The hot asphalt mix is spread evenly over the surface with a paver 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 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^{o}F. The dried aggregate is pulled by a bucket elevator to the top of a gradation control unit which separates and stores the aggregate by size. The required amount of each aggregate is dispensed into a weigh-hopper and from there into a pugmill where the hot liquid asphalt 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 waste oil (fuel oil NA1993, combustible liquid, off-specification used oil, vis. 90) 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 Gentec. 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

DATA SUMMARY ON STACK BEING TESTED

AGGREGATE

1. Name/type of mix 404 State Surface
2. Name/type of 2nd mix (if used) _____
3. Type/temperature of Liquid Asphalt AC #20 / 300°F
4. Sieve/Screening analysis: _____ % Passing:

	1st mix / 2nd mix		1st mix / 2nd mix		1st mix / 2nd mix
1"	____/____	3/8"	____/____	#____	____/____
3/4"	____/____	#200	____/____	#____	____/____
1/2"	____/____	#____	____/____	#____	____/____

CONTROL SYSTEM

Manufacturer Barber Green - Gen Tec

A. Baghouse:

1. Type of bags Nomex # of bags 600 Sq. ft. of bags _____
2. Air to cloth ratio 5.00 - 1.0 Designed ACFM 60346
3. Type of cleaning - pulse jet ✓ reverse air _____ plenum pulse _____ other _____
4. Cleaning cycle time _____ Interval between cleaning cycle 15 sec
5. Pulse pressure on cleaning cycle 90 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 Wallace Asphalt Mfg Inc. Date April 2-91

Company Representative Edward J Mahlenbrey

Form ...2#0...

DATA ON FACILITY BEING STACK TESTED

COMPANY NAME Walls Asphalt Mfg., Inc. COMPANY REP. Ed Muhlenkamp PHONE (513) 548-2234

LOCATION OF FACILITY 1843 Dayton Cedarville Pike Bro.ville ORIGINAL START-UP DATE ____ DESIGNED CAPACITY ____

OEM Barber Greene MODEL NO. CF130L245 TYPE Fabric Filter AC TYPE #20

1 Time (24 HR) NOTE: check small box in column when moisture sample is taken	2 Fuel Use (✓ Fuel Oil, Nat. Gas, Propane, Coal, Waste oil, 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 Venturi Scrubber / ☑ Baghouse: Water Pressure psi	10 Ambient Temp. °F	11 Relative Humidity %	12 Exhaust Damper Position
10:30	Off	32%		215		6.48	350	285	8½				76%
10:48	spec	30%		216		6.50	360	298	7				62%
11:00 ✓	used	34%		214		6.50	345	275	8				72% (2)
11:15	oil	34%		218		6.51	335	270	7½				62%
11:32		38%		220		6.49	350	290	7				62%
1:50		34%				6.50	350	280	6				58%
2:10		40%				6.50	345	275	6				58%
2:25		50%				6.49	340	288	6				58%
2:40		40%				6.51	330	270	7½				70%
2:55		42%		231		6.50	325	265	7½				70%
4:00		40%				6.49	325	270	6½				60%
4:15		45%				6.49	325	265	6½				60%
4:30		45%				6.50	325	270	7				70%
4:45		45%				6.45	330	280	8				75%
5:00		50%		230		6.50	325	270	8				80%

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.

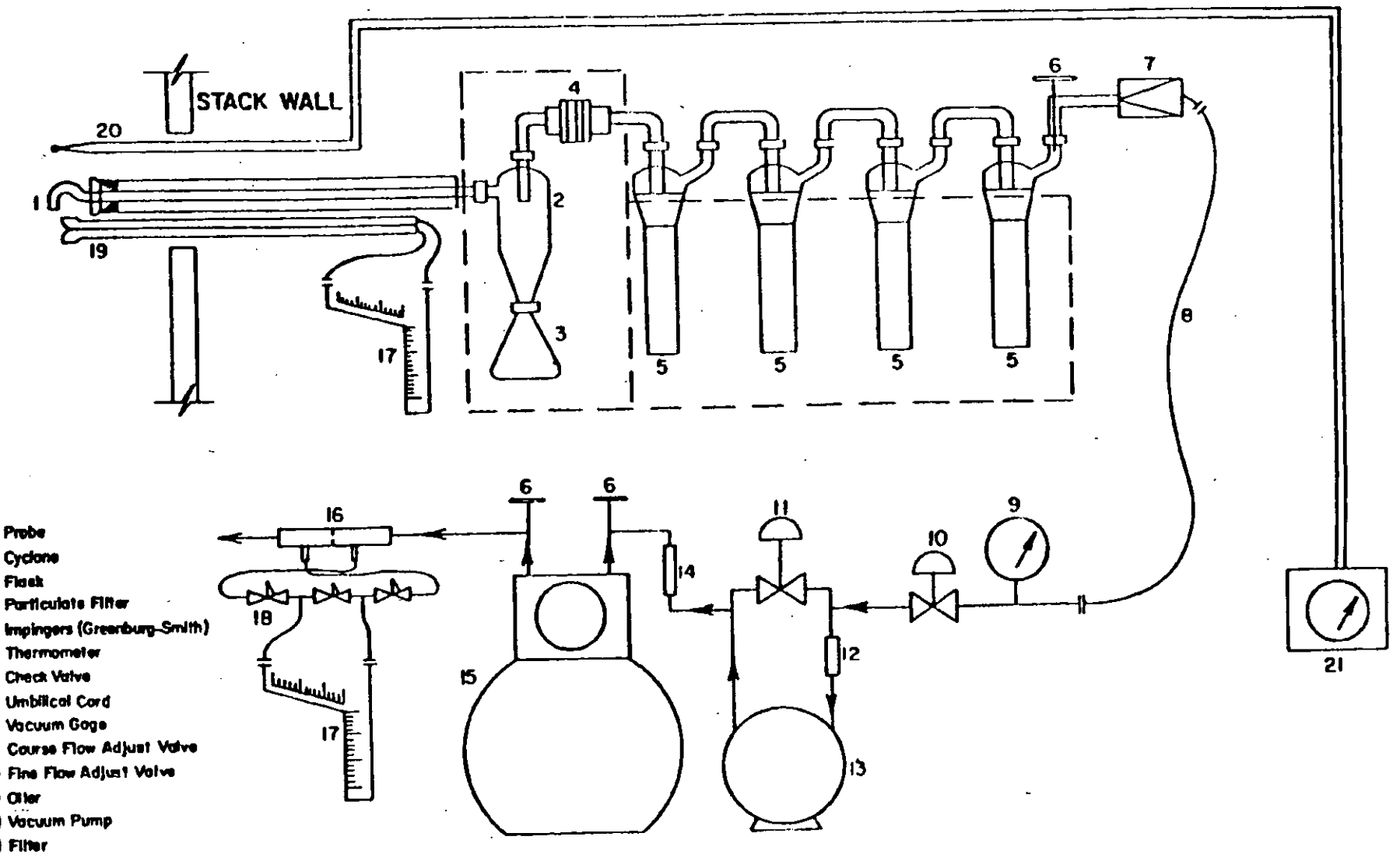
B. An Airguide Instruments Model 211-B (uncorrected) aneroid barometer was used to check the barometric pressure.

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.



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

SAMPLING TRAIN
USED FOR ISOKINETIC SAMPLING

LABORATORY PROCEDURES FOR PARTICULATE SAMPLING

I. Field Preparation

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

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

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

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

II. Post - Testing Lab Analysis

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

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

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

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

E. ACETONE: A blank analysis of acetone is conducted from the one gallon glass container used in the field preparation. This acetone was used in the field for rinsing the probe, nozzle, and top half of the filter holder. A blank analysis is performed prior to testing on all new containers of acetone received from the manufacturer to insure that the quality of the acetone used will be exceed the .001% residual purity standard.

SPECIAL NOTE

When sampling sources high in moisture content, (such as asphalt plants) the filter paper sometimes sticks to the filter holder. When removing the filter, it may tear. In order to maintain control of any small pieces of filter paper which may be easily lost, they are washed with acetone into the probe washing. This makes the filter weight light (sometimes negative) and the probe wash correspondingly heavier. this laboratory procedure is taught by EPA in the "Quality Assurance for Source Emissions Workshop" at Research Triangle Park and is approved by EPA.

WEIGHING PROCEDURE - SARTORIUS ANALYTICAL BALANCE

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

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

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

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

Form REC#8

(12)

SAMPLE ANALYTICAL DATA FORM

Plant Location Walls Bros. | Relative humidity in lab 50 %

Sample Location Watkins asphalt plant | Density of Acetone (pa) .7843 mg/ml

Blank volume (V_a) 300 ml

Date/Time wt. blank 4-10-91 12:20 | Gross wt. 163.4478 mg

Date/Time wt. blank 4-12-91 11:55 | Gross wt. 163.4483 mg

Ave. Gross wt. 163.4481 mg

Tare wt. 163.4471 mg

Weight of blank (m_{ab}) 0.0010 mg

Acetone blank residue concentration (C_a) (C_a) = (M_{ab}) / (V_a) (p_a) = (4.3×10^{-6} mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} p_a$ = ( )( )( ) = (0.0013)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	375	375	375
Date/Time of wt 4-12-91 11:55 Gross wt	g	173.9971	171.8720	174.4868
Date/Time of wt 4-10-91 12:20 Gross wt	g	173.9965	171.8721	174.4867
Average Gross wt	g	173.9968	171.8721	174.4868
Tare wt	g	173.9600	171.8416	174.4505
Less acetone blank wt (W_a)	g	0.0013	0.0013	0.0013
Wt of particulate in acetone rinse (m_a)	g	0.0355	0.0292	0.0350
Filter Numbers	#	HB-4775	HB-4776	HB-4777
Date/Time of wt 4/9 4:15 Gross wt	g	0.5951	0.5629	0.5694
Date/Time of wt 4-12-91 12:10 Gross wt	g	0.5951	0.5631	0.5695
Average Gross wt	g	0.5951	0.5630	0.5695
Tare wt	g	0.5672	0.5610	0.5619
Weight of particulate on filters(s) (m_f)	g	0.0279	0.0020	0.0076
Weight of particulate in acetone rinse	g	0.0355	0.0292	0.0350
Total weight of particulate (m_n)	g	0.0634	0.0312	0.0426

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] Signature of reviewer [signature]

WALLS BROS
Company Name

4-2-92
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: 15.5 = 20.9 - [1.3465 x 4]

RUN #2: 15.6 = 20.9 - [1.3465 x 3.667]

RUN #3 15.6 = 20.9 - [1.3465 x 3.667]

RUN 1:	CO_{2x}	4	CO_{2x}	4	CO_{2x}	4	AVG. 4
	O_{2x}		O_{2x}		O_{2x}		AVG. 15.5
	N_{2x}		N_{2x}		N_{2x}		AVG. 80.5
							3.7
RUN 2:	CO_{2x}	4	CO_{2x}	3	CO_{2x}	4	AVG. 3.667
	O_{2x}		O_{2x}		O_{2x}		AVG. 15.6
	N_{2x}		N_{2x}		N_{2x}		AVG. 80.7
							3.7
RUN 3:	CO_{2x}	4	CO_{2x}	4	CO_{2x}	3	AVG. 3.667
	O_{2x}		O_{2x}		O_{2x}		AVG. 15.6
	N_{2x}		N_{2x}		N_{2x}		AVG. 80.7

AMERICAN INTERPLEX
CORPORATION
LABORATORIES

8600 Kanis Road
Little Rock, Arkansas 72204
(501) 224-5060

Ramcon Environmental Corporation (C-488)
223 Scott Street
Memphis, TN 38112

April 22, 1991

ATTN: Mr. Joe Sewell

Control No. 1832

Description of Sample: Six (6) water/nitric acid samples received on 4/15/91
Re: Walls Brothers; P.O. No. 75692

Results:

Sample Identification	Lead, mg	Volume, ml
Walls Bro. Run 1 BH 4/2/91	<0.05	489
Walls Bro. Run 2 BH 4/2/91	<0.05	487
Walls Bro. Run 3 BH 4/2/91	<0.03	309
Walls Bro. Run 1 PW 4/2/91	<0.04	397
Walls Bro. Run 2 PW 4/2/91	<0.03	269
Walls Bro. Run 3 PW 4/2/91	<0.03	311

Method: 40 CFR Part 60, App. A, Method 12

AMERICAN INTERPLEX CORPORATION

MWM/lb

By Michael W. McNerlin
Michael W. McNerlin
Laboratory Director

WALLS ASPHALT & MANUFACTURING, INC.
BROOKVILLE, OHIO

SUMMARY OF TEST DATA

			4-2-91 RUN #1	4-2-91 RUN #2	4-2-91 RUN #3
SAMPLING TRAIN DATA					
		start	10:30	13:50	16:01
		finish	11:37	14:57	17:10
1.	Sampling time, minutes	Θ	60.0	60.0	60.0
2.	Sampling nozzle diameter, in.	D_n	.3000	.3000	.3000
3.	Sampling nozzle cross-sect. area, ft^2	A_n	.000491	.000491	.000491
4.	Isokinetic variation	I	99.4	98.4	102.2
5.	Sample gas volume - meter cond., cf.	V_m	43.693	46.136	45.540
6.	Average meter temperature, ^oR	T_m	537	547	550
7.	Avg. oriface pressure drop, in. H_2O	dH	1.49	1.61	1.55
8.	Total particulate collected, mg.	M_n	63.40	31.20	42.60
VELOCITY TRAVERSE DATA					
9.	Stack area, ft^2	A	19.60	19.60	19.60
10.	Absolute stack gas pressure, in. Hg.	P_s	29.70	29.70	29.70
11.	Barometric pressure, in. Hg.	P_{bar}	29.70	29.70	29.70
12.	Avg. absolute stack temperature, R^o	T_s	662	669	672
13.	Average $-\sqrt{\overline{vel.\ head}}$, (C_p= .88)	$-\sqrt{d\bar{P}}$	0.59	0.61	0.59
14.	Average stack gas velocity, ft./sec.	V_s	40.85	42.33	41.22
STACK MOISTURE CONTENT					
15.	Total water collected by train, ml.	V_{ic}	316.20	300.80	326.50
16.	Moisture in stack gas, %	B_{ws}	26.22	24.49	26.52
EMISSIONS DATA					
17.	Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	1683	1766	1666
18.	Stack gas flow rate, cfm	acfm	48040	49780	48475
19.	Particulate concentration, gr/dscf	C_s	0.0233	0.0111	0.0154
20.	Particulate concentration, lb/hr	E	5.60	2.80	3.67
21.	Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000
ORSAT DATA					
22.	Percent CO_2 by volume	CO_2	4.00	3.70	3.70
23.	Percent O_2 by volume	O_2	15.50	15.60	15.60
24.	Percent CO by volume	CO	.00	.00	.00
25.	Percent N_2 by volume	N_2	80.50	80.70	80.70

Format: summryR3

WALLS ASPHALT & MANUFACTURING, INC.
BROOKVILLE, OHIO

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:

$$V_{m(std)} = (17.64)(.980)(43.693)\left[\frac{(29.70) + \frac{1.49}{13.6}}{537}\right] = 41.929 \text{ dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(.980)(46.136)\left[\frac{(29.70) + \frac{1.61}{13.6}}{547}\right] = 43.477 \text{ dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(.980)(45.540)\left[\frac{(29.70) + \frac{1.55}{13.6}}{550}\right] = 42.675 \text{ dscf}$$

Format: dgmR3

WALLS ASPHALT & MANUFACTURING, (INC.
BROOKVILLE, OHIO

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:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{63.40}{41.929}\right] = 0.0233 \text{ gr./dscf.}$$

Run 2:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{31.20}{43.477}\right] = 0.0111 \text{ gr./dscf.}$$

Run 3:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{42.60}{42.675}\right] = 0.0154 \text{ gr./dscf.}$$

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:

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

Run 2:

$$M_d = 0.44(\ 3.70\%) + 0.32(15.60\%) + 0.28(\ .00\% + 80.70\%) = 29.22 \ \frac{lb}{lb\text{-mole}}$$

Run 3:

$$M_d = 0.44(\ 3.70\%) + 0.32(15.60\%) + 0.28(\ .00\% + 80.70\%) = 29.22 \ \frac{lb}{lb\text{-mole}}$$

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) (300.0) = 14.1 cu.ft
$V_{wsg(std)}$ = (0.04715) (16.2) = 0.8 cu.ft

Run 2:

$V_{wc(std)}$ = (0.04707) (285.0) = 13.4 cu.ft
$V_{wsg(std)}$ = (0.04715) (15.8) = 0.7 cu.ft

Run 3:

$V_{wc(std)}$ = (0.04707) (312.0) = 14.7 cu.ft
$V_{wsg(std)}$ = (0.04715) (14.5) = 0.7 cu.ft

WALLS ASPHALT & MANUFACTURING, (20)C.
BROOKVILLE, OHIO

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:

$$B_{ws} = \frac{14.1 + 0.8}{14.1 + 0.8 + 41.929} \times 100 = 26.22\ \%$$

Run 2:

$$B_{ws} = \frac{13.4 + 0.7}{13.4 + 0.7 + 43.477} \times 100 = 24.49\ \%$$

Run 3:

$$B_{ws} = \frac{14.7 + 0.7}{14.7 + 0.7 + 42.675} \times 100 = 26.52\ \%$$

Format: bwsR3

WALLS ASPHALT & MANUFACTURING, INC.
BROOKVILLE, OHIO

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:

$M_s = 29.26 (1 - 26.22) + 18 (26.22) = 26.31$ (lb./lb.-mole)

Run 2:

$M_s = 29.22 (1 - 24.49) + 18 (24.49) = 26.47$ (lb./lb.-mole)

Run 3:

$M_s = 29.22 (1 - 26.52) + 18 (26.52) = 26.24$ (lb./lb.-mole)

WALLS ASPHALT & MANUFACTURING, (28)C.
BROOKVILLE, OHIO

Stack Gas Velocity

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

Where:

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

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

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, (^of).

T_s = Absolute stack temperature, (^oR). = 460 + t_s.

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

Run 1:

$$V = (85.49)\ (\ .88)\ (\ 0.59)\ \sqrt{\frac{662}{(29.70)(26.31)}} = 40.85 \text{ ft/sec.}$$

Run 2:

$$V = (85.49)\ (\ .88)\ (\ 0.61)\ \sqrt{\frac{669}{(29.70)(26.47)}} = 42.33 \text{ ft/sec.}$$

Run 3:

$$V = (85.49)\ (\ .88)\ (\ 0.59)\ \sqrt{\frac{672}{(29.70)(26.24)}} = 41.22 \text{ ft/sec.}$$

Format: vsR3

WALLS ASPHALT & MANUFACTURING, (23)C.
BROOKVILLE, OHIO

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:

$$Q_{sd}=3600(1-\ .2622\ )(\ 40.85)(\ 19.60)\left[\frac{528}{662}\right]\left[\frac{29.70}{29.92}\right] = 1683682.0\ \frac{dscf}{hr}$$

Run 2:

$$Q_{sd}=3600(1-\ .2449\ )(\ 42.33)(\ 19.60)\left[\frac{528}{669}\right]\left[\frac{29.70}{29.92}\right] = 1766908.2\ \frac{dscf}{hr}$$

Run 3:

$$Q_{sd}=3600(1-\ .2652\ )(\ 41.22)(\ 19.60)\left[\frac{528}{672}\right]\left[\frac{29.70}{29.92}\right] = 1666845.0\ \frac{dscf}{hr}$$

Format: qR3

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:

$$E = \frac{(0.0233)(1683682.0)}{7000} = 5.60 \text{ lb. / hr.}$$

Run 2:

$$E = \frac{(0.0111)(1766908.2)}{7000} = 2.80 \text{ lb. / hr.}$$

Run 3:

$$E = \frac{(0.0154)(1666845.0)}{7000} = 3.67 \text{ lb. / hr.}$$

Isokinetic Variation

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

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:

$$I = (100)(662)\left[\frac{(0.002669)(316.20) + \frac{43.693}{537}\left[29.70 + \frac{1.49}{13.6}\right]}{60\ (\ 60.0\ )\ (\ 40.85\ )\ (\ 29.70\ )\ (\ .000491\ )} \right] = 99.4\%$$

Run 2:

$$I = (100)(669)\left[\frac{(0.002669)(300.80) + \frac{46.136}{547}\left[29.70 + \frac{1.61}{13.6}\right]}{60\ (\ 60.0\ )\ (\ 42.33\ )\ (\ 29.70\ )\ (\ .000491\ )} \right] = 98.4\%$$

Run 3:

$$I = (100)(672)\left[\frac{(0.002669)(326.50) + \frac{45.540}{550}\left[29.70 + \frac{1.55}{13.6}\right]}{60\ (\ 60.0\ )\ (\ 41.22\ )\ (\ 29.70\ )\ (\ .000491\ )} \right] = 102.2\%$$

WALLS ASPHALT & MANUFACTURING, INC.
BROOKVILLE, OHIO
4-2-91

PERCENT EXCESS AIR

$$\% E_a = \frac{100 \times (\% O_2) - 0.5 (\% CO)}{0.264 (\% N_2) - (\% O_2) + 0.5 (\% CO)}$$

Where: $\%E_a$ = Percent excess air.

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

$\%CO$ = Percent carbon monoxide by volume, dry basis.

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

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

Run # 1: $\frac{100 \times (\% \ 15.50) - .05 (\% \ .00)}{0.264 (\% \ 80.50) - (\% \ 15.50) + 0.5 (\% \ .00)} = 269.5 \%$

Run # 2: $\frac{100 \times (\% \ 15.60) - .05 (\% \ .00)}{0.264 (\% \ 80.70) - (\% \ 15.60) + 0.5 (\% \ .00)} = 273.5 \%$

Run # 3: $\frac{100 \times (\% \ 15.60) - .05 (\% \ .00)}{0.264 (\% \ 80.70) - (\% \ 15.60) + 0.5 (\% \ .00)} = 273.5 \%$

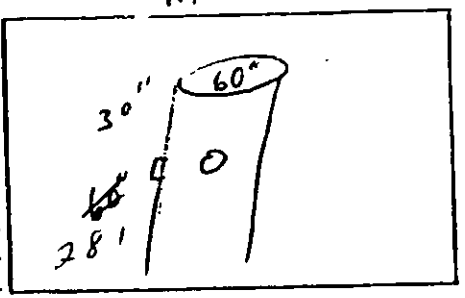
Format:ear3

RAMCON ENVIRONMENTAL CORPORATION

4.18

Plant WALLS BROS

Location ANSONIA, OH
Operator W. T. LOCKETT
Date 4-2-91
Run No. 1
Sample Box No. 1
Meter Box No. C.382
Meter H @ 1.54
C Factor .977
Pitot Tube Coefficient Cp .881



Schematic of Stack Cross Section

		IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
Ambient Temperature	50°		
Barometric Pressure	29.70 FINAL	500	456.0
Assumed Moisture, %	28 INITIAL	200	439.8
Probe Length, m(ft)	6 DIFFERENCE	300	16.2

Nozzle Identification No. .0004908
Avg. Calibrated Nozzle Dia., (in.) .30/.30/.30
Probe Heater Setting 4
Leak Rate, m^3/min. (cfm) .01 @ 8"
Probe Liner Material SS
Static Pressure, mm Hg (in. Hg) 1
Filter No. HB4775

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H_2O	PRESSURE DIFF. ORF. MTR in H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
1	10:30 / 10:32:30	2	197	.33	1.4	507.8 / 507.81	70	70	250	50°
2	10:35	2	195	.31	1.3	511.3	80	68	260	50
3	10:37:30	2	199	.30	1.3	513.03	82	68	265	50
4	10:40	3	201	.30	1.3	514.6	84	68	265	50
5	10:42:30	3	202	.37	1.9	516.4	82	68	265	50
6	10:45	4	203	.34	1.4	518.3	86	68	265	50
7	10:47:30	3	203	.34	1.41	520.3	88	68	265	50
8	10:50	3	204	.28	1.2	522.0	88	68	265	50
9	10:52:30	3	204	.30	1.3	523.8	88	68	265	50
10	10:55	3	204	.34	1.4	225.5	88	68	265	50
11	10:57:30	3	204	.30	1.3	527.4	88	68	265	50
12	11:00	3	204	.31	1.4	529.1	88	68	265	50

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 4-2-91 LOCATION WALLS BSO 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 Vm (ft^3)	GAS SAMPLE TEMP.(°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
							in	out		
1	11:07 / 11:09:30	3	200	.25	1.0	530.6	74	66	265	50
2	11:12	3	200	.25	1.0	532.0	88	68	265	50
3	11:14:30	3	198	.28	1.2	533.7	88	68	265	50
4	11:17	3	204	.23	.96	535.3	88	68	265	50
5	11:19:30	3	204	.25	1.0	536.9	90	68	265	50
6	11:22	3	204	.25	1.0	538.3	90	68	265	50
7	11:24:30	4	204	.50	2.0	540.5	90	68	265	50
8	11:27	4	204	.54	2.3	242.5	90	68	265	50
9	11:29:30	4	204	.63	2.6	544.8	90	68	265	50
10	11:32	4	204	.50	2.0	547.0	90	68	265	50
11	11:34:30	4	204	.55	2.3	549.3	90	68	265	50
12	11:37	4	204	.55	2.3	551.493	90	68	265	50

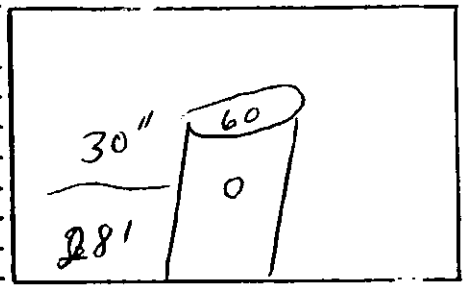
(28)

RAMCON ENVIRONMENTAL CORPORATION

Plant WALLS BROTHERS

Location ANSONIA, OH
Operator W.J. LOCKETT
Date 4-2-91
Run No. 2
Sample Box No. 1
Meter Box No. C-252
Meter H @ 1.54
C Factor .977
Pitot Tube Coefficient Cp .881

4,30



			Impinger Volume, ml	Silica Gel Weight, g
Ambient Temperature	60°			
Barometric Pressure	29.70	FINAL	485	507.7
Assumed Moisture, %	25	INITIAL	200	491.9
Probe Length, m(ft)	6'	DIFFERENCE	285	15.8

Nozzle Identification No. .0064.908
Avg. Calibrated Nozzle Dia., (in.) .30/.30/.30
Probe Heater Setting 4
Leak Rate, m^3/min. (cfm) .001 AT 8"
Probe Liner Material SS
Static Pressure, mm Hg (in.Hg) 1
Filter No. HB 4776

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H_2O	PRESSURE DIFF. ORF. MTR in H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F		FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
							Inlet	Outlet		
1	13:50 / 13:52:30	3	204	.31	1.3	554.2 / 555.7	72	72	260	50
2	13:55	3	204	.31	1.3	557.6	90	74	260	50
3	13:57:30	3	206	.30	1.3	559.3	92	74	260	50
4	14:00	3	206	.25	1.0	560.9	92	74	260	50
5	14:02:30	3	206	.27	1.2	562.5	94	74	260	50
6	14:05	3	208	.33	1.4	564.4	98	74	260	50
7	14:07:30	3	210	.56	2.4	566.6	100	74	260	50
8	14:10	4	210	.54	2.3	569.0	100	74	260	50
9	14:12:30	4	210	.57	2.5	571.6	100	74	260	50
10	14:15	5	216	.60	2.6	573.8	100	74	260	50
11	14:17:30	4	210	.54	2.3	576.3	100	74	260	50
12	14:20	4	210	.54	2.3	578.3	102	74	260	50

(28)

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 4-2-91 LOCATION WALLS BRO 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		
1	14:27 / 14:24:30	3	210	.33	1.4	580.3	90	76	260	50
2	14:32	3	210	.31	1.3	582.6	100	75	260	50
3	14:34:30	3	206	.35	1.5	584.6	102	78	260	50
4	14:37	3	206	.37	1.6	585.9	102	78	260	50
5	14:39:30	3	206	.30	1.3	587.7	102	78	260	50
6	14:42	3	210	.31	1.3	589.4	102	78	260	50
7	14:44:30	3	210	.37	1.6	591.4	102	78	260	50
8	14:47	3	210	.36	1.5	593.2	102	78	260	50
9	14:49:30	3	212	.40	1.7	595.3	102	78	260	50
10	14:52	3	212	.35	1.5	597.1	102	78	260	50
11	14:54:30	3	212	.25	1.0	598.6	102	78	260	50
12	14:57	3	212	.25	1.0	600.136	102	78	260	50

(30)

RAMCON ENVIRONMENTAL CORPORATION

Plant WALLS BROS

Location ANSONIA, OH
Operator W. T. LOCKETT
Date 4-2-91
Run No. 3
Sample Box No. 1
Meter Box No. C-282
Meter H @ 1.54
C Factor .977
Pitot Tube Coefficient Cp .841

4.4

30 / 60
6
281

		IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
Ambient Temperature	62		
Barometric Pressure	29.70 FINAL	512	466.9
Assumed Moisture, %	2.5% INITIAL	200	452.4
Probe Length, m(ft)	6 DIFFERENCE	312	14.5

Nozzle Identification No. .0004908
Avg. Calibrated Nozzle Dia., (in.) .30/.30/.30
Probe Heater Setting 4
Leak Rate, m^3/min. (cfm) .01 @ 10"
Probe Liner Material 316 SS
Static Pressure, mm Hg (in. Hg) 1
Filter No. HB 4777

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 H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F		FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
							Inlet	Outlet		
1	16:01 / 16:03:30	2	210	.33	1.3	601.0 / 602.4	76	76	260	50
2	16:06	2	210	.30	1.3	603.7	90	76	260	50
3	16:08:30	2	210	.32	1.3	605.3	98	76	260	50
4	16:11	2	212	.32	1.3	607.1	102	78	260	50
5	16:13:30	3	212	.36	1.6	609.3	102	78	260	50
6	16:16	3	212	.35	1.5	611.0	104	78	260	50
7	16:18:30	3	212	.34	1.5	612.9	104	78	260	50
8	16:21	3	212	.26	1.1	614.6	104	78	260	50
9	16:23:30	3	210	.31	1.4	616.3	104	78	260	50
10	16:26	3	210	~~.35~~	1.5	618.3	104	78	260	50
11	16:28:30	3	210	.33	1.5	620.2	104	78	260	50
12	16:31	3	210	.31	1.4	622.1	104	78	260	50

Form #REC-05

Form #REC-06

RAMCON emissions test log sheet, cont. DATE_____ LOCATION_____ TEST NO._____

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		
1	16:40 / 16:42:30	3	212	.24	1.1	623.6	102	78	260	50
2	16:45	3	212	.25	1.1	625.3	102	78	260	50
3	16:47:30	3	214	.30	1.3	627.0	104	78	260	50
4	16:50	3	214	.25	1.1	624.3	104	78	260	50
5	16:52:30	3	214	.25	1.1	630.9	104	78	260	50
6	16:55	3	214	.26	1.1	632.5	104	78	260	50
7	16:57:30	4	214	.50	2.2	635.5	104	78	260	50
8	17:00	4	212	.53	2.3	637.1	104	78	260	50
9	17:02:30	4	212	.60	2.6	639.5	104	78	260	50
10	17:05	4	212	.53	2.3	641.9	104	78	260	50
11	17:07:30	4	212	.55	2.4	644.1	104	78	260	50
12	17:10	4	212	.52	2.3	646.54	104	78	260	50

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number ________ Date 3-31-91 Meter box number C222

Barometric pressure, P_b = 29.67 in. Hg Dry gas meter number ________ Plant ________

Pretest Y ________

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: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
1	10	4779.0 / 4784.411	[illegible] 68° F	8[illegible] / 92	6[illegible] / 68	77.5	16.58	1	.983	1.523
2	10	[illegible] / 4914.1	68° F	92 / 94	63 / 70	82	11.77	1	.977	1.53[illegible]
3	10	4772.[illegible] / [illegible]	68° F	[illegible] / 95	[illegible] / 72	8[illegible]	4.78	1	.981	1.5[illegible]3
									Y = .977	1.54

[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 6/6/91 Meter box number C-282 Plant _____

Barometric pressure, P_b = 29.55 in. Hg Dry gas meter number _____ Pretest Y _____

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: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	$\frac{Y_i V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
5,277.2	~~10~~ 5	879.524	73.4	102 / 106	78 / 82	92.5	8.4		.985	1.61
10552	10	884.267 / 889.06	73.4	98 / 106	78 / 80	91.25	12.4	~~55~~	.991	1.68
10,551	10	905.3 / 915.154	73.4	97 / 104	78 / 80	90	9.96		.971	1.61
									Y = .982	1.63

[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 ±0.05Y.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-5-90 Thermocouple number Hotbox

Ambient temperature 20 °C Barometric pressure 29.65 in. Hg

Calibrator Sam Lewis 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 °F	0
B	Oven	200 °F	200 °F	0
C	Oven	350 °F	350 °F	0
D	Ambient 4-2-91	50 °F	50 °F	0

[a] Type of calibration system used.

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

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-5-90 Thermocouple number Inlet/Outlet

Ambient temperature 20 °C Barometric pressure 29.88 in. Hg

Calibrator Same as 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 °F	0
B	Oven	200 °F	200 °F	0
C	Oven	350 °F	350 °F	0
D	Ambient 4-2-91	50 °F	50 °F	0

[a] Type of calibration system used.

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

RAMCON

Lear Siegler Stack Sampler

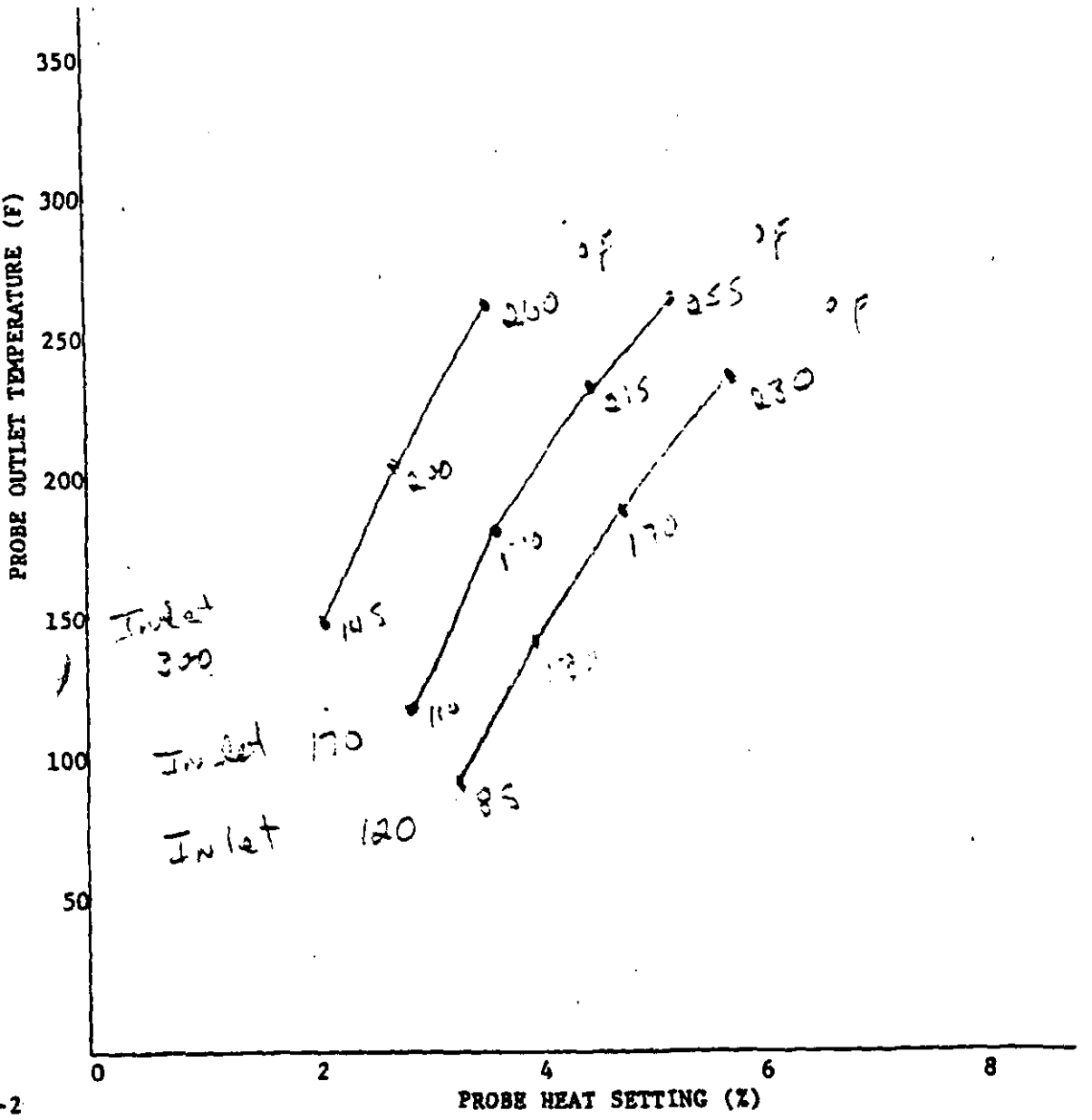
Heating Probe Calibration

Probe No. 63 Probe Length 6'

Date of Calibration 5-7-89 Signature S. Turner

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 3-29-91 Thermocouple number 63

Ambient temperature 25 °C Barometric pressure 29.97 in. Hg

Calibrator RV 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	32	32	
B	Cooling H_2O	212	212	
C	Oil	344	341	
D	Aimil			
	4-2-91	50	50	

[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. #63 Date: 3-30-91

Calibrated by: _____

"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	.17	.22	.870	.002
2	.37	.47	.867	.006
3	1.7	2.2	.879	.002
		$\bar{C}_p$ (SIDE A)	.871	

"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	.17	.22	.879	.006
2	.37	.47	.867	.006
3	1.7	2.2	.879	.006
		$\bar{C}_p$ (SIDE B)	.881	

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

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

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

RAMCON Environmental Stack Test Team

Sumner Buck - President

Sumner Buck is the President of RAMCON Environmental Corporation. He is a graduate of the EPA 450 "Source Sampling for Particulate Pollutant's" course and the 474 "Continuous Emissions Monitoring" course all given at RTP. Mr. Buck is a certified V.E. reader with current certification. Mr. Buck has personally sampled over 400 stacks including over 300 asphalt plants. He is 47 years old and a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis.

Tommy Crook - Team Leader

Tommy Crook has undergone extensive training in Method 1 through 9. He is qualified as a team leader and is currently certified as a V.E. reader.