SOURCE SAMPLING
for
PARTICULATE EMISSIONS

F. G. SULLIVAN CO., INC.
PORT ALLEN, LOUISIANA
October 6, 1992

Steve Strickland
F. G. Sullivan Co., Inc.

William Joseph Sewell
Vice President

RAMCON

ENVIRONMENTAL CORPORATION

October 21, 1992

Mr. Steve Strickland
F. G. Sullivan Co., Inc.
9313 South Chocktaw
P. O. Box 15196
Baton Rouge, Louisiana 70895

RE: Particulate Emissions

Dear Mr. Strickland

Enclosed are four (4) copies of the report regarding the particulate emissions test conducted at your asphalt plant in Port Allen, Louisiana on October 6, 1992. 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 Louisiana. 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:

Serugudi Mani
EPA Louisiana
11720 Airline Hwy
Baton Rouge, LA 70817

We certainly have enjoyed working with you. Please let us know if we can be of further assistance.

Sincerely,

William Joseph Sewell
Vice President

WJSii:wpc
Enclosures

RAMCON BUILDING, 6707 FLETCHER CREEK COVE, MEMPHIS, TENNESSEE 38134
TELEPHONE 800/458-4567 IN TENNESSEE 901/387-0500 FAX 901/387-0400

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2. TEST RESULTS
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SECTION A.

1. INTRODUCTION

On October 6, 1992 personnel from RAMCON Environmental Corporation conducted a source emissions test for particulate emissions compliance at F.G. Sullivan Co., Inc.'s Astec Double Drum asphalt plant located in Port Allen, Louisiana. RAMCON personnel conducting the test were Allen Turner, Team Leader, and Chuck Hughes. Tommy South was responsible for the laboratory analysis including taring the beakers and filters and recording final data in the laboratory record books. Custody of the samples was limited to Mr. Turner and Mr. South.

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 Louisiana.

2. 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 Louisiana are the same as those set by EPA.

Allen Turner of RAMCON Environmental conducted the opacity test which ranged from 0% to 10% on all three runs and therefore meets N.S.P.S. requirements.

SUMMARY OF TEST RESULTS

TABLE I
October 6, 1992

Test Run	Time	Grain Loading gr/DSCF	Isokinetic Variation	Emissions Lbs/Hr
1	09:51 - 11:04	0.0055	101.2%	1.33
2	13:44 - 14:48	0.0074	98.1%	1.67
3	15:43 - 16:47	0.0045	99.3%	.96
	Average:	0.0058		1.32

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 Louisiana. Therefore, the plant is operating in compliance with State and Federal Standards.

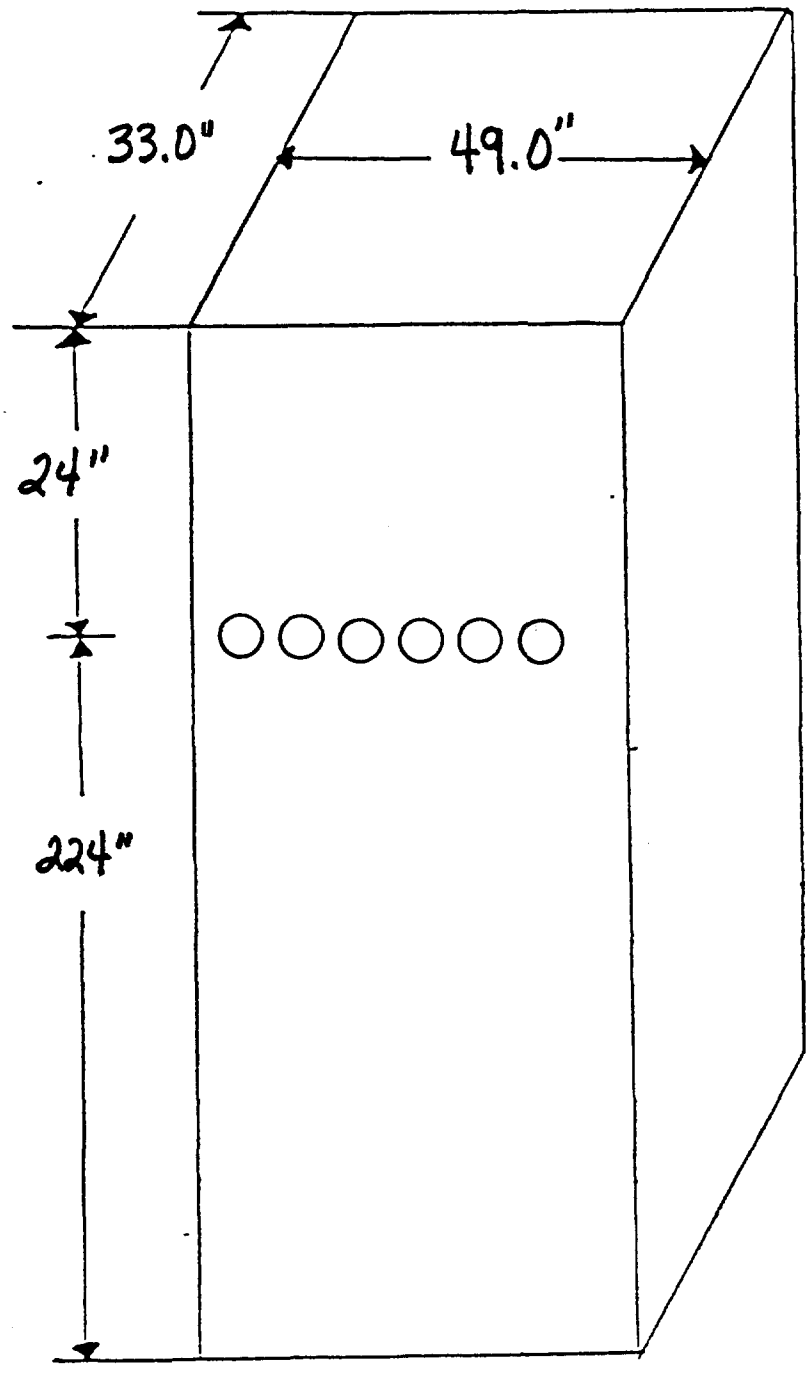
3. TEST PROCEDURES

(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 rectangular stack measuring 33" x 49" with an equivalent diameter of 39.4". Six sampling ports were placed 24" down (.06 diameters upstream) from the top of the stack and 224" up (5.7 diameters downstream) from the last flow disturbance. The ports were evenly spaced on 8.2" centers. The two outside ports are 4.1 from the side walls of the stack. Thirty points were sampled, five through each port for two minutes each.

Points on a Diameter	Probe Mark
1	3.3"
2	9.9"
3	16.5"
4	23.1"
5	29.7"



SECTION B:

THE SOURCE

B. THE SOURCE

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

The following is a general description of the plant's manufacturing process: The cold feed materials (aggregate) are dumped into 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 temperature ranging from 300°F to 1600°F. When recycled asphalt mix is used, it is added halfway down the drum through a separate conveyor. The hot and dried aggregate moves to an outer shell around the rotating drum where the required amount of hot asphalt oil is then injected onto and mixed into the dried aggregate. The now newly formed hot asphalt mix is pulled to the top of a storage silo by a conveyor. 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 drum mixer uses a burner fired with natural gas to heat air to dry the aggregate, and the motion of the rotating drum to blend the aggregate. The air is drawn into the system via an exhaust fan. After passing through the gas burner and the mixing drum, the air passes through a baghouse. The baghouse is manufactured by Astec. The exhaust gases are 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 drum mixer.

DATA ON FACILITY BEING STACK TESTED

COMPANY NAME F D Sullivan COMPANY REP. PHONE ( )

LOCATION OF FACILITY Port Allen ORIGINAL START-UP DATE DESIGNED CAPACITY P-401-0 80 TPH

OEM MODEL NO. 92-006 TYPE AZTEC DRUM MX AC TYPE

1 Time (24 HR) NOTE: check small box in column when moisture sample is taken	2 Fuel Use #Fuel Oil / Nat. Gas X / 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 / X Baghouse Pressure Drop in w.g.	9 Venturi Scrubber / X Baghouse Water Pressure psi	10 Ambient Temp. °F	11 Relative Humidity %	12 Exhaust Damper Position
9:50 X		45	80	315		3.9	315°	248	4		65		.23
10:05		46.7	90	314		3.9	312	252	4.5				.23
10:20		43.4	70	317		3.9	311	257	4.1				.22
10:35		48	90	316	49.70	4.4	315	286	4.2				.22
10:50		50.5	90	~~308~~ 310	50.57	4.4	306	268	4.1				.21
11:05		45.1	70	290	48.89	4.4	318	266	4.0				.23
11:20		48.3	90	315		3.9	317	255	4.1				.21
11:35		45.6	80	320		3.9	325	260	4.3				.20
11:50		47.8	80	~~325~~		3.9	318	260	4.2				.21
12:05		46.7	80	322		3.9	320	~~258~~	4.1				.22
12.20		43.7	70	314		3.9	325	250	4.1				.21
12.35		44	70	315			324	251	4.3				.20
12:50		51	85	315	49.75	4.4	321	281	4.2				.19
1:05		50.5	80	335		3.9	278	285	4.1				.20
1:20		46.7	90	304		3.9	318	262	4.3				.19
1:35		45.1	80	315		3.9	318	262	4.2				.21
1:50		48.9	80	320		3.9	322	265	4.2				.20
2:05		48.3	80	318		3.9	312	270	4.1				.21

DATA SUMMARY ON STACK BEING TESTED

AGGREGATE

1. Name/type of mix P-401/B - FAA Airport Base Mix
2. Name/type of 2nd mix (if used) TYPE 90 WCRP - City of Baton Rouge WEARING Course w/RAP 5% w/Poly
3. Type/temperature of Liquid Asphalt AC-30 MAC-20 / 320° / 320° °F
4. Sieve/Screening analysis: _____ % Passing:

	1st mix / 2nd mix		1st mix / 2nd mix		1st mix / 2nd mix	
1"	100%	100%	3/8"	67%	84%	#10	41%	48%
3/4"	99%	100%	#200	5%	7%	#40	23%	30%
1/2"	82%	95%	#4	54%	64%	#80	9%	9%

CONTROL SYSTEM

Manufacturer ASTEC - 8' Double BARREL Drum Mixer

A. Baghouse:

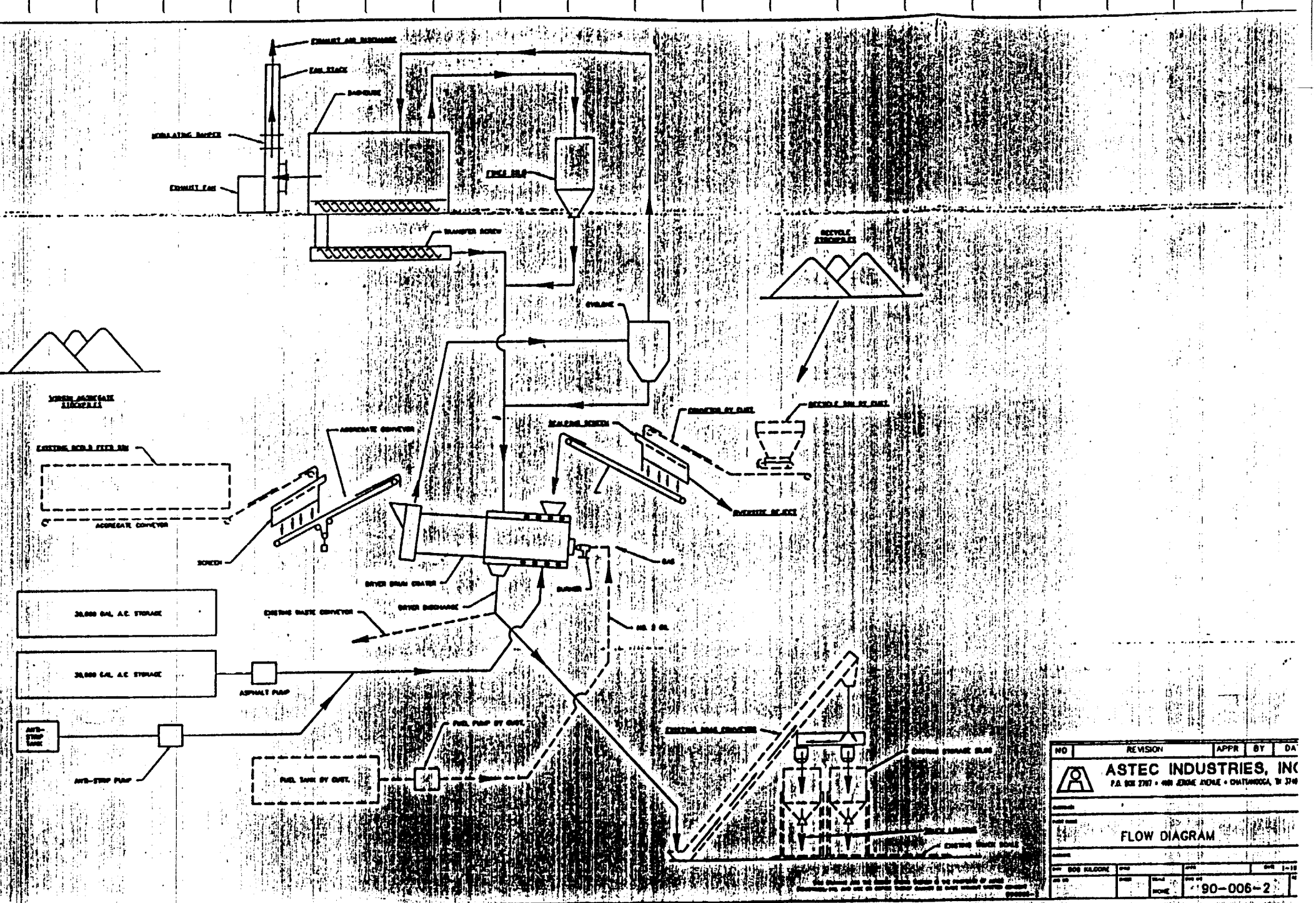
1. Type of bags _____ # of bags _____ Sq. ft. of bags _____
2. Air to cloth ratio _____ Designed ACFM _____
3. Type of cleaning - pulse jet _____ reverse air _____ plenum pulse _____ other _____
4. Cleaning cycle time _____ Interval between cleaning cycle _____
5. Pulse pressure on cleaning cycle _____ 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 ~~Hollis & Poorel~~ F.J. Sullivan Date 10-6-92

Company Representative Hollis W Poorer



NO	REVISION	APPR	BY	DA

ASTEC INDUSTRIES, INC

P.O. BOX 2787 • 4101 JEROME AVENUE • CHATTANOOGA, TN 3740

FLOW DIAGRAM

90-006-2

1. Aggregate bins: Virgin aggregate is 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

SECTION C:

EQUIPMENT USED

EQUIPMENT USED

Equipment used to conduct the particulate emissions test was:

A. A Lear Siegler PM-100 stack sampler with appropriate auxiliary equipment and glassware (with train set up according to the schematic on the next page).

B. An Airguide Instruments Model 211-B (uncorrected) aneroid barometer for checking the barometric pressure.

C. Weston dial thermometers to check meter temperatures or an Analogic Model 2572 Digital Thermocouple to check stack temperatures.

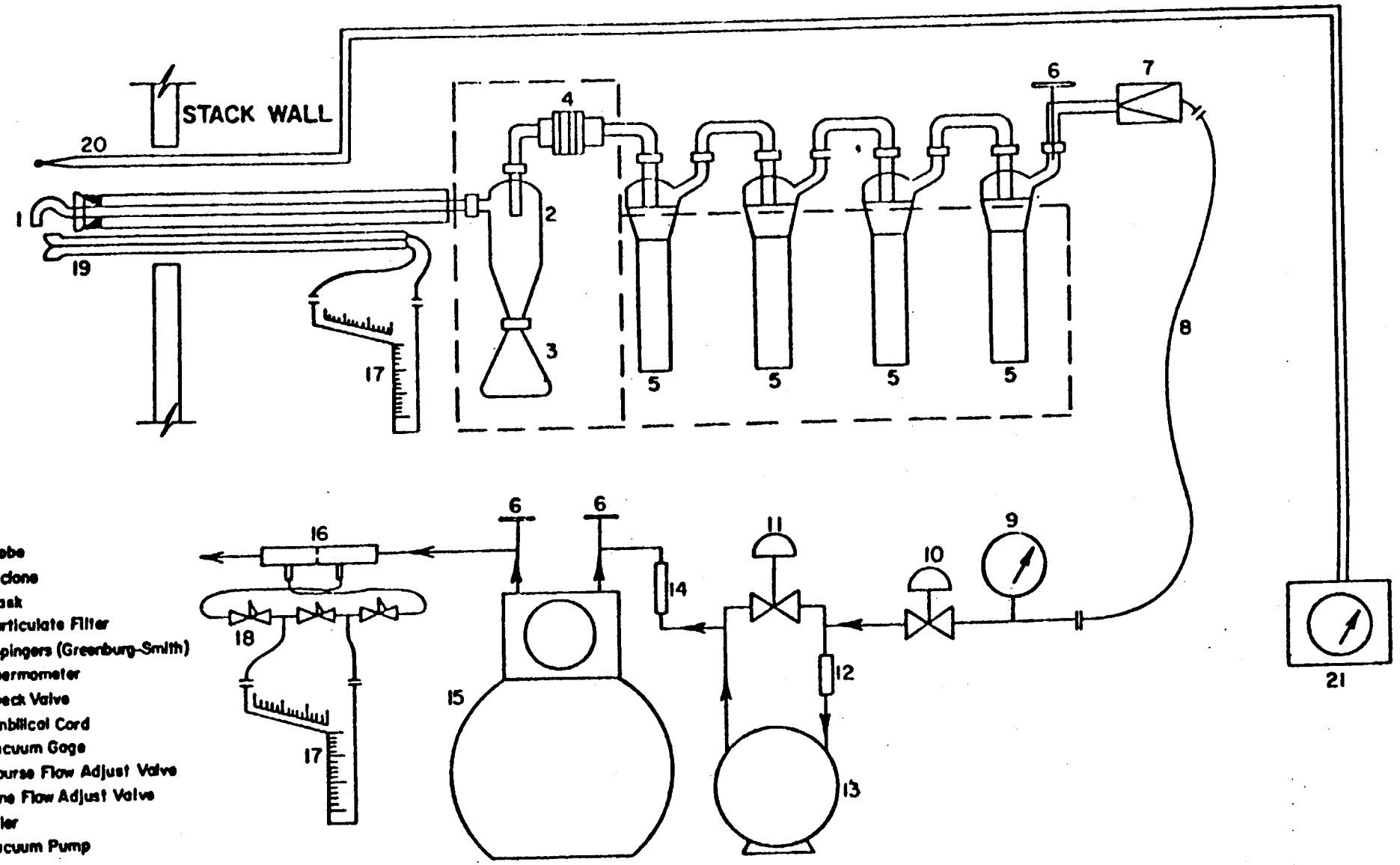
D. A Hays 621 Analyzer to measure the oxygen, carbon dioxide and carbon monoxide content of the stack gases or, for non-combustion sources, a Bacharach Instrument Company Fyrite for gas analysis.

E. Schleicher and Schuell Type 1-HV filters with a porosity of .03 microns.

F. Reagent- or ACS-grade acetone with a residue of ≤ .001.

SECTION D:

LABORATORY PROCEDURES AND RESULTS



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

SAMPLE ANALYTICAL DATA FORM

Company Name SULLIVAN

Sample Location BATON ROUGE LA. Relative Humidity in Lab 50 %

Blank Volume (V_a) 100 ml Density of Acetone (ρ_a) .7857 mg/ml

Date/Time wt. blank 10/13 8:00A Gross wt. 100.7116 g

Date/Time wt. blank 10/14 8:00A Gross wt. 100.7116 g

Ave. Gross wt. 100.7116 g

Tare wt. 100.7115 g

Weight of blank (m_{ab}) .0001 g

Acetone blank residue concentration (C_a): (C_a) = (m_{ab}) / (V_a) (ρ_a) = (.000001 mg/g)

Acetone Blank Wt.: $W_a = C_a V_{aw} \rho_a$ = (.000001)(300)(.7857) = (.0002 g)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	300	300	300
Date/Time of wt. 10/13 8:00A Gross wt.	g	102.0204	100.7214	105.5641
Date/Time of wt. 10/14 8:00A Gross wt.	g	102.0202	100.7212	105.5639
Average Gross wt.	g	102.0203	100.7213	105.5640
Tare wt.	g	102.0103	100.7124	105.5586
Less Acetone blank wt. (W_a)	g	.0002	.0002	.0002
Weight of particulate in acetone rinse (m_a)	g	.0098	.0087	.0052

Filter Numbers	#	TS6545	TS6407	TS6406
Date/Time of wt. 10/13 8:00A Gross wt.	g	.5784	.5700	.5648
Date/Time of wt. 10/14 8:00A Gross wt.	g	.5785	.5700	.5646
Average Gross wt.	g	.5785	.5700	.5647
Tare wt.	g	.5733	.5603	.5593

Weight of particulate on filter (m_f)	g	.0052	.0097	.0054
Weight of particulate in acetone rinse (m_a)	g	.0098	.0087	.0052
Total weight of particulate (m_n)	g	.0150	.0184	.0106

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 Thomas South Signature of Reviewer

D:\DONNA\FORMS\LAB\SAMPLE.TBL

Sullivan
Company Name

10-6-92
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: ____ = 20.9 - [____ x ____]

RUN #2: ____ = 20.9 - [____ x ____]

RUN #3 ____ = 20.9 - [____ x ____]

RUN 1:	$CO_2\%$	4	$CO_2\%$	4	$CO_2\%$	4	AVG.	4
	$O_2\%$	14	$O_2\%$	14	$O_2\%$	14	AVG.	14
	$N_2\%$		$N_2\%$		$N_2\%$		AVG.	
RUN 2:	$CO_2\%$	4	$CO_2\%$	4	$CO_2\%$	4	AVG.	4
	$O_2\%$	14	$O_2\%$	14	$O_2\%$	14	AVG.	14
	$N_2\%$		$N_2\%$		$N_2\%$		AVG.	
RUN 3:	$CO_2\%$	4	$CO_2\%$	4	$CO_2\%$	4	AVG.	4
	$O_2\%$	14	$O_2\%$	14	$O_2\%$	14	AVG.	14
	$N_2\%$		$N_2\%$		$N_2\%$		AVG.	

SECTION E:

CALCULATIONS

SULLIVAN
PORT ALLEN, LA

SUMMARY OF TEST DATA

		10-06-92 RUN #1	10-06-92 RUN #2	10-06-92 RUN #3
SAMPLING TRAIN DATA				
	start	09:51	11:30	13:04
	finish	11:04	12:43	14:16
1. Sampling time, minutes	Θ	60.0	60.0	60.0
2. Sampling nozzle diameter, in.	D_n	.2250	.2250	.2250
3. Sampling nozzle cross-sect. area, ft^2	A_n	.000276	.000226	.000276
4. Isokinetic variation	I	101.2	98.1	99.3
5. Sample gas volume - meter cond., cf.	V_m	43.551	40.364	39.159
6. Average meter temperature, ^oR	T_m	549	562	567
7. Avg. oriface pressure drop, in. H_2O	dH	1.51	1.23	1.15
8. Total particulate collected, mg.	M_n	15.00	18.40	10.60
VELOCITY TRAVERSE DATA				
9. Stack area, ft^2	A	11.23	11.23	11.23
10. Absolute stack gas pressure, in. Hg.	P_s	29.95	29.95	29.95
11. Barometric pressure, in. Hg.	P_{bar}	29.95	29.95	29.95
12. Avg. absolute stack temperature, R^o	T_s	700	706	712
13. Average $-\sqrt{\overline{vel.\ head}}$, (C_p= .84)	$-\sqrt{dP}^-$	1.10	1.04	1.00
14. Average stack gas velocity, ft./sec.	V_s	74.41	70.77	68.43
STACK MOISTURE CONTENT				
15. Total water collected by train, ml.	V_{ic}	305.90	288.10	286.80
16. Moisture in stack gas, %	B_{ws}	25.50	26.33	26.95
EMISSIONS DATA				
17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	1692	1577	1500
18. Stack gas flow rate, cfm	acfm	50137	47685	46108
19. Particulate concentration, gr/dscf	C_s	0.0055	0.0074	0.0045
20. Particulate concentration, lb/hr	E	1.33	1.67	0.96
21. Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000
ORSAT DATA				
22. Percent CO_2 by volume	CO_2	4.00	4.00	4.00
23. Percent O_2 by volume	O_2	14.00	14.00	14.00
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	82.00	82.00	82.00

Format: summryR3

SECTION D:

LABORATORY PROCEDURES AND RESULTS

SULLIVAN
PORT ALLEN, LA

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:

$$V_{m(std)} = (17.64)(1.000)(43.551)\left[\frac{(29.95) + \frac{1.51}{13.6}}{549}\right] = 42.066 \text{ dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(1.000)(40.364)\left[\frac{(29.95) + \frac{1.23}{13.6}}{562}\right] = 38.059 \text{ dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(1.000)(39.159)\left[\frac{(29.95) + \frac{1.15}{13.6}}{567}\right] = 36.591 \text{ dscf}$$

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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:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{15.00}{42.066}\right] = 0.0055 \text{ gr./dscf.}$$

Run 2:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{18.40}{38.059}\right] = 0.0074 \text{ gr./dscf.}$$

Run 3:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{10.60}{36.591}\right] = 0.0045 \text{ gr./dscf.}$$

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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:

$$M_d = 0.44(\ 4.00\%) + 0.32(14.00\%) + 0.28(\ .00\% + 82.00\%) = 29.20 \ \frac{lb}{lb\text{-mole}}$$

Run 2:

$$M_d = 0.44(\ 4.00\%) + 0.32(14.00\%) + 0.28(\ .00\% + 82.00\%) = 29.20 \ \frac{lb}{lb\text{-mole}}$$

Run 3:

$$M_d = 0.44(\ 4.00\%) + 0.32(14.00\%) + 0.28(\ .00\% + 82.00\%) = 29.20 \ \frac{lb}{lb\text{-mole}}$$

Format: mdR3

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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) (5.9) = 0.3 cu.ft

Run 2:

$V_{wc(std)}$ = (0.04707) (280.0) = 13.2 cu.ft
$V_{wsg(std)}$ = (0.04715) (8.1) = 0.4 cu.ft

Run 3:

$V_{wc(std)}$ = (0.04707) (280.0) = 13.2 cu.ft
$V_{wsg(std)}$ = (0.04715) (6.8) = 0.3 cu.ft

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Moisture Content of Stack Gases

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

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:

$$B_{ws} = \frac{14.1 + 0.3}{14.1 + 0.3 + 42.066} \quad X \quad 100 = 25.50\ \%$$

Run 2:

$$B_{ws} = \frac{13.2 + 0.4}{13.2 + 0.4 + 38.059} \quad X \quad 100 = 26.33\ \%$$

Run 3:

$$B_{ws} = \frac{13.2 + 0.3}{13.2 + 0.3 + 36.591} \quad X \quad 100 = 26.95\ \%$$

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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:

$M_s = 29.20 (1 - 25.50) + 18 (25.50) = 26.34$ (lb./lb.-mole)

Run 2:

$M_s = 29.20 (1 - 26.33) + 18 (26.33) = 26.25$ (lb./lb.-mole)

Run 3:

$M_s = 29.20 (1 - 26.95) + 18 (26.95) = 26.18$ (lb./lb.-mole)

Format: msR3

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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 $\sqrt{(g/g\text{-mole})\text{-}(mm\ Hg)}$ / $(^oK)(\sqrt{mm\ H_2O})^{1/2}$

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:

$$V = (85.49)\ (\ .84)\ (\ 1.10)\ -\sqrt{\frac{700}{(29.95)(26.34)}} = 74.41\ ft/sec.$$

Run 2:

$$V = (85.49)\ (\ .84)\ (\ 1.04)\ -\sqrt{\frac{706}{(29.95)(26.25)}} = 70.77\ ft/sec.$$

Run 3:

$$V = (85.49)\ (\ .84)\ (\ 1.00)\ -\sqrt{\frac{712}{(29.95)(26.18)}} = 68.43\ ft/sec.$$

Format: vsR3

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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:

$$Q_{sd}=3600(1-\ .2550\ )(\ 74.41)(\ 11.23)\left[\frac{528}{700}\right]\left[\frac{29.95}{29.92}\right] = 1692158.2\ \frac{dscf}{hr}$$

Run 2:

$$Q_{sd}=3600(1-\ .2633\ )(\ 70.77)(\ 11.23)\left[\frac{528}{706}\right]\left[\frac{29.95}{29.92}\right] = 1577925.8\ \frac{dscf}{hr}$$

Run 3:

$$Q_{sd}=3600(1-\ .2695\ )(\ 68.43)(\ 11.23)\left[\frac{528}{712}\right]\left[\frac{29.95}{29.92}\right] = 1500162.1\ \frac{dscf}{hr}$$

Format: qR3

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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:

$$E = \frac{(0.0055)(1692158.2)}{7000} = 1.33 \text{ lb. / hr.}$$

Run 2:

$$E = \frac{(0.0074)(1577925.8)}{7000} = 1.67 \text{ lb. / hr.}$$

Run 3:

$$E = \frac{(0.0045)(1500162.1)}{7000} = 0.96 \text{ lb. / hr.}$$

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Isokinetic Variation

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

Where:

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

Run 1:

$$I = (100)(700)\left[\frac{(0.002669)(305.90) + \frac{43.551}{549}\left[29.95 + \frac{1.51}{13.6}\right]}{60\ (60.0)\ (74.41)\ (29.95)\ (.000276)} \right] = 101.2\%$$

Run 2:

$$I = (100)(706)\left[\frac{(0.002669)(288.10) + \frac{40.364}{562}\left[29.95 + \frac{1.23}{13.6}\right]}{60\ (60.0)\ (70.77)\ (29.95)\ (.000276)} \right] = 98.1\%$$

Run 3:

$$I = (100)(712)\left[\frac{(0.002669)(286.80) + \frac{39.159}{567}\left[29.95 + \frac{1.15}{13.6}\right]}{60\ (60.0)\ (68.43)\ (29.95)\ (.000276)} \right] = 99.3\%$$

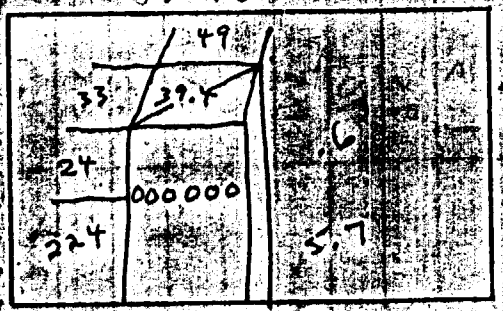
SECTION F:

FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Sullivan — M5

Location Port Allen, LA
Operator C. Hughes
Date 10-6-93
Run No. 1
Sample Box No. 1
Meter Box No. C-282
Meter H@ 1.536
C Factor 1.0
Pitot Tube Coefficient Cp .84



Schematic of Stack Cross Section

		IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
Ambient Temperature 65			
Barometric Pressure 29.95	FINAL	500	331.4
Assumed Moisture, % 23	INITIAL	200	337.3
Probe Length, m(ft) 4'	DIFFERENCE	300	5.9

Nozzle Identification No. 000271
Avg. Calibrated Nozzle Dia., (in.) .225/.225/.225
Probe Heater Setting 4
Leak Rate, m^3/min. (cfm) .006 @ 8"
Probe Liner Material Stainless
Static Pressure, mm Hg (in.Hg) +.01
Filter No. T56545

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts)	VELOCITY HEAD (Δp)	PRESSURE DIFF. ORF. MTR	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
A 1	0951.30 / 0953.30	2	233	.94	1.1	416.925 / 418.1	60	62	240	68
2	0955.30	4	238	1.4	1.7	419.6	87	61	245	65
3	0957.30	5	239	1.6	2.0	421.3	91	62	249	61
4	0959.30	4	239	1.6	2.0	422.9	95	63	250	60
5	1001.30	4	237	1.5	1.8	424.5	97	63	259	60
B 1	1005 / 1007	3	231	1.4	1.7	426.1	92	66	232	68
2	1009	3	237	1.4	1.7	427.6	99	66	245	64
3	1011	3	238	1.3	1.6	429.1	101	67	263	62
4	1013	3	238	1.4	1.7	430.6	104	68	256	61
5	1015	3	238	1.4	1.7	432.2	106	69	237	60
C 1	1018 / 1020	3	240	1.1	1.3	433.6	101	71	258	68
2	1022	3	242	1.2	1.5	435.0	106	71	243	64
3	1024	3	242	1.1	1.3	436.4	108	72	247	63

SULLIVA1

Form #REC-05

Form #REC-06

RAMCON emissions test log sheet, cont DATE 10-6-92 LOCATION Port Allen, LA TEST NO. 1

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP. Ts	VELOCITY HEAD	ORFICE DIFF. PRESSURE	GAS VOLUME Vm (ft.3)	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	1026	3	242	1.4	1.7	438.0	110	73	255	63
5	1028	4	239	1.6	2.0	439.7	111	74	257	63
D 1	1030 / 1032	3	241	.99	1.2	441.0	110	74	229	68
2	1034	3	240	.83	1.0	442.2	110	75	249	68
3	1036	3	242	.93	1.1	443.5	111	75	259	68
4	1038	4	242	1.5	1.8	445.1	113	77	264	67
5	1040	5	241	1.9	2.3	446.9	115	77	255	67
E 1	1042.30 / 1044.30	3	242	.80	.98	448.2	106	76	241	68
2	1046.30	3	243	.76	.93	449.3	115	78	256	67
3	1048.30	3	243	.84	1.0	450.5	114	78	265	67
4	1050.30	3	242	1.4	1.7	452.0	115	79	256	68
5	1052.30	5	242	1.8	2.2	453.8	117	79	235	64
F 1	1054.30 / 1056.30	2	245	.45	.55	454.8	109	80	260	67
2	1058.30	2	244	.51	.62	455.7	114	80	242	68
3	1100.30	3	243	.96	1.2	457.0	116	81	241	67
4	1102.30	4	242	1.5	1.8	458.5	118	81	247	66
5	1104.30	5	242	1.8	2.2	460.376	118	81	255	63

RAMCON ENVIRONMENTAL CORPORATION

Plant: Sullivan
Location: Port Allen LA
Operator: C. Hughes
Date: 10-6-92
Run No.: 2
Sample Box No.: 1
Meter Box No.: C-282
Meter H@: 1.536
C Factor: 1.0
Pitot Tube Coefficient Cp: .84

Schematic of Stack Cross Section

		IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
Ambient Temperature	70		
Barometric Pressure	29.95 FINAL	480	3251
Assumed Moisture, %	25 INITIAL	200	333.2
Probe Length, m(ft)	4' DIFFERENCE	280	8.1
Nozzle Identification No.	.0002261		
Avg. Calibrated Nozzle Dia., (in.)	.225/.225/.225		
Probe Heater Setting	4		
Leak Rate, m^3/min. (cfm)			
Probe Liner Material	Stainless		
Static Pressure, mm Hg (in. Hg)	+.01		
Filter No.	~~TS6415~~ TS6407		

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (m)	VELOCITY HEAD (ΔP)	PRESSURE DIFF. ORF. MTR	GAS SAMPLE VOLUME ft³	GAS SAMPLE TEMP. AT DRY GAS METER °F [redacted]	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	1130.30 / 1132.30	2	24	.45	1.5	461.050 / 461.7	105	83	241	68
2	1134.30	2	243	.54	.61	462.7	110	82	249	68
3	1136.30	2	245	.51	.58	463.5	112	82	256	67
4	1138.30	2	244	.75	.85	464.7	114	82	261	67
5	1140.30	3	242	1.2	1.4	466.1	116	82	256	67
B 1	1142.30 / 1144.30	2	245	.75	.85	467.2	111	82	238	68
2	1146.30	2	247	.66	.74	468.3	115	83	260	67
3	1148.30	2	247	.70	.79	469.4	116	83	254	67
4	1150.30	3	248	1.1	1.2	470.7	118	83	235	68
5	1152.30	3	248	1.6	1.2	472.0	119	83	249	67
C 1	1155.30 / 1157.30	2	247	.92	1.0	473.2	111	84	242	68
2	1159.30	2	248	.85	.96	474.4	117	84	235	68
3	1201.30	2	248	.84	.95	475.6	119	84	255	68

SULLIVAN

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 10-6-92 LOCATION Port Allen, LA TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP [redacted]	VELOCITY HEAD	ORFICE DIFF PRESSURE	GAS VOLUME Vm (ft.3)	GAS SAMPLE TEMP. (°F) [redacted]		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	1203.30	3	248	1.1	1.2	477.0	120	85	260	65
5	1205.30	4	248	1.6	1.8	478.7	121	85	240	63
D 1	1208.30 / 1210.30	3	247	1.1	1.2	480.1	113	86	265	68
2	1212.30	3	251	1.1	1.2	481.5	120	86	260	66
3	1214.30	3	250	1.0	1.1	482.8	121	86	236	64
4	1216.30	3	249	1.2	1.4	484.2	122	86	243	65
5	1218.30	4	249	1.7	1.9	486.1	124	87	257	64
E 1	1221.30 / 1223.30	3	249	.95	1.1	487.5	118	88	233	67
2	1225.30	3	250	1.4	1.6	489.0	122	88	235	67
3	1227.30	3	248	1.4	1.6	490.6	124	88	257	67
4	1229.30	3	246	1.5	1.7	492.1	125	88	255	67
5	1231.30	3	245	1.3	1.5	493.7	125	88	237	67
F 1	1233 / 1235	3	243	1.2	1.4	495.0	120	89	249	68
2	1237	3	243	1.4	1.6	496.5	124	89	260	67
3	1239	3	243	1.5	1.7	498.1	126	89	254	65
4	1241	3	244	1.5	1.7	499.7	127	90	237	65
5	1243	3	243	1.4	1.6	501.414	127	90	248	66

RAMCON ENVIRONMENTAL CORPORATION

Plant Sullivan

Location Port Allen, LA
Operator C. Hughes
Date 10-6-92
Run No. 3
Sample Box No. 1
Meter Box No. C-282
Meter H @ 1.536
C Factor 1.00
Pitot Tube Coefficient Cp .84

MS

		IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
Ambient Temperature 70			
Barometric Pressure 29.95	FINAL	480	383.7
Assumed Moisture, % 12.5	INITIAL	200	390.5
Probe Length, m(ft) 4'	DIFFERENCE	280	6.8

Nozzle Identification No. 00027761
Avg. Calibrated Nozzle Dia., (in.) .225/.225/.225
Probe Heater Setting 4
Leak Rate, m^3/min. (cfm) .012 @ 10"
Probe Liner Material Stainless
Static Pressure, mm Hg (in.Hg) +.01
Filter No. TS6406

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts)	VELOCITY HEAD (Ps)	PRESSURE DIFF. ORF. MTR	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
A 1	1304/1306	3	260	1.10	1.11	501.843/502.4	110	90	233	68
2	1308	3	256	1.13	1.15	504.6	120	90	247	68
3	1310	4	252	1.13	1.15	506.10	122	89	252	68
4	1312	4	250	1.14	1.16	507.5	123	89	253	67
5	1314	4	250	1.13	1.15	509.1	124	90	253	67
B 1	1316/1318	3	250	1.11	1.12	510.13	120	90	267	68
2	1320	4	251	1.12	1.14	511.8	123	90	260	67
3	1322	4	252	1.13	1.15	513.2	125	90	247	68
4	1324	4	253	1.12	1.14	514.7	125	90	235	67
5	1326	4	253	1.12	1.14	516.2	126	90	248	67
C 1	1329/1331	4	254	1.11	1.12	517.16	117	90	257	68
2	1333	4	252	1.10	1.11	519.10	124	90	234	68
3	1335	4	251	1.09	1.11	520.13	125	90	236	68

SULLIVAN

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 10-6-92 LOCATION Port Allen, LA TEST NO. 3

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP	VELOCITY [illegible]	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME Vm (ft^3)	GAS SAMPLE TEMP. (°F)		SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
4	1337	4	250	1.11	1.2	521.6	126	90	247	67
5	1339	4	250	1.47	1.6	523.1	126	90	266	68
D 1	1341.30 / 1343.30	4	248	1.96	1.1	524.4	120	90	238	68
2	1345.30	3	252	1.61	.91	525.6	125	90	259	67
3	1347.30	3	251	1.75	.85	526.8	125	90	270	67
4	1349.30	4	252	1.96	1.1	528.1	125	90	263	67
5	1351.30	4	252	1.47	1.6	529.7	126	90	239	68
8 1	1354 / 1356	3	251	1.65	.73	530.8	120	90	242	68
2	1358	3	252	1.67	.76	532.0	124	90	247	67
3	1400	3	251	1.68	.77	533.0	126	91	260	66
4	1402	4	250	1.94	1.1	534.3	126	91	265	66
5	1404	4	252	1.47	1.6	535.80	127	91	247	67
F 1	1406.30 / 1408.30	3	249	1.48	.75	536.5	120	91	253	68
2	1410.30	3	250	1.89	.55	537.6	124	91	270	67
3	1412:30	3	252	1.52	.62	538.6	125	91	257	67
4	1414,30	3	253	1.79	.89	539.7	127	91	236	68
5	1416.30	3	253	1.40	1.1	541.002	128	92	241	67

SECTION G:

CALIBRATION

4A

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) ✓ no

α_1 = 1.3 ° (<10°), α_2 = 0.8 ° (<10°), β_1 = 0.5 ° (<5°),

β_2 = 1.8 ° (<5°)

γ = 2.9 °, θ = 1.7 °, A = .97 cm (in.)

z = A sin γ = .05 cm (in.); <0.32 cm (<1/8 in.),

w = A sin θ = .03 cm (in.); <.08 cm (<1/32 in.)

P_A .48 cm (in.) P_b .49 cm (in.)

D_t = .38 cm (in.)

Comments: _____

_____

_____

Calibration required? _____ yes ✓ no

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) _____ no

α_1 = 2.3 ° (<10°), α_2 = .5 ° (<10°), β_1 = 1.8 ° (<5°),
β_2 = 1.8 ° (<5°)

γ = 3.2 °, θ = 1.0 °, A = .98 cm (in.)

z = A sin γ = .05 cm (in.); <0.32 cm (<1/8 in.),
w = A sin θ = .02 cm (in.); <.08 cm (<1/32 in.)

P_A .49 cm (in.) P_b .49 cm (in.)

D_t = .38 cm (in.)

Comments: _____

_____

_____

Calibration required? _____ yes ✓ no

RAMCON ENVIRONMENTAL CORPORATION

Lear Siegler Stack Sampler

Nozzle Diameter Calibration

Date _____ Signature _____

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

Pitot Tube Calibration (S Type)

Pitot Tube Identification No. 44 Date 6-9-91

Calibrated by: [signature]

"A" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	2.2	3.3	.816	.004
2	1.8	2.7	.816	.004
3	1.1	1.6	.829	.009
		$\bar{C}_p$ (SIDE A)	.820	

"B" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	2.2	3.3	.816	.004
2	1.8	2.7	.816	.004
3	1.1	1.6	.829	.009
		$\bar{C}_p$ (SIDE B)	.820	

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

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

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

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-5-90 Thermocouple number 44

Ambient temperature 20 °C Barometric pressure 29.88 in. Hg

Calibrator S 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			

[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

RAMCON

Lear Siegler Stack Sampler

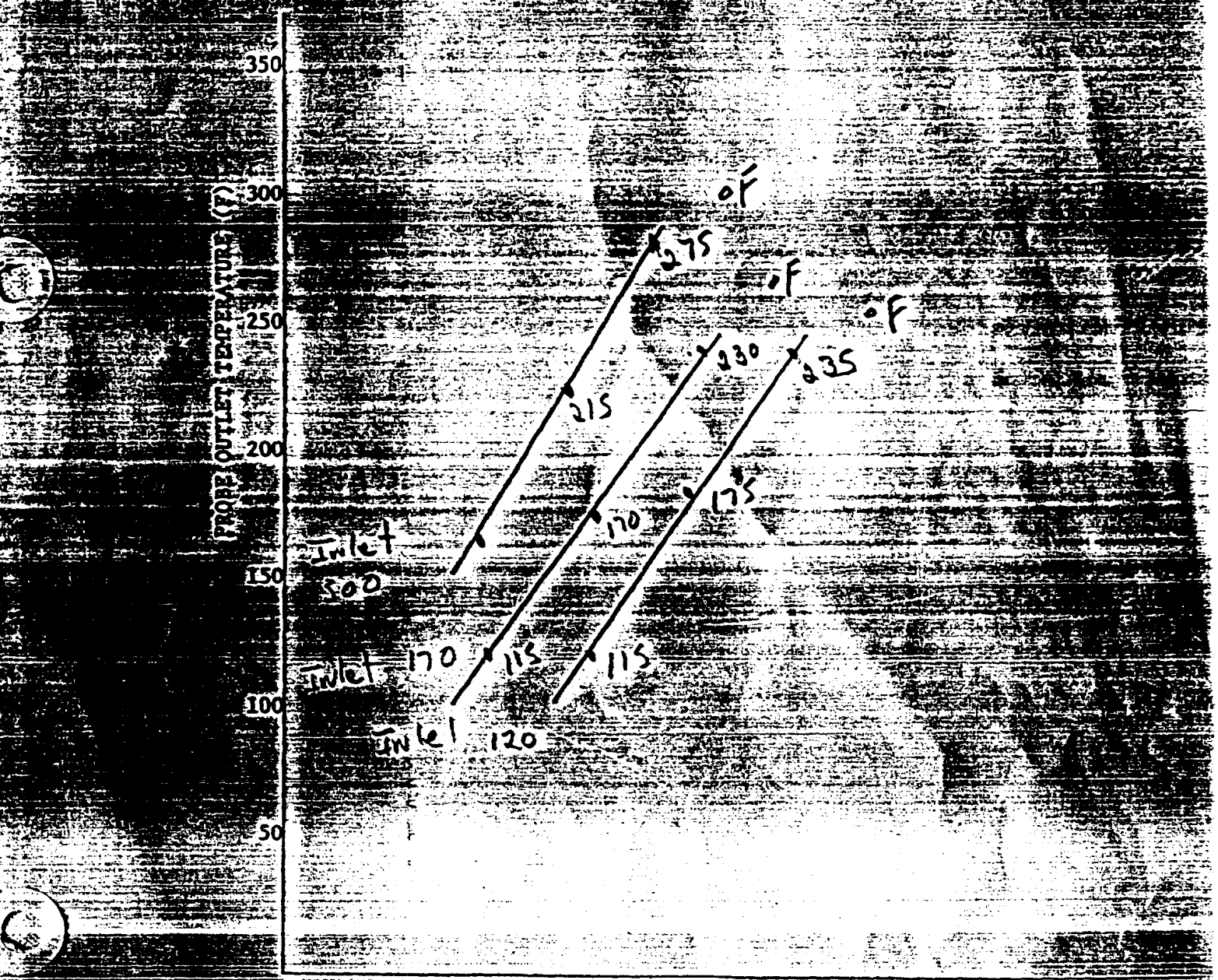
Heating Probe Calibration

Probe No. 414 Probe Length 4'

Date of Calibration 5-7-89 Signature Sam 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

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 2-13-92 Meter box number C-282

Barometric pressure, P_b = 29.98 in. Hg Calibrated by [illegible]

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Avg[a] (t_d), °F	Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
0.5	5								
1.0	10	77.953 / 88.423	68	92 / 102	62 / 62	79.5	12.01	.974	1.58
1.5	10								
2.0	10	77.120 / 87.489	68	92 / 106	62 / 64	91	12.50	.983	1.70
3.0	10	86.591 / 96.926	68	96 / 108	62 / 64	82.5	9.97	.991	1.62
4.0	10								
							Avg	.983	1.63

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

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

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number _____ Date 10-15-92 Meter box number C-282 Plant _____

Barometric pressure, P_b = 30.05 in. Hg Dry gas meter number ~~0-499147810~~ 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	$\frac{Y_i V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
0.5	10.	677.522 / 687.803	75	94 / 103	66 / 71	83.5	26.93	1	0.987	
1.0	10	688.045 / 698.372	75	110 / 112	76 / 78	94.0	17.47	2	1.000	
2.0	10	698.979 / 709.185	75	109 / 112	78 / 79	94.5	12.15	4	1.010	
									Y = 0.999	

[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.

Form #PEC-01

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number _____ Date 9-25-92 Meter box number C-282 Plant _____

Barometric pressure, P_b = 29.90 in. Hg Dry gas meter number 147810 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	$Y_i \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
5.198	1	~~10~~ 5	166.639 / 171.837	72	90 / 104	73 / 74	~~54~~ 56.3	8.40	1	.99	1.550
10.276	2	10	173.426 / 183.702	72	96 / 111	74 / 75	549	11.92	1	1.0	1.553
10.12	3	10	155.047 / 165.167	72	100 / 111	71 / 73	548.8	9.58	1	1.01	1.505
										Y = 1.0	1.536

[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.