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RAMCON
ENVIRONMENTAL CORPORATION

July 9, 1990

Mr. Mike Haddox
Lincoln Asphalt Paving
P.O. Box 1510
Ruston, LA 71220

Re: Particulate Emissions Test: Ruston, Louisiana

Dear Mr. Haddox:

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 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:

Mr. James Shope
Louisiana DEQ
Air Quality Division
1525 Fairfield Avenue
Shreveport, LA 71101

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

I. INTRODUCTION

On June 19, 1990 personnel from RAMCON Environmental Corporation conducted a source emissions test for particulate emissions compliance at Lincoln Asphalt Paving Company's ADM drum mix asphalt plant located in Ruston, Louisiana. RAMCON personnel conducting the test were Bill Turner, Team Leader and Dave Bailey. Mark Landry 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. Landry.

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

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 Louisiana are the same as those set by EPA.

Mr. James Shope of Louisiana's Department of Environmental Quality observed the testing conducted by RAMCON Environmental. Bill Turner conducted the opacity test (Reference Method 9) which was 0% on all three runs and therefore meets N.S.P.S. standards.

TABLE I

SUMMARY OF TEST RESULTS

June 19, 1990

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	09:22 to 11:52	0.0335 gr/DSCF	96.4%	3.8 lbs/hr
2	13:43 to 15:24	0.0288 gr/DSCF	97.2%	3.4 lbs/hr
3	15:53 to 17:30	0.0312 gr/DSCF	93.7%	3.5 lbs/hr
	Average:	0.0312 gr/DSCF		3.6 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 Louisiana. Therefore, the plant is operating in compliance with State and Federal Standards.

III. TEST PROCEDURES

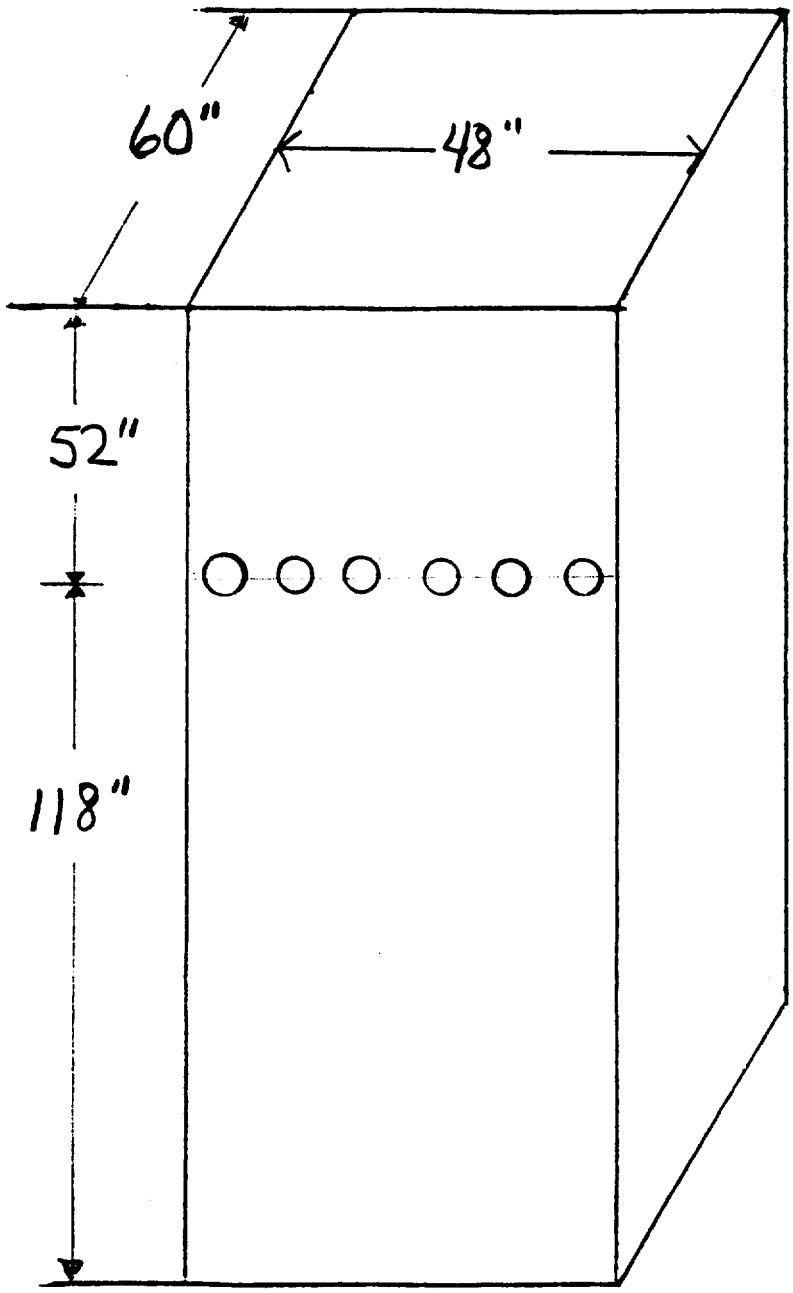
A. Method Used: Method 5 source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

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

C. Sampling Site: The emissions test was conducted after a scrubber on a rectangular stack measuring 60" x 48" with an equivalent diameter of 53.3". Six sampling ports were placed 52" down (1.0 diameters upstream) from the top of the stack and 118" up (2.2 diameters downstream) from the last flow disturbance. The ports were evenly spaced on 8.0" centers. The two outside ports are 4.0" 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	*12.0"
2	24.0"
3	36.0"
4	48.0"
5	60.0"

*Measurements include a 6" standoff.



IV. THE SOURCE

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Lincoln Asphalt Paving employs an ADM 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 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°F. When recycled asphalt mix is used, it is added halfway down the drum through a separate conveyor. 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 mixer uses a burner fired with natural gas 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 high efficiency scrubber. The scrubber is manufactured by ADM. The exhaust gases are blown through the scrubber and discharged to the atmosphere through the stack. The design pressure drop across the venturi is 10 inches of water. The particulate matter, which is removed by the scrubber, is fed into a scrubber pond where it drops out of suspension.

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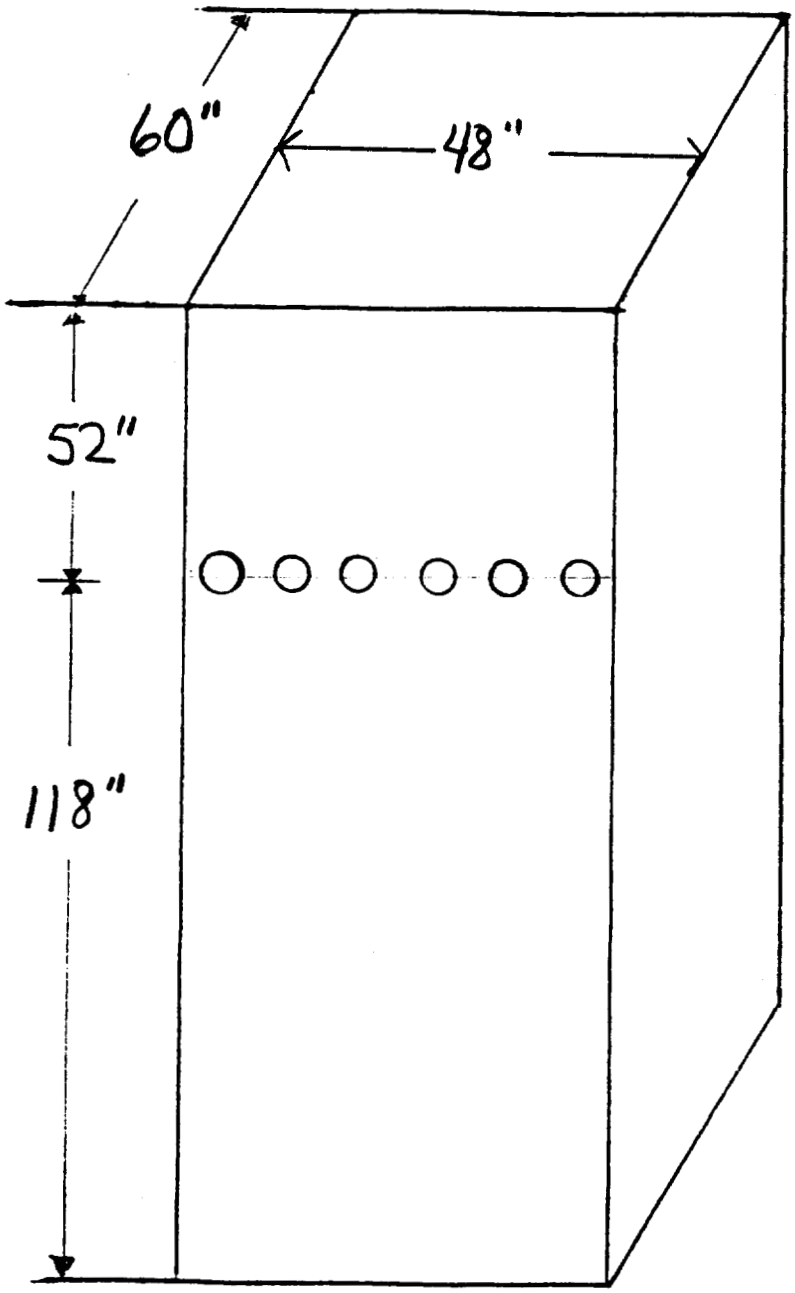

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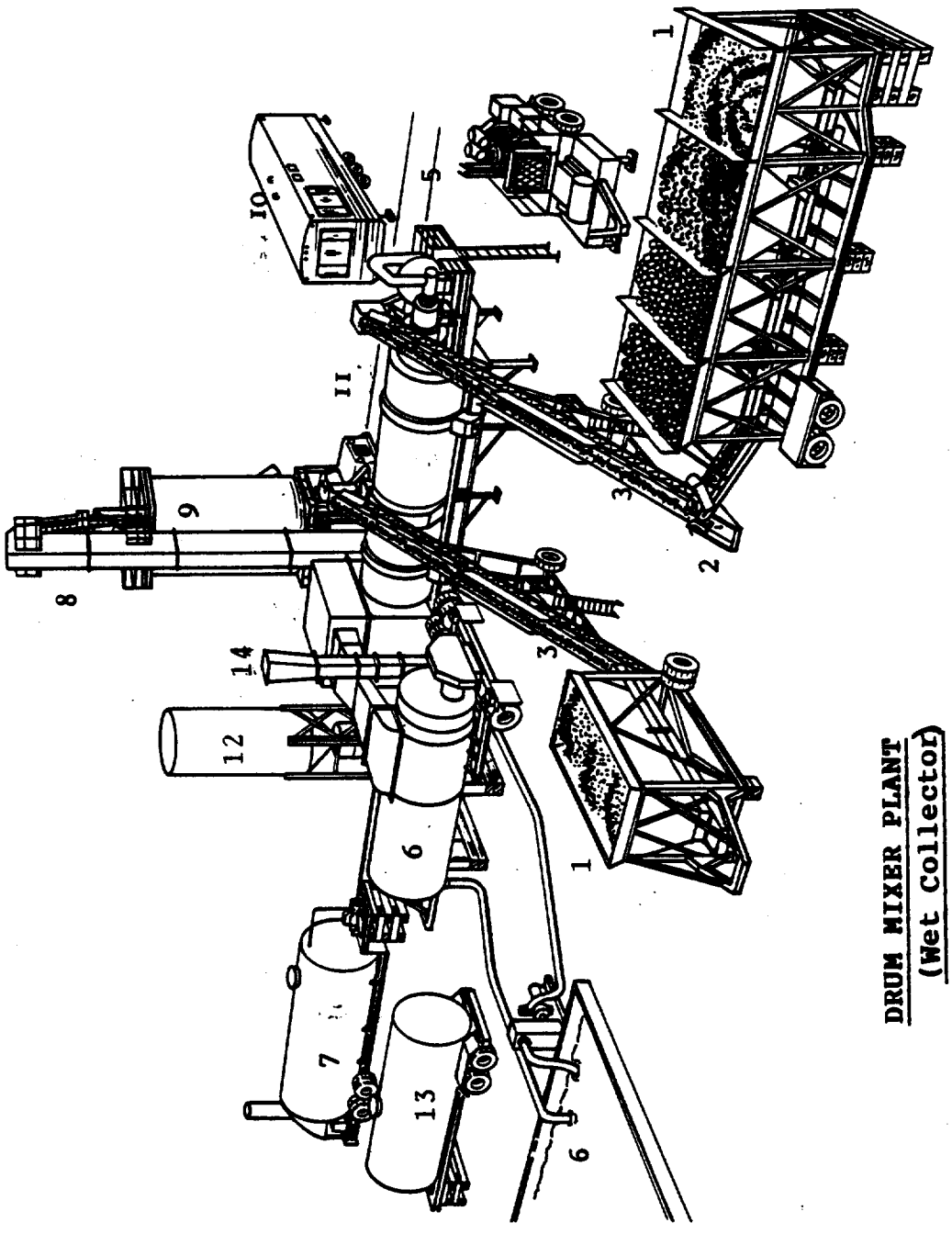
The mixer uses a burner fired with natural gas to heat air to dry the aggregate. The air is drawn into the system via an exhaust fan. After passing through the gas burner, the air passes through a high efficiency scrubber. The scrubber is manufactured by ADM. The exhaust gases are blown through the scrubber and discharged to the atmosphere through the stack. The design pressure drop across the venturi is 10 inches of water. The particulate matter, which is removed by the scrubber, is fed into a scrubber pond where it drops out of suspension.



DRUM MIXER PLANT
(Wet Collector)

1. Aggregate bins: Virgin and recycled aggregate is fed individually into each of the bins by type. It is metered onto a conveyor belt running under the bins to a shaker screen. The proportion of each aggregate type is determined by the job mix formula and pre-set to be metered out to meet these specifications.

2. Preliminary oversize screen: The aggregate is fed through a shaker screen where oversize rocks and foreign material is screened out of the mix.

3. Weigh conveyor belt: The aggregate is conveyed to the rotary drum dryer on a conveyor belt which weighs the material. The production rate is determined by this weight reading.

4. Rotary drum dryer/mixer: The aggregate is fed into the rotary drum dryer where it is tumbled by flighting into a veil in front of a gas flame which drives off the moisture. Further mixing is also accomplished in this drum. Hot liquid asphalt is injected approximately one-third of the way down the inclined drum where it is mixed with the aggregate.

5. Burner: The fuel fired burner is used to dry the rough aggregate and sand in the rotating drum as well as reheat recycled asphalt when it is part of the mix.

6. Wet scrubbing system: A system of cyclonic action, spray nozzles and a venturi removes 99% of particulates in the gas stream.

7. 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.

8. Conveyor to surge/storage bin: The finished product of aggregate mixed with liquid asphalt is conveyed to a surge bin.

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

10. Control/operators house: The entire plant operation is controlled from this operator's house.

11. Truck loading scale: As the trucks receive the asphalt from the storage/surge bin they are weighed on the loading scale which tells the plant operator the amount of asphalt that is being trucked on each individual load.

12. Mineral filler system (when used).

13. Burner fuel storage (when used).

14. Stack.

DATA SUMMARY ON STACK BEING TESTED

AGGREGATE

1. Name/type of mix TYPE NO. I BINDER
2. Name/type of 2nd mix (if used) NONE
3. Type/temperature of Liquid Asphalt AC30 / 300 °F
4. Sieve/Screening analysis: _____ % Passing;

	1st mix / 2nd mix		1st mix / 2nd mix		1st mix / 2nd mix
1"	100 /	3/8"	85 /	#	/
3/4"	100 /	#200	6 /	#	/
1/2"	95 /	#	/	#	/

CONTROL SYSTEM

Manufacturer ASPHALT DRUM MIXERS INC.

~~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 ADJUSTABLE Wet Washer HORZ.
   Spray Booth ——— Other ———
2. Gallons per minute through system 96
3. Water source POND (2) (i.e., pond, lagoon, etc.)
4. Number of spray nozzles 36

Company Name LINCOLN ASPHALT PAVING Date 6/19/80

Company Representative KEVIN HARPER

Form REC#03

DATA ON FACILITY BEING STACK TESTED 1 OF 2

COMPANY NAME LINCOLN ASPHALT PAVING. COMPANY REP. KEVIN HARPER PHONE (318) 255-9282

LOCATION OF FACILITY RUSTON, LA. ORIGINAL START-UP DATE FEB 1ST 90 DESIGNED CAPACITY 225

OEM ASPHALT DRUM MIXERS INC. MODEL NO. S8434S TYPE DRUM AC TYPE 30

1 Time (24 HR) NOTE: check small box in column when moisture sample is taken	2 Fuel Use ☐ #Fuel Oil ☒ Nat. Gas ☐ Propane ☐ Coal ☐ other	3 Burner Setting	4 Blower Pressure	5 Production Rate ☒ Mix/Aggregate TPH	5 ☐ RAP TPH	6 Asphalt Cement %	7 Mix Temp. °F	8 Exhaust Gas Temp. °F	9 ☒ Venturi Scrubber ☐ Baghouse Pressure Drop (in w.g.)	9 Water Pressure (psi)	10 Ambient Temp. °F	11 Relative Humidity %	12 Exhaust Damper Position
MOISTURE 4.9													
0900	☒ N-GAS	53	24oz	220	-0-	4.7	280		10	40			OPEN
0915	"	53	24oz	221	-0-	4.7	275		10	40			"
0930	"	52	24oz	220	-0-	4.7	280		10	40			"
0945	"	53	24oz	221	-0-	4.7	275		10	40			"
1000	"	54	24oz	223	-0-	4.7	275		10	40			"
1015	"	53	24oz	223	-0-	4.7	275		10	40			"
1030	"	53	24oz	223	-0-	4.7	275		10	40			"
1045	"	53	24oz	222	-0-	4.7	280		10	40			"
11:00	SHUT DOWN												
11:15	SHUT DOWN.												
13:45	N GAS	53	24oz	220	-0-	4.7	280		10	40			"
14:00	"	53	24oz	220	-0-	4.7	280		10	40			"
14:15	"	53	24oz	221	-0-	4.7	280		10	40			"
14:30	"	52	24oz	220	-0-	4.7	280		10	40			"
14:45	"	52	24oz	219	-0-	4.7	280		10	40			"
15:00	"	52	24oz	218	-0-	4.7	280		10	40			"
15:15	"	51	24 oz		-0-	4.7	280		10	40			"
15:30	"				-	4.7			10	40			"

(8)

Form REC#04

1 Time (24 HR) NOTE: check small box in column when moisture sample is taken 4.4	2 Fuel Use ___#Fuel Oil Nat. Gas X Propane ___ Coal ___ ___ other	3 Burner Setting	4 Blower Pressure	5 Production Rate X Mix ___ Aggregate TPH	5 Production Rate ___RAP TPH	6 Asphalt Cement %	7 Mix Temp. °F	8 Exhaust Gas Temp. °F	9 ___Venturi Scrubber ___Baghouse Pressure Drop in w.g.	9 Water Pressure psi	10 Ambient Temp. °F	11 Relative Humidity %	12 Exhaust Damper Position
15:45	N.GAS	54	240Z		-0-	4.7	280	—	10	40	—	—	OPEN
16:00	"	52	"		-0-	4.7	285	—	10	40	—	—	"
16:15	"	50	"		-0-	4.7	290	—	10	40	—	—	"
16:30	"	54	"		-0-	4.7	285	—	10	40	—	—	"
16:45	SHUTD	DOWN											
17:00	"	53	"		-0-	4.7	285	—	10	40	—	—	"
17:15	"	51	"		-0-	47	280	—	10	40	—	—	"
17:30	"	51	"		-0-	47	280	—	10	40	—	—	"
17:45	"	52	"		-0-	47	285	—	10	40	—	—	"

(6)

V. EQUIPMENT USED

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Equipment used on conducting the particulate emissions test was:

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

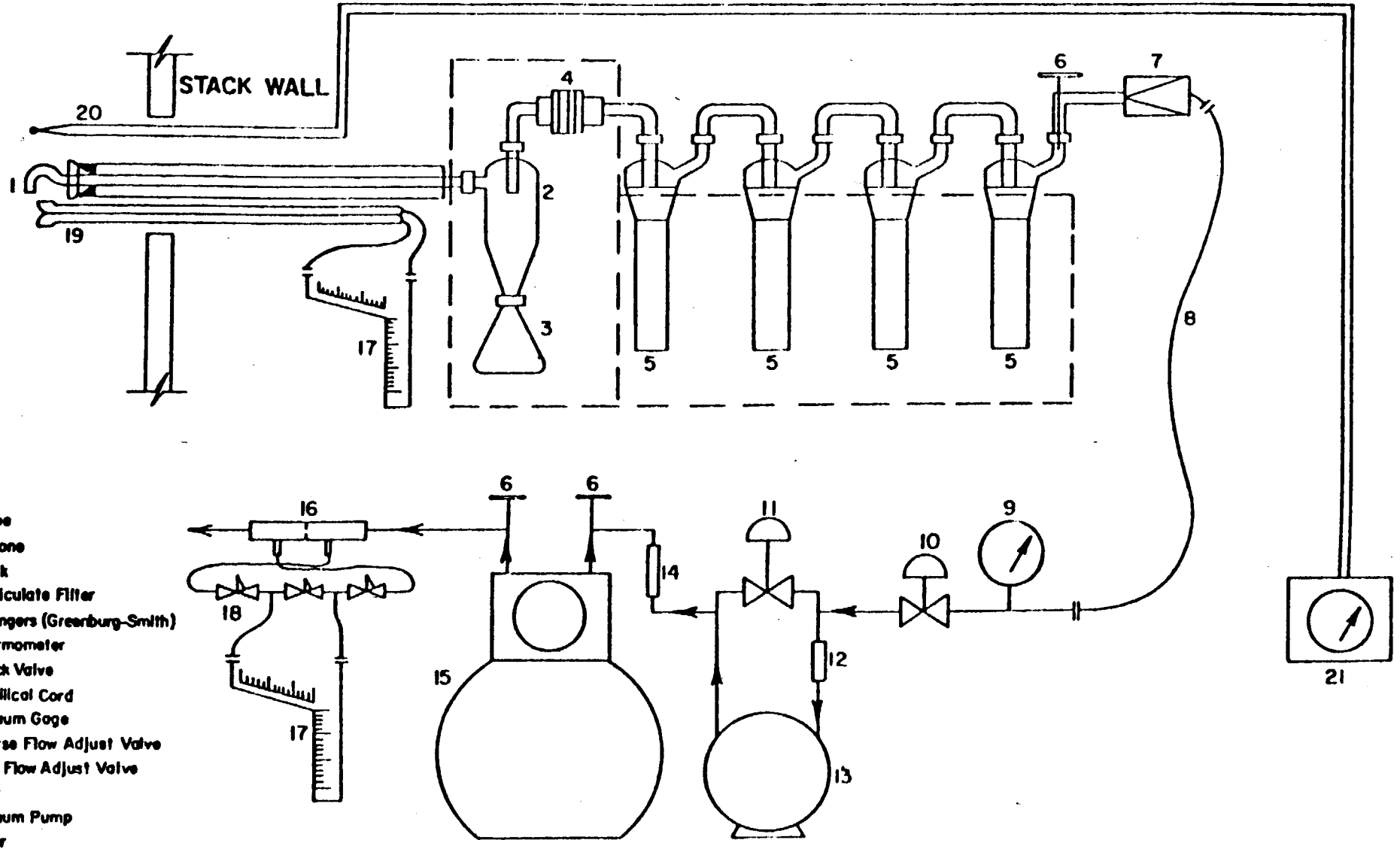
B. An Airguide Instruments Model 211-B (uncorrected) aneroid barometer was used to check the barometric pressure.

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

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

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

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



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

VI. LABORATORY PROCEDURES & RESULTS

LABORATORY PROCEDURES FOR PARTICULATE SAMPLING

I. Field Preparation

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

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

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

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

II. Post - Testing Lab Analysis

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

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

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

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

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

Plant Location LINCOLN Relative humidity in lab 50 %

Sample Location Lot wet asphalt plant Density of Acetone (pa) .7857 mg/ml

Blank volume (V_a) 275 ml

Date/Time wt. blank 6-25-90:8:15 a.m. Gross wt. 167.1477 mg

Date/Time wt. blank 6-26-90:7:45 a.m. Gross wt. 167.1474 mg

Ave. Gross wt. 167.1476 mg

Tare wt. 162.1447 mg

Weight of blank (m_{ab}) 0.0029 mg

Acetone blank residue concentration (C_a) (C_a) = (M_{ab}) / (V_a) (p_a) = (0.0000134 mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} p_a$ = (0.0000134)(275)(.7857) = (0.0029)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	275	275	275
Date/Time of wt 6-25-90:8:15 a.m. Gross wt	g	126.4376	136.4278	134.3786
Date/Time of wt 6-26-90:7:45 a.m. Gross wt	g	126.4373	136.4278	134.3789
Average Gross wt	g	126.4375	136.4278	134.3789
Tare wt	g	126.4139	136.4096	134.3389
Less acetone blank wt (W_a)	g	0.0029	0.0029	0.0029
Wt of particulate in acetone rinse (m_a)	g	0.0207	0.0153	0.0371

Filter Numbers	#	BS-4274	BS-4275	BS-4276
Date/Time of wt 6-25-90:8:15 a.m. Gross wt	g	0.6341	0.6311	0.6058
Date/Time of wt 6-26-90:7:45 a.m. Gross wt	g	0.6342	0.6314	0.6060
Average Gross wt	g	0.6342	0.6313	0.6059
Tare wt	g	0.5636	0.5634	0.5607

Weight of particulate on filters(s) (m_f)	g	0.0706	0.0629	0.0452
Weight of particulate in acetone rinse	g	0.0207	0.0153	0.0371
Total weight of particulate (m_n)	g	0.0913	0.0832	0.0823

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 Mark Landy Signature of reviewer Bruce Shrader

Lincoln
Company Name

6-15-94
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 2.2]

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

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

RUN 1:	$CO_{2\%}$	2	$CO_{2\%}$	2.5	$CO_{2\%}$	2	AVG.	2.2
	$O_{2\%}$	20.87	$O_{2\%}$		$O_{2\%}$	20.81	AVG.	17.0
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.8
RUN 2:	$CO_{2\%}$	2	$CO_{2\%}$	2.5	$CO_{2\%}$	2.5	AVG.	2.3
	$O_{2\%}$	20.87	$O_{2\%}$		$O_{2\%}$		AVG.	16.9
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.8
RUN 3:	$CO_{2\%}$	2	$CO_{2\%}$	2	$CO_{2\%}$	2	AVG.	2.0
	$O_{2\%}$	20.87	$O_{2\%}$	20.87	$O_{2\%}$	20.87	AVG.	17.4
	$N_{2\%}$		$N_{2\%}$		$N_{2\%}$		AVG.	80.6

VII. CALCULATIONS

LINCOLN PAVING
RUSTON, LOUISIANA

SUMMARY OF TEST DATA

		6-19-90 RUN #1	6-19-90 RUN #2	6-19-90 RUN #3
SAMPLING TRAIN DATA				
	start	09:22	13:43	15:53
	finish	11:52	15:24	17:30
1. Sampling time, minutes	θ	60.0	60.0	60.0
2. Sampling nozzle diameter, in.	D_n	.4500	.4500	.4500
3. Sampling nozzle cross-sect. area, ft^2	A_n	.001105	.001105	.001105
4. Isokinetic variation	I	96.4	97.2	93.7
5. Sample gas volume - meter cond., cf.	V_m	45.500	48.616	44.472
6. Average meter temperature, ^oR	T_m	572	577	578
7. Avg. oriface pressure drop, in. H_2O	dH	1.59	1.61	1.54
8. Total particulate collected, mg.	M_n	91.30	83.20	82.30
VELOCITY TRAVERSE DATA				
9. Stack area, ft^2	A	20.00	20.00	20.00
10. Absolute stack gas pressure, in. Hg.	P_s	29.82	29.82	29.82
11. Barometric pressure, in. Hg.	P_{bar}	29.82	29.82	29.82
12. Avg. absolute stack temperature, R^o	T_s	637	635	631
13. Average $-\sqrt{\text{vel. head}}$, (C_p= .81)	$-\sqrt{dP}$	0.31	0.32	0.31
14. Average stack gas velocity, ft./sec.	V_s	19.68	20.21	19.61
STACK MOISTURE CONTENT				
15. Total water collected by train, ml.	V_{ic}	432.00	430.00	432.00
16. Moisture in stack gas, %	B_{ws}	32.69	31.22	33.32
EMISSIONS DATA				
17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	787	829	785
18. Stack gas flow rate, cfm	acfm	23616	24252	23532
19. Particulate concentration, gr/dscf	C_s	0.0335	0.0288	0.0312
20. Particulate concentration, lb/hr	E	3.77	3.41	3.50
21. Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000
ORSAT DATA				
22. Percent CO_2 by volume	CO_2	2.20	2.30	2.00
23. Percent O_2 by volume	O_2	17.00	16.90	17.40
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	80.80	80.80	80.60

Format: summryR3

LINCOLN PAVING
RUSTON, LOUISIANA

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:

$$V_{m(std)} = (17.64)(1.000)(45.500)\left[\frac{(29.82) + \frac{1.59}{13.6}}{572}\right] = 42.007 \text{ dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(1.000)(48.616)\left[\frac{(29.82) + \frac{1.61}{13.6}}{577}\right] = 44.497 \text{ dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(1.000)(44.472)\left[\frac{(29.82) + \frac{1.54}{13.6}}{578}\right] = 40.627 \text{ dscf}$$

LINCOLN PAVING
RUSTON, LOUISIANA

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:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{91.30}{42.007}\right] = 0.0335 \text{ gr./dscf.}$$

Run 2:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{83.20}{44.497}\right] = 0.0288 \text{ gr./dscf.}$$

Run 3:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{82.30}{40.627}\right] = 0.0312 \text{ gr./dscf.}$$

LINCOLN PAVING
RUSTON, LOUISIANA

Dry Molecular Weight

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%CO + \%N_2)$$

Where:

M_d = Dry molecular weight, lb./lb.-mole.

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

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

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

%CO = Percent carbon monoxide by volume (dry basis).

0.264 = Ratio of O_2 to N_2 in air, v/v.

0.28 = Molecular weight of N_2 or CO, divided by 100.

0.32 = Molecular weight of O_2 divided by 100.

0.44 = Molecular weight of CO_2 divided by 100.

Run 1:

$$M_d = 0.44(\ 2.20\%) + 0.32(17.00\%) + 0.28(\ .00\% + 80.80\%) = 29.03 \ \frac{lb}{lb\text{-mole}}$$

Run 2:

$$M_d = 0.44(\ 2.30\%) + 0.32(16.90\%) + 0.28(\ .00\% + 80.80\%) = 29.04 \ \frac{lb}{lb\text{-mole}}$$

Run 3:

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

LINCOLN PAVING
RUSTON, LOUISIANA

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) (416.0) = 19.6 cu.ft
$V_{wsg(std)}$ = (0.04715) (16.0) = 0.8 cu.ft

Run 2:

$V_{wc(std)}$ = (0.04707) (410.0) = 19.3 cu.ft
$V_{wsg(std)}$ = (0.04715) (20.0) = 0.9 cu.ft

Run 3:

$V_{wc(std)}$ = (0.04707) (414.0) = 19.5 cu.ft
$V_{wsg(std)}$ = (0.04715) (18.0) = 0.8 cu.ft

LINCOLN PAVING
RUSTON, LOUISIANA

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:

$$B_{ws} = \frac{19.6 + 0.8}{19.6 + 0.8 + 42.007} \times 100 = 32.69\ \%$$

Run 2:

$$B_{ws} = \frac{19.3 + 0.9}{19.3 + 0.9 + 44.497} \times 100 = 31.22\ \%$$

Run 3:

$$B_{ws} = \frac{19.5 + 0.8}{19.5 + 0.8 + 40.627} \times 100 = 33.32\ \%$$

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:

$M_s = 29.03 (1 - 32.69) + 18 (32.69) = 25.42$ (lb./lb.-mole)

Run 2:

$M_s = 29.04 (1 - 31.22) + 18 (31.22) = 25.59$ (lb./lb.-mole)

Run 3:

$M_s = 29.02 (1 - 33.32) + 18 (33.32) = 25.35$ (lb./lb.-mole)

LINCOLN PAVING
RUSTON, LOUISIANA

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 $\left[\frac{(g/g\text{-mole})\text{-}(mm\ Hg)}{(^oK)(mm\ H_2O)}\right]^{1/2}$

C_p = Pitot tube coefficient, (dimensionless).

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

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

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

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

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

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

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

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

Run 1:

$$V = (85.49)\ (\ .81)\ (\ 0.31) \sqrt{\frac{637}{(29.82)(25.42)}} = 19.68 \text{ ft/sec.}$$

Run 2:

$$V = (85.49)\ (\ .81)\ (\ 0.32) \sqrt{\frac{635}{(29.82)(25.59)}} = 20.21 \text{ ft/sec.}$$

Run 3:

$$V = (85.49)\ (\ .81)\ (\ 0.31) \sqrt{\frac{631}{(29.82)(25.35)}} = 19.61 \text{ ft/sec.}$$

LINCOLN PAVING
RUSTON, LOUISIANA

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:

$$Q_{sd}=3600(1-\ .3269\ )(\ 19.68)(\ 20.00)\left[\frac{528}{637}\right]\left[\frac{29.82}{29.92}\right]=\ 787912.0\ \frac{dscf}{hr}$$

Run 2:

$$Q_{sd}=3600(1-\ .3122\ )(\ 20.21)(\ 20.00)\left[\frac{528}{635}\right]\left[\frac{29.82}{29.92}\right]=\ 829406.1\ \frac{dscf}{hr}$$

Run 3:

$$Q_{sd}=3600(1-\ .3332\ )(\ 19.61)(\ 20.00)\left[\frac{528}{631}\right]\left[\frac{29.82}{29.92}\right]=\ 785156.6\ \frac{dscf}{hr}$$

LINCOLN PAVING
RUSTON, LOUISIANA

Emissions Rate from Stack

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

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:

$$E = \frac{(0.0335)\ (787912.0)}{7000} = 3.77 \text{ lb. / hr.}$$

Run 2:

$$E = \frac{(0.0288)\ (829406.1)}{7000} = 3.41 \text{ lb. / hr.}$$

Run 3:

$$E = \frac{(0.0312)\ (785156.6)}{7000} = 3.50 \text{ lb. / hr.}$$

LINCOLN PAVING
RUSTON, LOUISIANA

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:

$$I = (100)(637)\left[\frac{(0.002669)(432) + \frac{45.500}{572}\left[29.82 + \frac{1.59}{13.6}\right]}{60\ (60.0)\ (19.68)\ (29.82)\ (.001105)} \right] = 96.4\%$$

Run 2:

$$I = (100)(635)\left[\frac{(0.002669)(430) + \frac{48.616}{577}\left[29.82 + \frac{1.61}{13.6}\right]}{60\ (60.0)\ (20.21)\ (29.82)\ (.001105)} \right] = 97.2\%$$

Run 3:

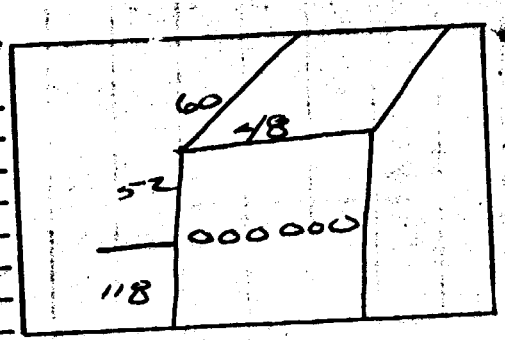
$$I = (100)(631)\left[\frac{(0.002669)(432) + \frac{44.472}{578}\left[29.82 + \frac{1.54}{13.6}\right]}{60\ (60.0)\ (19.61)\ (29.82)\ (.001105)} \right] = 93.7\%$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Lincoln Asphalt

Location Rocklin, Ca.
Operator J. L. Turner
Date 6-19-90
Run No. 1
Sample Box No. 1
Meter Box No. C-185
Meter H @ 1.69
C Factor 1.0
Pitot Tube Coefficient Cp .81



Schematic of Stack Cross Section

	IMPINGER VOLUME (CC)	SILICA GEL WEIGHT (g)
Ambient Temperature 90		
Barometric Pressure 29.82 FINAL	670	228
Assumed Moisture, % 4.4 INITIAL	200	212
Probe Length, m(ft) 6' DIFFERENCE	470	16
Nozzle Identification No. 42d104		
Avg. Calibrated Nozzle Dia., (in.) .150/.150/.150		
Probe Heater Setting 5.0		
Leak Rate, m^3/min. (cfm) .005@5"		
Probe Liner Material SS		
Static Pressure, mm Hg (in. Hg) 0+		
Filter No. BS 4274		

TRAV. PT	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft3	GAS SAMPLE TEMP. AT DRY GAS METER °F In	Out	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	9:20:30 / 9:21:30	3	174	.15	2.1	224.10 / 226.01	106	100	265	64
2	9:26:30	3	174	.12	1.9	227.55	110	100	265	64
3	9:28:30	3	174	.10	1.6	229.11	112	100	265	64
4	9:30:36	3	174	.08	1.3	230.48	114	100	265	64
5	9:32:30	3	176	.12	1.9	231.91	116	100	265	64
B 1	9:33:30 / 9:35:30	3	174	.11	1.8	233.11	116	100	265	64
2	9:37:30	3	176	.08	1.3	234.65	118	100	265	64
3	9:39:30	3	176	.08	1.3	236.10	120	100	265	64
C 1	9:41:30	3	178	.10	1.6	237.71	122	100	265	64
5	9:43:30	3	176	.10	1.6	239.00	122	100		

(27)

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 8-19-90 LOCATION Ruston LA 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)
							[redacted]	out		
C 1	9:45:45 9:47	3	176	.08	1.3	240.35	120	100	255	64
2	9:49:45	3	178	.08	1.3	241.62	122	100	255	64
3	9:51:45	3	178	.06	.95	242.85	124	100	255	64
4	9:53:45	3	178	.08	1.3	244.36	126	100	255	64
5	9:55:45	3	178	.12	1.9	246.00	126	100	255	64
D 1	9:56:50 9:58	3	178	.09	1.4	247.22	124	104	255	64
2	10:04:50	3	178	.10	1.6	248.55	126	104	260	64
3	10:02:50	3	178	.10	1.6	249.72	128	104	260	64
4	10:04:50	3	180	.12	1.9	250.25	128	104	260	64
5	10:06:50	3	180	.12	1.9	253.34	128	104	260	64
E 6	10:08 10:10	3	172	.09	1.4	254.80	124	104	260	64
2	10:12	3	178	.09	1.4	256.20	126	104	260	64
3	10:14	3	180	.12	1.9	257.82	128	104	260	64
4	10:16	3	182	.12	1.9	259.52	128	104	265	64
5	11:38 10:18	3	173	.13	2.1	262.71	110 120	110 104	265	64
F 1	11:40 11:42:45	3	172	.06	.95	264.00	122	110	265	64
2	11:42 11:43:40	3	174	.08	1.3	265.31	122	110	265	64
3	11:49:55	3	178	.08	1.3	266.65	122	110	265	64
4	11:50:55	3	178	.09	1.4	268.10	122	108	265	64
5	11:52:55	3	178	.12	1.9	269.70	124	108	265	64

RAMCON ENVIRONMENTAL CORPORATION

Plant Lincoln
Location Eunice LA
Operator T.D.C. Tucker
Date 6/19/20
Run No. 1
Sample Box No. 2
Meter Box No. 3 G185
Meter H@ 1.69
C Factor 1.0
Pitot Tube Coefficient Cp .81

Schematic of Stack Cross Section

Ambient Temperature 95
Barometric Pressure 29.82
Assumed Moisture, % 4
Probe Length, m(ft) 6'
Nozzle Identification No. 001107
Avg. Calibrated Nozzle Dia., (in.) .450/.454/.450
Probe Heater Setting 5.0
Leak Rate, m^3/min. (cfm) .0023"
Probe Liner Material SS
Static Pressure, mm Hg(in. Hg) .01
Filter No. BS415

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	610	240
INITIAL	600	220
DIFFERENCE	410	20

TRAVERSE POINT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (ΔPs) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	1:45:37 / 1:45	2	172	.08	1.3	270:03 / 271:53	114	108	260	65
2	1:47:35	2	172	.06	.95	272:82	116	108	260	65
3	1:49:35	2	174	.1	1.6	274:25	118	108	260	65
4	1:51:35	2	178	.12	1.9	275:75	120	108	260	65
5	1:53:38	2	178	.08	1.3	277:07	122	106	260	65
B 1	1:54:25 / 1:56:25	2	172	.10	1.6	278:59	120	106	260	65
2	1:58:25	2	176	.10	1.6	280:22	122	106	260	65
3	2:00:25	2	178	.5	2.4	282:16	126	106	260	65
4	2:02:25	2	178	.12	1.9	283:76	126	108	260	65
5	2:04:25	3	176	.15	2.4	285:76	128	108	260	65

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Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6/19/98 LOCATION Lisbon LA TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP	VELOCITY HEAD ΔPs (in H2O)	ORFICE DIFF. PRESSURE ΔH (in. H2O)	GAS VOLUME Vm (ft3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
C-1	2:08	2	172	.10	1.6	287.11	124	106	265	68
2	2:10	2	172	.10	1.6	288.72	126	106	265	68
3	2:12	2	178	.10	1.6	289.72	126	106	265	68
4	2:14	2	178	.12	1.9	293.42	128	106	265	68
5	2:16	2	178	.08	1.3	296.34	130	106	268	65
D-1	2:18:45 2:20	2	172	.12	1.9	297.85	128	106	265	65
2	2:22:45	2	172	.10	1.6	299.58	128	106	265	65
3	2:58:15 2:00	2	172	.08	1.3	300.90	122	112	268	65
4	3:02:16	2	172	.08	1.3	302.25	124	112	268	68
B	3:04:10	2	174	.08	1.3	303.65	128	112	265	65
B-1	3:04:20 3:06	2	172	.12	1.9	305.29	128	112	265	65
2	3:08	2	178	.10	1.6	306.82	128	112	268	65
3	3:10	2	178	.09	1.4	308.26	128	112	268	65
4	3:12	2	178	.09	1.4	309.72	130	112	268	65
5	3:14:20	2	176	.10	1.6	311.36	130	112	265	65
F-5	3:14:32 3:16:35	2	170	.09	1.4	312.70	130	112	268	65
4	3:18:35	2	174	.12	1.9	314.39	130	112	268	65
3	3:20:35	2	176	.12	1.9	316.15	132	112	268	65
2	3:22:35	2	176	.11	1.8	317.52	132	112	268	65
1	3:24:35	2	174	.11	.95	318.70	132	112	265	68

RAMCON ENVIRONMENTAL CORPORATION

Plant Lonecon
Location Russia bar
Operator Carl Turner
Date 6-19-90
Run No. 3
Sample Box No. 3
Meter Box No. C-185
Meter H @ 1.69
C Factor 1.0
Pitot Tube Coefficient Cp .81

Ambient Temperature 79
Barometric Pressure 29.82 FINAL
Assumed Moisture, % 24 INITIAL
Probe Length, m(ft) 6' DIFFERENCE

IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
614	220
220	202
394	18

Nozzle Identification No. .601104
Avg. Calibrated Nozzle Dia., (in.) .550/.554/.552
Probe Heater Setting 5.0
Leak Rate, m^3/min. (cfm) .00103
Probe Liner Material SS
Static Pressure, mm Hg (in. Hg) .04
Filter No. BS 4296

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	3:53:10 / 3:55	2	174	.13	2.1	318:90 / 320:12	114	112	265	64
2	3:57	2	174	.12	1.9	322:51	122	112	265	64
3	3:59	2	174	.12 / .09	1.9 / 1.4	325:81	124	112	265	64
4	4:01:10	2	178	.09	1.4	329:36	124	112	265	64
5	4:03:10	2	178	.09	1.4	326:55	126	112	265	64
B 1	4:05:55 / 4:07:55	2	170	.11	1.8	328:84	116	108	265	64
2	4:09:55	2	170	.10	1.6	329:72	120	108	265	64
3	4:11:55	2	173	.08	1.3	331:14	124	108	265	64
4	4:13:55	2	175	.08	1.3	332:61	124	108	265	64
5	4:15:55	2	174	.10	1.6	333:98	128	108	265	64

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Form #REC-06

RAMCON emissions test log sheet, cont. DATE 6-19-90 LOCATION [redacted] LA TEST NO. 3

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP (°F)	VELOCITY HEAD ΔP (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		
0 1	4:16 / 4:18	2	174	.11	1.8	335:71	130	108	265	64
2	4:20	2	174	.10	1.6	337:17	130	108	265	64
3	4:22	2	174	.09	1.4	338:600	130	108	265	64
4	4:24	2	174	.10	1.6	340:24	130	108	265	64
5	4:26	2	174	.06	.95	341:31	130	108	265	64
1	4:26:10 / 4:28:10	2	174	.06	.95	342:55	130	108	265	64
Port 2	4:30:10	2	174	.10	1.6	344:00	130	108	265	64
[redacted] 3	5:04:10 / 5:06:10	2	174	.12	1.9	345:68	116	110	265	64
4	5:08:10	2	165	.09	1.4	347:21	122 / 116	110	265	64
5	5:10:10	2	168	.15	2.4	348:92	122	110	265	64
1	5:10:25 / 5:12:25	2	168	.09	1.4	350:33	126	110	265	64
2	5:14:25	2	168	.12	1.9	352:00	126	110	265	64
3	5:16:25	2	162	.10	1.6	353:52	126	110	265	64
4	5:18:25	2	165	.10	1.6	355:05	128	110	265	64
5	5:20:25	2	165	.09	1.4	356:61	128	110	265	64
1	5:20:40 / 5:22	2	165	.08	1.3	358:91	130	110	265	64
2	5:24	2	165	.08	1.3	359:21	130	110	265	64
3	5:26	2	165	.08	1.3	360:61	130	110	265	64
4	5:28	2	165	.10	1.6	362:85	130	110	265	64
5	5:30:40	2	165	.10	1.6	[illegible]	130	110	[illegible]	[illegible]

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IX. CALIBRATION

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 7-3-90 Meter box number C-185

Barometric pressure, P_b = 29.95 in. Hg Calibrated by B. Oz Turner

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Avg[a] (t_d), °F	Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
0.5	5								
1.0	5	151.80 / 156.991	80.6	102 / 100	92 / 90	97.5	8.52	.99	1.61
1.5	10								
2.0	10	157.10 / 167.11	80.6	102 / 100	90 / 90	97	12.55	.992	1.75
3.0	10	162.60 / 172.86	80.6	100 / 98	88 / 88	96	10.37	.994	1.79
4.0	10							.992	
							Avg	.992	1.72

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t + 460)}$	$\Delta H@_i = \frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\ \theta}{V_w}\right]^2$
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.

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 6-18-90 Meter box number G185

Barometric pressure, P_b = 29.80 in. Hg Calibrated by BobTurner

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Avg[a] (t_d), °F	Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
0.5	5								
1.0	5	198.11 / 203.11	75.2	90 / 100	76 / 76	85.5	8.68	1.00	1.68
1.5	10								
2.0	10	203.45 / 213.88	75.2	94 / 104	76 / 76	87	12:43	1.00	1.72
3.0	10	213.88 / 223.95	75.2	96 / 104	76 / 76	88	10:10	1.00	1.69
4.0	10								
							Avg	1.00	1.69

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t + 460)}$	$\Delta H@_i = \frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\ \theta}{V_w}\right]^2$
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.

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-7-89 Thermocouple number inlet/outlet

Ambient temperature 20 °C Barometric pressure 29.88 in. Hg

Calibrator Kenny Reference: mercury-in-glass ✓

other _____

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	Ice Bath	32	32	0
B	Boiling water	212	212	0
C	Boiling oil	381	381	0
D	Ambient 6/19/90	90	90	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 5-7-89 Thermocouple number Hotbox

Ambient temperature 20 °C Barometric pressure 29.88 in. Hg

Calibrator Turner Reference: mercury-in-glass ✓

other _____

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	Ice Bath	32°F	32	0
B	Boiling water	212	212	0
C	Boiling oil	381	381	0
D	Ambient			
	6/19/90	90	90	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

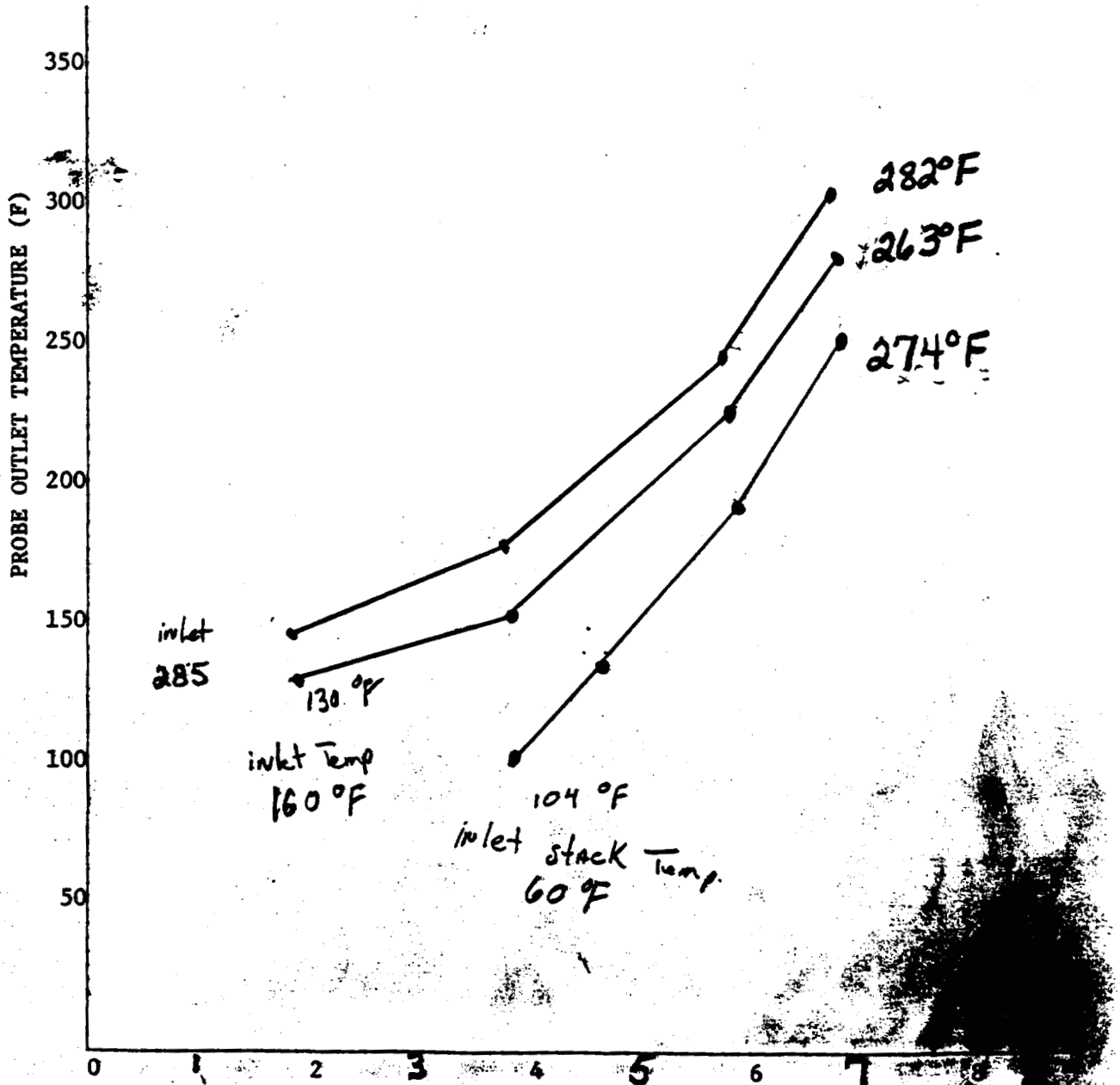
Heating Probe Calibration

Probe No. 61 Probe Length 6'

Date of Calibration 5-8-89 Signature Sam T 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



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. 61 Date 5-4-90

Calibrated by: Sam Turner

"A" SIDE CALIBRATION #61

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	2.05	3.2	.80	0.006
2	1.05	1.6	.810	0.003
3	.42	.64	.81	0.003
		$\bar{C}_p$ (SIDE A)	.806	

"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	2.05	3.15	.807	0.002
2	1.05	1.65	0.798	0.007
3	.42	.64	.81	0.005
		$\bar{C}_p$ (SIDE B)	.805	

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

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

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

Form No. EED-17-1

Date 5-4-90 Thermocouple number 61

Ambient temperature 24 °C Barometric pressure 29.8 in. Hg

Calibrator Juan Reference: mercury-in-glass ✓

other _____

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C °F	Thermocouple Potentiometer Temperature, °C °F	Temperature Difference,[c] %
A	Ice water	32°	32°	0
B	Boiling water	212°	212°	0
C	Oil Boiling	392°	392°	0
D	Ambient 6/19/90	90°	90°	0

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

[b]Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.