RAMCON
ENVIRONMENTAL CORPORATION

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
CORUN & GATCH, INC.
Aberdeen, Maryland
September 14, 1988

Ronald Corun
Corun & Gatch, Inc.

G. Sumner Buck, III
President

Sam Turner
Team Leader

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

RAMCON
ENVIRONMENTAL CORPORATION

October 17, 1988

Mr. Ronald Corun
Corun & Gatch, Inc.
1900 Bel Air Road
Fallston, MD 21047

Re: Particulate Emissions Tests- Aberdeen, Maryland

Dear Mr. Corun:

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

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

Mr. Craig Holdefer
Maryland Air Management
Div. of Environmental Affairs
P. O. Box 13387
Baltimore, MD 21203

You will need to keep one copy of the report.

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

Sincerely,

G. Sumner Buck, III
President

GSBIII:mew

Enclosures

RAMCON BUILDING, 223 SCOTT STREET, MEMPHIS, TENNESSEE 38112
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I. INTRODUCTION

On September 14-15, 1988, personnel from RAMCON Environmental Corporation (REC) conducted a source emissions test for particulate emissions compliance at Corun & Gatch's Standard-Havens drum mix asphalt plant located in Aberdeen, Maryland. RAMCON personnel conducting the test were Sam Turner, Field Supervisor, and Bill Turner. John Biggs was responsible for the particulate 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. Biggs.

The purpose of the test was to determine if the rate of particulate emissions from the plant's baghouse and the total contaminants by weight (grain loading) is below the allowable N.S.P.S. limits set by the State of Maryland.

II. TEST RESULTS

Table I summarizes the test results. The grain loading limitation for EPA is specified in 39 FR 9314, March 8, 1974, 60.92 Standards for Particulate Matter (1), as amended. The allowable N.S.P.S. particulate emissions for EPA and the State of Maryland is .03 gr/dscf.

Mr. Craig Holdefer of Maryland Air Management in Baltimore, Maryland, observed the testing conducted by RAMCON. The visible emissions test (Reference Method 9) was conducted by Sam Turner and Bill Turner. The opacity on the two test runs was 0%, therefore meeting N.S.P.S. requirements.

TABLE I
SUMMARY OF TEST RESULTS
September 14-15, 1988

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	07:43 to 09:00	0.0033 gr/DSCF	100.9%	0.9 lbs/hr
2	10:39 to 12:01	0.0083 gr/DSCF	98.4%	2.2 lbs/hr
3	08:00 to 08:53	0.0045 gr/DSCF	104.0%	1.2 lbs/hr
	Average:	0.0054 gr/DSCF		1.4 lbs/hr

On the basis of these test results, the average grain loading of the three test runs was below the .03 gr/DSCF emissions limitation set by US EPA and the State of Maryland. Therefore, the plant is operating in compliance with State and Federal Standards.

III. TEST PROCEDURES

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

B. Problems Encountered: The plant shut down ten minutes before the test was completed and could not operate anymore that day. The State observer was consulted and it was agreed that since sufficient air sample had already been taken the test could stand as is.

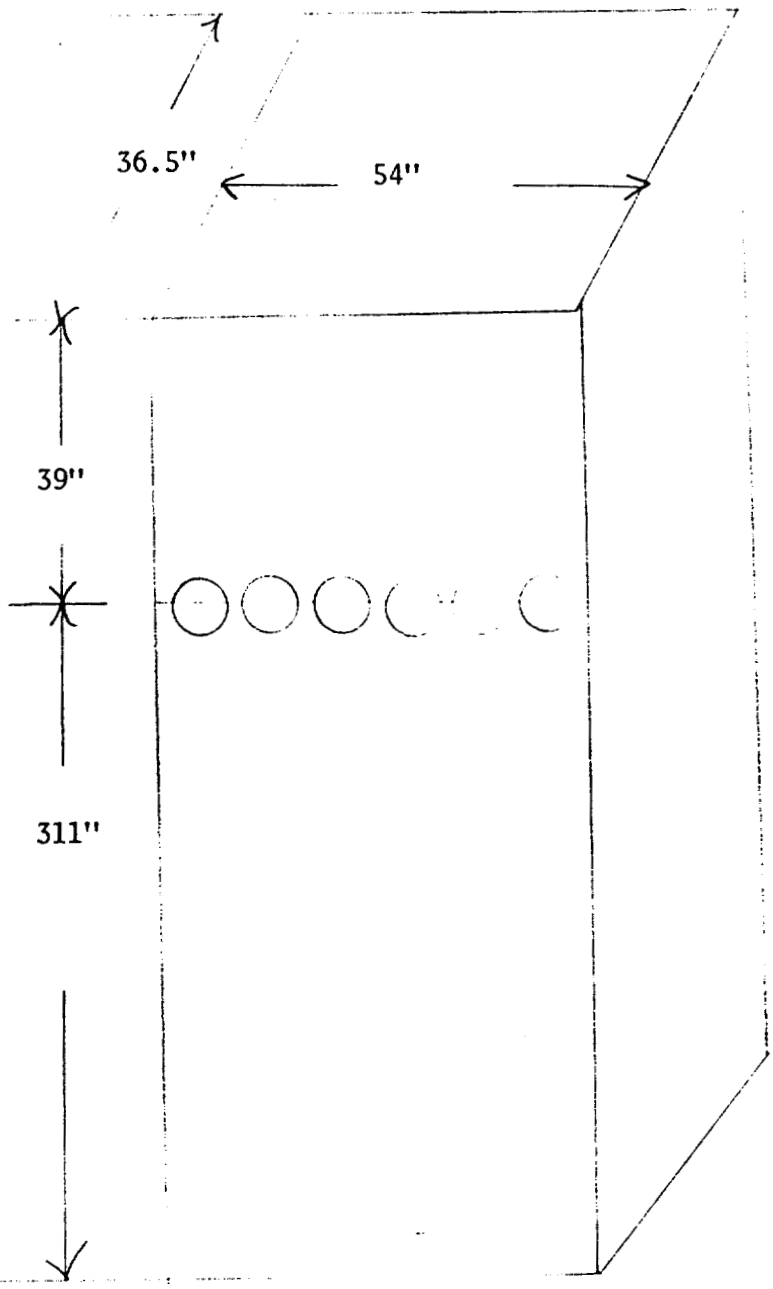
C. Sampling Site: The emissions test was conducted after a baghouse on a rectangular stack measuring 54" x 36.5" with an equivalent diameter of 43.6". Six sampling ports were placed 39" down (0.9 diameters upstream) from the top of the stack and 311" up (7.1 diameters downstream) from the last flow disturbance.

** Twenty-four points were sampled, five through each port for 3 minutes each for a total test time of 72 minutes per test run.

Points on a Diameter	Probe Mark
1	* 9.6"
2	18.7"
3	27.8"
4	36.9"

*Measurements include a 5" standoff.

**Only 17 points were sampled on Run 3 for a total test time of 50 minutes.



IV. THE SOURCE

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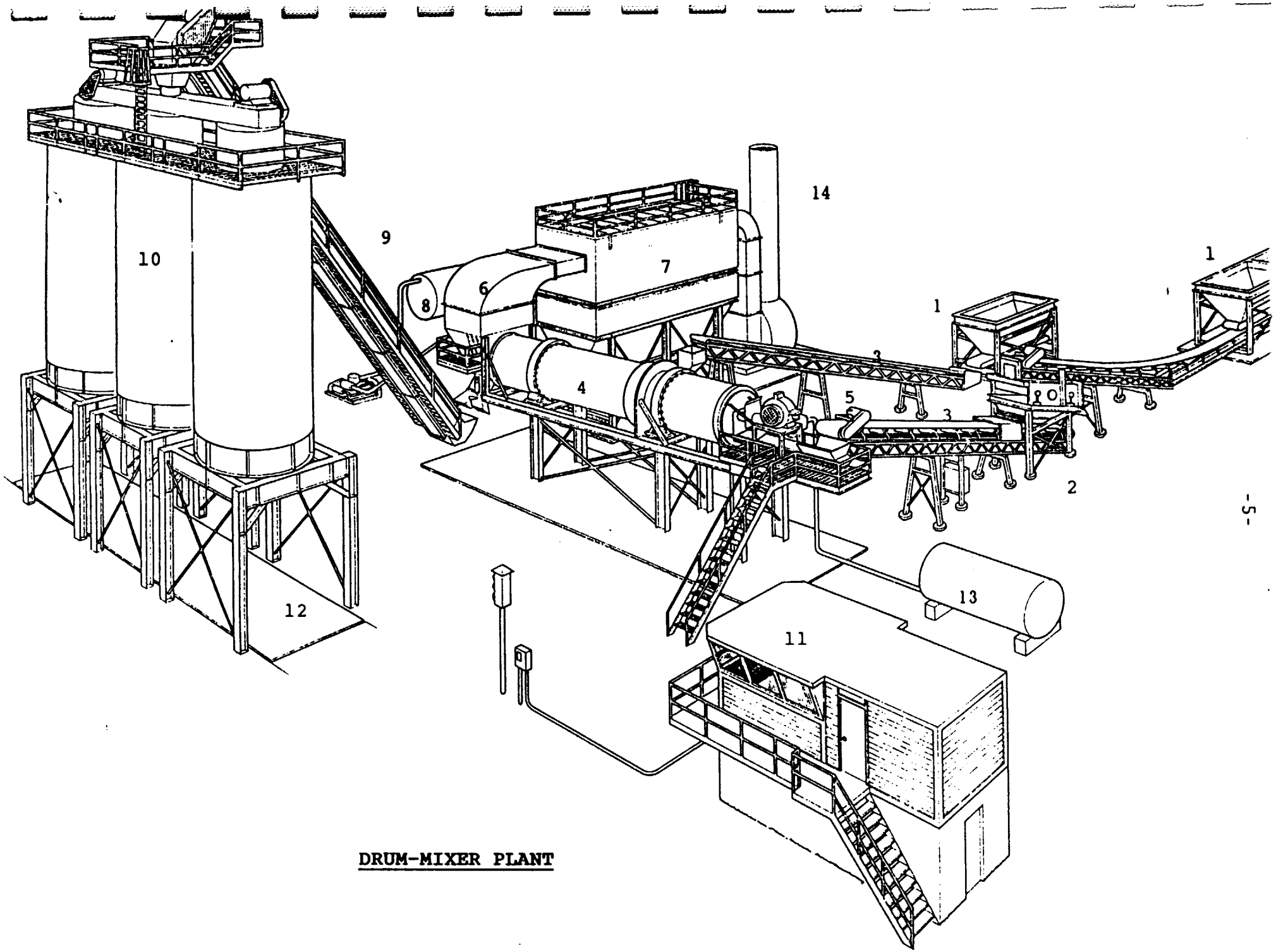
Corun & Gatch, Inc. employs a Standard Havens drum mix asphalt plant which is used to manufacture hot mix asphalt for road pavement. The process consists of blending prescribed portions of cold feed materials (sand, gravel, screenings, chips, etc.) uniformly and adding sufficient hot asphalt oil to bind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

The following is a general description of the plant's manufacturing process: The cold feed materials (aggregate) are dumped into separate bins which in turn feed a common continuous conveyor. The aggregate is dispensed from the bins in accordance with the desired formulation onto the cold feed system conveyor to an inclined weigh conveyor then to a rotating drum for continuous mixing and drying at approximately 300°F. The required amount of hot asphalt oil is then injected onto and mixed into the dried aggregate. The now newly formed hot asphalt mix is pulled to the top of a storage silo by conveyor. The hot asphalt mix is then discharged from the storage silo through a slide gate into waiting dump trucks, which transport the material to a final destination for spreading. The rated capacity of the plant will vary with each aggregate mix and moisture content with a 5% moisture removal.

The drum dryer uses a burner fired with #4 fuel oil to heat air to dry the aggregate, and the motion of the rotating drum to blend the aggregate and hot asphalt oil thoroughly. The air is drawn into the system via an exhaust fan. After passing through the burner and the mixing drum, the air passes through a baghouse. The baghouse was manufactured by Standard Havens. The exhaust gas is drawn through the baghouse and discharged to the atmosphere through the stack. The design pressure drop across the tube sheet is 1-6 inches of water. The particulate matter, which is removed by the baghouse, is reinjected into the drum mixer.



DRUM-MIXER PLANT

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

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

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

4. Rotary drum dryer/mixer: The aggregate is fed into the rotary drum dryer where it is tumbled by flighting into a veil in front of a flame which drives off the moisture. Further mixing is also accomplished in this drum. Hot liquid asphalt is injected 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 provide the flame which drys the aggregate.

6. Knock off baffleing: A baffeling plate is inserted in the "dirty" side plenum as a knock out for heavy particles in the air stream. These particles fall to the bottom of the baghouse.

7. Baghouse: The hot gases are pulled through the bags into the clean air plenum. The solid particulate matter is trapped on the dust coat buildup on the bags. A bag cleaning cycle consisting of jet burst of air from the inside (or clean air side) of the bags sends a large bubble of air down the inside of the bags shaking loose buildup on the bag surface. This particulate matter is collected at the bottom of the baghouse and reinjected into the drum mixer where it is used as part of the finished project.

8. Liquid asphalt storage: The liquid asphalt is stored in this heated tank until it is needed in the mixer. The amount of asphalt content and its temperature are pre-set for each different type job.

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

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

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

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

13. Fuel Storage

14. Stack

PLANT DATA

COMPANY NAME CORUN & GATCH, INC.

COMPANY REP. RON CORUN DATE 9/14/88 PHONE # 272-8640

DATA SOURCE

PLANT LOCATION ABERDEEN, MARYLAND

PLANT MFG. STANDARD HAVENS PLANT MODEL # CF- PLANT TYPE COUNTER FLOW DRUM

MIX SPECIFICATION # OIL SPECIFICATION # 4

Time 24 Hour	#4 Fuel Oil X Nat. Gas__ Propane__ Coal__	Burner Setting	Aggregate TPH	Recycle TPH	Liquid Asphalt TPH	Mix Temp. °F	__Venturi __Baghouse Pressure Drop Inches Water
7:45		49	279	—	15	310	2.4
8:01		48	275	—	15	303	3.3
8:15		49	283		16	305	3.3
8:30		49	280		16	312	3.0
8:45		51	282		17	312	3.5
8:55		51	282		17	310	3.7
		SHUTDOWN					
10:40		48	282		16	308	3.5
10:55		49	282		16	294	3.0
11:06		49	284		16	289	3.0
11:20		55	289		16	254	2.8
11:40		51	274		15	323	3.2
11:47		50	289		16	315	3.1
9/15/88							
8:32		56	278		16	280	3.2
8:47		54	292		16	317	3.2

DATA SUMMARY

Plant

1. Manufacturer of plant STANDARD HAVENS.
2. Designed maximum operating capacity 350 TPH @ 5 % moisture.
3. Actual operation rate 300 TPH @ 3.4 % moisture.
4. Startup date 7-11-88.
5. Type of fuel used in dryer #4 OIL.
6. Quanity of fuel consumption 1.7 GAL/TON.

Aggregate

7. Name/type of mix MO. STATE BASE BI.
8. Percent asphalt in mix 5.3 %.
9. Temperature of asphalt 310°.
10. Sieve/Screening analysis: % Passing;

1 1/2	4" 100	3/8"	64	#16	27
	3/4" 91	# 4	50	#50	11
	1/2" —	# 8	38	#200	4.3

Baghouse

11. Manufacturer STANDARD HAVENS.
12. No. of bags 448. Type of bags NOMEX.
13. Air to cloth ratio _____. Designed ACFM 52,000.
14. Square feet of bags _____.
15. Type of cleaning; pulse jet ✓, reverse air _____, plenum pulse _____, other _____.
16. Cleaning cycle time .10 SEC.
17. Interval between cleaning cycle 20 SEC.
18. Pressure drop across baghouse 3.7 psi.
19. Pulse pressure on cleaning cycle 100psi psi.

COMPANY NAME CORUN & GATCH, INC. DATE 9/14/88

V. EQUIPMENT USED

V. EQUIPMENT USED

Equipment used on conducting the particulate emissions test was:

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

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

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

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

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

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

VI. LABORATORY PROCEDURES & RESULTS

LABORATORY PROCEDURES FOR PARTICULATE SAMPLING

I. Field Preparation

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

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

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

Approximately 200 g of silica gel is placed in a wide mouth "Mason" type jar and dried in an oven (175°C for two hours). The open jars are removed and placed in a dessicator until cool (2 hours) and then tightly sealed. The jars are then numbered and weighed on the triple beam balance to the closest tenth of a gram, and this weight is recorded for each sealed jar. The number of silica gel jars used is the same as the number of filters. Silica gel should be indicating type, 6-16 mesh.

II. Post-Testing Lab Analysis

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

Alternately, the test team may opt to oven dry the filters at 220°F for two to three hours, weigh the sample, and use this weight as a final weight.

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

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

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

E. ACETONE: Conduct a blank analysis of acetone from the one gallon glass container. This acetone will be used in the field for rinsing the probe, nozzle, and top half of the filter holder. Performing such a blank analysis prior to testing will insure that the quality of the acetone to be used will not exceed the .001% residual purity standard.

SPECIAL NOTE

When sampling sources high in moisture content, (such as asphalt plants) the filter paper sometimes sticks to the filter holder. When removing the filter, it may tear. In order to maintain control of any small pieces of filter paper which may be easily lost, they are washed with acetone into the probe washing. This makes the filter weight light (sometimes negative) and the probe wash correspondingly heavier. The net weight is the same and no particulate is lost. This laboratory procedure is taught by EPA in the Quality Assurance for Source Emissions Workshop at Research Triangle Park and is approved by EPA.

WEIGHING PROCEDURE - SARTORIUS ANALYTICAL BALANCE

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

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

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

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

Form REC#8

SAMPLE ANALYTICAL DATA FORM

Plant Location Corey's Gotch Relative humidity in lab 40 %

Sample Location _____ Density of Acetone (pa) .78[illegible] mg/ml

Blank volume (V_a) 200 ml

Date/Time wt. blank 9-20-88 Gross wt. [illegible] mg

Date/Time wt. blank 9-21-88 Gross wt. [illegible] mg

Ave. Gross wt. [illegible] mg

Tare wt. [illegible] mg

Weight of blank (m_{ab}) [illegible] mg

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

Weight of residue in acetone wash: $W_a = C_a V_{aw} p_a$ = ([illegible])(200)([illegible]) = ([illegible])

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	200	200	200
Date/Time of wt [illegible] Gross wt	g	167.1436	135.8015	159.5914
Date/Time of wt [illegible] Gross wt	g	167.1431	135.8011	159.5910
Average Gross wt	g	167.1434	135.8013	159.5912
Tare wt	g	167.1392	135.7984	159.5812
Less acetone blank wt (W_a)	g	0.0002	0.0002	0.0002
Wt of particulate in acetone rinse (m_a)	g	0.0040	0.0027	0.0098

Filter Numbers	#	ST-2990	KA-2898	KA-2896
Date/Time of wt 9/20/88 9:00 Gross wt	g	0.5410	0.5616	0.5353
Date/Time of wt 9/21/88 [illegible] Gross wt	g	0.5410	0.5618	0.5353
Average Gross wt	g	0.5410	0.5617	0.5353
Tare wt	g	0.5313	0.5308	0.5314

Weight of particulate on filters(s) (m_f)	g	0.0097	0.0309	0.0039
Weight of particulate in acetone rinse	g	0.0040	0.0027	0.0098
Total weight of particulate (m_n)	g	0.0137	0.0336	0.0137

Note: In no case should a blank residue greater than 0.01 mg/g (or 0.001% of the blank weight) be subtracted from the sample weight.

Remarks _____

Signature of analyst [signature] Signature of reviewer [signature]

COMPANY NAME Corun and Gatch

Chloroform and Ethyl Ether Extraction for EPA Method 5 (back half)

Relative humidity in lab 51%

Density of chloroform and ethyl ether _____

				RUN 1	RUN 2	RUN 3
Chloroform and ethyl ether rinse volume			ml	354	374	324
Date/time of wt 10/12/88	Gross wt.		g	93.3953	94.8276	97.7200
Date/time of wt 10/13/88	Gross wt.		g	93.3950	94.8274	97.7196
	Avg. Gross wt.		g	93.3952	94.8275	97.7198
	Tare wt.		g	93.3812	94.8047 ~~97.6628~~	97.6628
Wt. of particulate in chloroform ethyl ether rinse			g	.0140	.0228	.0570
Water evaporation			#	Imp 1	Imp 2	Imp 3
Date/time of wt. 10/12/88	Gross wt.		g	138.8464	159.0107	155.2476
Date/time of wt. 10/13/88	Gross wt.		g	138.8460	159.0106	155.2473
	Avg. Gross wt.		g	138.8462	159.0107	155.2475
	Tare wt.		g	138.8319	158.9886	155.1700
Less chloroform & ehtyl either blank wt.			g	.0000	.0000	.0000
Weight of particulate from water (m_f)			g	.0143	.0221	.0775
Wt. of particulate in chloroform ethyl ether rinse			g	.0140	.0228	.0570
Total weight of particulate (m_n)			g	.0283	.0449	.1345

Note: In no case should a blank residue 0.02 mg/g or 0.001% of the weight of chloroform ethyl ether used be subtracted from the sample weight.

Remarks _____

Signature of Analyst Kim Rea

Signature of Reviewer _____

VII. CALCULATIONS

SUMMARY OF TEST DATA

		9-14-88 RUN #1	9-14-88 RUN #2	9-15-88 RUN #3
SAMPLING TRAIN DATA				
	start	7:43	10:39	8:00
	finish	9:00	12:01	8:53
1. Sampling time, minutes	Θ	72.0	72.0	50.0
2. Sampling nozzle diameter, in.	D_n	.2700	.2700	.2700
3. Sampling nozzle cross-sect. area, ft^2	A_n	.000398	.000398	.000398
4. Isokinetic variation	I	100.9	98.4	104.0
5. Sample gas volume - meter cond., cf.	V_m	64.902	64.110	48.170
6. Average meter temperature, ^oR	T_m	538	545	543
7. Avg. oriface pressure drop, in. H_2O	dH	2.94	2.96	3.31
8. Total particulate collected, mg.	M_n	13.70	33.60	13.70
VELOCITY TRAVERSE DATA				
9. Stack area, ft^2	A	13.70	13.70	13.70
10. Absolute stack gas pressure, in. Hg.	P_s	30.00	30.05	30.07
11. Barometric pressure, in. Hg.	P_{bar}	30.00	30.05	30.07
12. Avg. absolute stack temperature, R^o	T_s	651	658	656
13. Average $-\sqrt{\text{vel. head}}$, (C_p= .81)	$-\sqrt{dP}$	0.92	0.94	0.99
14. Average stack gas velocity, ft./sec.	V_s	57.20	58.88	62.20
STACK MOISTURE CONTENT				
15. Total water collected by train, ml.	V_{ic}	361.00	384.00	329.00
16. Moisture in stack gas, %	B_{ws}	21.08	22.55	24.82
EMISSIONS DATA				
17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	1810	1812	1865
18. Stack gas flow rate, cfm	acfm	47018	48399	51128
19. Particulate concentration, gr/dscf	C_s	0.0033	0.0083	0.0045
20. Particulate concentration, lb/hr	E	0.85	2.15	1.20
21. Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000
ORSAT DATA				
22. Percent CO_2 by volume	CO_2	4.50	4.50	4.50
23. Percent O_2 by volume	O_2	14.50	14.80	14.50
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	81.00	80.70	81.00

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:

$$V_{m(std)} = (17.64)(.990)(64.902)\left[\frac{(30.00) + \frac{2.94}{13.6}}{538}\right] = 63.657 \text{ dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(.990)(64.110)\left[\frac{(30.05) + \frac{2.96}{13.6}}{545}\right] = 62.179 \text{ dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(.990)(48.170)\left[\frac{(30.07) + \frac{3.31}{13.6}}{543}\right] = 46.962 \text{ dscf}$$

Total Contaminants by Weight: GRAIN LOADING

Particulate concentration C_s' gr./dscf.

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

Where:

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

M_n = Total amount of particulate matter collected, mg.

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

Run 1:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{13.70}{63.657}\right] = 0.0033 \text{ gr./dscf.}$$

Run 2:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{33.60}{62.179}\right] = 0.0083 \text{ gr./dscf.}$$

Run 3:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{13.70}{46.962}\right] = 0.0045 \text{ gr./dscf.}$$

Dry Molecular Weight

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

Where:

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

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

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

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

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

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

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

0.32 = Molecular weight of O_2 divided by 100.

0.44 = Molecular weight of CO_2 divided by 100.

Run 1:

$$M_d = 0.44(\ 4.50\%) + 0.32(14.50\%) + 0.28(\ .00\% + 81.00\%) = 29.30 \ \frac{lb}{lb\text{-mole}}$$

Run 2:

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

Run 3:

$$M_d = 0.44(\ 4.50\%) + 0.32(14.50\%) + 0.28(\ .00\% + 81.00\%) = 29.30 \ \frac{lb}{lb\text{-mole}}$$

Water Vapor Condensed

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

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

Where:

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

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

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

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

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

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

p_w = Density of water, 0.002201 lb/ml.

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

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

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

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

Run 1:

$V_{wc(std)}$ = (0.04707) (354.0) = 16.7 cu.ft
$V_{wsg(std)}$ = (0.04715) (7.0) = 0.3 cu.ft

Run 2:

$V_{wc(std)}$ = (0.04707) (374.0) = 17.6 cu.ft
$V_{wsg(std)}$ = (0.04715) (10.0) = 0.5 cu.ft

Run 3:

$V_{wc(std)}$ = (0.04707) (324.0) = 15.3 cu.ft
$V_{wsg(std)}$ = (0.04715) (5.0) = 0.2 cu.ft

Moisture Content of Stack Gases

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

Where:

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

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

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

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

Run 1:

$$B_{ws} = \frac{16.7 + 0.3}{16.7 + 0.3 + 63.657} \times 100 = 21.08\ \%$$

Run 2:

$$B_{ws} = \frac{17.6 + 0.5}{17.6 + 0.5 + 62.179} \times 100 = 22.55\ \%$$

Run 3:

$$B_{ws} = \frac{15.3 + 0.2}{15.3 + 0.2 + 46.962} \times 100 = 24.82\ \%$$

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:

$M_s = 29.30 (1 - 21.08) + 18 (21.08) = 26.92$ (lb./lb.-mole)

Run 2:

$M_s = 29.31 (1 - 22.55) + 18 (22.55) = 26.76$ (lb./lb.-mole)

Run 3:

$M_s = 29.30 (1 - 24.82) + 18 (24.82) = 26.50$ (lb./lb.-mole)

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:

$$V = (85.49)\ (\ .81)\ (\ 0.92)\ \sqrt{\frac{651}{(30.00)(26.92)}} = 57.20 \text{ ft/sec.}$$

Run 2:

$$V = (85.49)\ (\ .81)\ (\ 0.94)\ \sqrt{\frac{658}{(30.05)(26.76)}} = 58.88 \text{ ft/sec.}$$

Run 3:

$$V = (85.49)\ (\ .81)\ (\ 0.99)\ \sqrt{\frac{656}{(30.07)(26.50)}} = 62.20 \text{ ft/sec.}$$

Stack Gas Flow Rate

$$Q_{sd} = 3600 \left[1 - B_{wc} \right] V_s A \left[\frac{T_{std}}{T_{stk}} \right] \left[\frac{P_s}{P_{std}} \right]$$

Where:

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

A = Cross sectional area of stack, ($ft.^2$).

3600 = Conversion factor, (sec./hr.).

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

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

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

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

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

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

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

Run 1:

$$Q_{sd}=3600(1-\ .2108\ )(\ 57.20)(\ 13.70)\left[\frac{528}{651}\right]\left[\frac{30.00}{29.92}\right] = 1810584.4\ \frac{dscf}{hr}$$

Run 2:

$$Q_{sd}=3600(1-\ .2255\ )(\ 58.88)(\ 13.70)\left[\frac{528}{658}\right]\left[\frac{30.05}{29.92}\right] = 1812605.1\ \frac{dscf}{hr}$$

Run 3:

$$Q_{sd}=3600(1-\ .2482\ )(\ 62.20)(\ 13.70)\left[\frac{528}{656}\right]\left[\frac{30.07}{29.92}\right] = 1865596.4\ \frac{dscf}{hr}$$

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:

$$E = \frac{(0.0033)\ (1810584.4)}{7000} = 0.85 \text{ lb. / hr.}$$

Run 2:

$$E = \frac{(0.0083)\ (1812605.1)}{7000} = 2.15 \text{ lb. / hr.}$$

Run 3:

$$E = \frac{(0.0045)\ (1865596.4)}{7000} = 1.20 \text{ lb. / hr.}$$

Isokinetic Variation

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

Where:

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

Run 1:

$$I = (100)(651)\left[\frac{(0.002669)(361.00) + \frac{64.902}{538}\left[30.00 + \frac{2.94}{13.6}\right]}{60\ (72.0)\ (57.20)\ (30.00)\ (.000398)} \right] = 100.9\%$$

Run 2:

$$I = (100)(658)\left[\frac{(0.002669)(384.00) + \frac{64.110}{545}\left[30.05 + \frac{2.96}{13.6}\right]}{60\ (72.0)\ (58.88)\ (30.05)\ (.000398)} \right] = 98.4\%$$

Run 3:

$$I = (100)(656)\left[\frac{(0.002669)(329.00) + \frac{48.170}{543}\left[30.07 + \frac{3.31}{13.6}\right]}{60\ (50.0)\ (62.20)\ (30.07)\ (.000398)} \right] = 104.0\%$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant CORUN [illegible]

Location Tellico Plains

Operator [illegible]

Date 9-14-89

Run No.

Sample Box No.

Meter Box No. C-1

Meter H@ 1.82

C Factor .99

Pitot Tube Coefficient Cp .84

Ambient Temperature 60

Barometric Pressure 30.0

Assumed Moisture, % 2.0

Probe Length, m(ft) 4'

Nozzle Identification No. [illegible]

Avg. Calibrated Nozzle Dia. (in.) [illegible]

Probe Heater Setting 450

Leak Rate, m^3/min. (cfm) [illegible]

Probe Liner Material Stainless Steel

Static Pressure, mm Hg (in. Hg) .02

Filter No. 57-2990

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP. (Ts) °F	VELOCITY HEAD (Ps) in H_2O	PRESSURE DIFF. ORF. MTR in H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP. °F	GAS TEMP. AVG. CONDENSER OR LAST IMPINGER
A 1	7:43 / 7:46	2	187	.95	3.6	69.52 / 4.250	62	60	230	[illegible]
2	7:49	2	187	.95	3.6	75.70	72	60	235	[illegible]
3	7:52	3	187	1.3	4.9	79.50	80	61	235	60
4	7:55	3	187	1.5	4.8	83.10	80	61	235	60
B 1	7:57 / 8:00	2	188	.99	3.2	85.90	76	62	250	55
2	8:03	2	190	1.2	3.8	89.20	86	64	250	55
3	8:06	3	190	1.5	4.8	93.20	88	64	250	55
4	8:09	3	190	1.3	4.2	96.06	88	64	245	56
C 1	8:10 / 8:13	2	190	.85	2.7	98.90	84	64	245	55
2	8:16	3	191	1.3	4.2	102.40	92	66	245	55
3	8:19	3	190	1.5	4.8	105.48	92	66	250	55
4	8:22	2	190	1.2	3.8	108.80	92	66	250	55

CO_2= 4.5 O_2= 14.5 O_2= 14.5 CO_2=4.5 CO_2=4.5 O_2= 14.5

Form #REC-06

RAMCON emission test log sheet from DATE 9-14-88 LOCATION Hollister rd TEST NO. 1

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP. T_s (°F)	VELOCITY HEAD ΔP (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	[illegible] BOX TEMP (°F)	[illegible]
D 1	8:23 / 8:26	1	188	.60	1.90	111.30	88	68	250	S
2	8:29	2	190	.90	2.9	113.90	94	68	250	
3	8:32	2	190	1.0	3.2	116.90	96	68	245	
4	8:35	2	190	.75	2.4	119.50	96	68	245	
E 1	8:36 / 8:39	1	190	.43	1.4	122.50	92	69	245	
2	8:42	2	190	.60	1.9	123.70	96	69	245	
3	8:45	1	193	.53	1.7	126.00	96	70	245	
4	8:47	1	195	.40	1.3	127.30	98	70	255	
F 1	8:48 / 8:51	1	197	.30	.96	128.80	92	70	255	S
2	8:54	1	195	.35	1.1	130.70	96	70	255	
3	857	1	196	.40	1.3	132.60	98	70	245	
4	9:00	2	197	.63	2.0	134.422	98	70	245	S
1										

RAMCON ENVIRONMENTAL CORPORATION

Plant Crown Zellerbach 3.2 2.9 3.2

Location Hollister, Maryland

Operator Roger Turner

Date 9-14-88

Run No. 2

Sample Box No. 9

Meter Box No. C-175

Meter H@ 1.92

C Factor .99

Pitot Tube Coefficient Cp .81

Ambient Temperature 66

Barometric Pressure 30.05

Assumed Moisture, % 23

Probe Length, m(ft) 4(

Nozzle Identification No. .000 397

Avg. Calibrated Nozzle Dia. (in.) .206

Probe Heater Setting 4

Leak Rate, m^3/min. (cfm) .008 @ 9" Hg

Probe Liner Material Stainless Steel

Static Pressure, mm Hg (in. Hg) .024

Filter No. KA-2898

	INITIAL VOLUME, ml	FINAL VOLUME, ml
IMPINGER	574	774
SILICA GEL	200	202

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (ΔPs) in H_2O	PRESSURE DIFF. ORF. MTR in H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP. °F	GAS TEMP. AVG. CONDENSER LAST IMPINGER
A 1	10:39 / 10:42	1	210	.30	.96	134.57 / 136.40	74	70	230	
2	10:46	1	210	.33	1.06	138.10	86	72	230	
3	10:48	1	200	.33	1.02	139.80	88	72	235	
4	10:51	1	195	.30	.96	141.54	92	72	245	
B 1	10:53 / 10:56	1	195	.30	.96	143.50	88	72	245	
2	10:59	1	192	.60	1.9	145.50	86	72	250	55
3	11:02	1	192	.65	2.1	148.00	98	72	250	55
4	11:05	1	192	.80	.98	149.20	100	72	250	55
C 1	11:09 / 11:12	1	190	.70	2.0	152.40	90	72	250	55
2	11:15	1	190	1.0	3.2	154.80	100	74	250	55
3	11:18	3	194	.85	.87	157.60	100	74	250	55
4	11:21	5	195	.70	2.2	160.00	100	74	250	55

CO_2= 4.5 O_2=15.0 CO_2= 4.5 O_2=15.0 CO_2= 4.5 O_2=14.5

Form #REC-06

RAMCON emissions test log sheet cont. DATE 9-14-88 LOCATION Fallston md TEST NO. 2

TRAVERSE POINT		SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP. Ts (°F)	VELOCITY HEAD ΔPs (in H_2O)	ORIFICE DIFF. PRESSURE ΔH (in H_2O)	GAS VOLUME Vm (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	TEMP.
A)	1	11:23 / 11:26	4	198	1.0	3.2	162.99	92	74	245	5
	2	11:29	4	201	1.4	4.5	166.60	102	76	245	5
	3	11:32	4	201	1.4	4.5	169.90	101	76	250	5
	4	11:35	4	203	1.3	4.2	173.27	101	76	250	
B)	1	11:36 / 11:39	4	201	1.1	3.5	176.10	98	76	245	5
	2	11:42	5	202	1.5	4.8	179.80	104	76	245	5
	3	11:45	5	202	1.5	4.8	183.50	100	76	250	5
	4	11:48	5	200	1.5	4.8	186.94	98	78	250	5
C)	1	11:49 / 11:52	4	198	1.2	3.8	190.10	98	78	245	5
	2	11:55	4	197	1.2	3.8	193.20	101	78	245	5
	3	11:58	4	197	1.4	4.5	196.50	104	78	245	5
	4	12:01	4	197	1.4	4.5	198.685	104	78	245	5

RAMCON ENVIRONMENTAL CORPORATION

Plant Corn & Cobb
Location Fallbrook MO
Operator W.J. Farmer
Date 9-15-88
Run No. 3
Sample Box No. 3
Meter Box No. C-185
Meter H @ 1.89
C Factor .99
Pitot Tube Coefficient Cp .84

Schematic of Stack Cross Section

Ambient Temperature 60
Barometric Pressure 30.07
Assumed Moisture, % 15
Probe Length, m(ft) 4'
Nozzle Identification No. 5940
Avg. Calibrated Nozzle Dia. (in.) .276
Probe Heater Setting 4
Leak Rate, m^3/min. (cfm) .006 at 5
Probe Liner Material 316 Stainless Ste
Static Pressure, mm Hg (in. Hg) .029
Filter No. KA-2898

TRAV. PT NO.	SAMPLING TIME (θ) min	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft³	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP AT CONDENSER LAST IMPINGER
A) 1	8:00 8:03	1	180	1.0	3.2	198.985 201.77	68	62	225	50
2	8:06	1	190	1.3	4.2	204.86	80	60	225	40
3	8:09	1	191	1.1	3.5	207.89	82	62	225	40
4	8:12:30	1	191	1.5	4.8	211:33	88	64	230	40
B) 1	8:13:30 8:16	1	191	.90	2.9	214.14	86	66	235	40
2	8:19	1.5 X 2	195	1.3	4.2	217:39	94	68	240	40
3	8:22	2	195	1.5	4.8	220.88	96	68	245	40
4	8:25:30	2	198	1.5	4.8	224:343	96	70	245	40
C) 1	8:26 8:29	1	198	.82	2.6	227:08	98	70	250	42
2	8:32	1	200	1.2	3.8	230:15	100	72	250	42
3	8:35	2	202	1.4	4.5	233:59	104	74	250	42
4	8:38	2	202	1.1	3.5	236:599	104	74	250	42

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 9-15-88 LOCATION Fulton MO TEST NO. 3

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP. T_s (°F)	VELOCITY HEAD (ΔP) (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER
D) 1	~~8:38:30~~ 8:41	1	198	.35	1.1	238.93	104	76	250	
2	8:44	1	202	.89	2.7	240.98	106	78	250	
3	8:47	1	204	.93	3.0	243.77	108	78	250	
4	8:50:30	1	209	.56	1.8	246.066	110	80	250	
E) *1	8:53 ~~8:53~~	1	198	.25	.80	~~247.155~~	108	80	245	
2						247.155				
3										
4										
F) 1										
2										
3										
4										

* 8:53:05 = plant went down

IX. CALIBRATIONS

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number _____ Date 10-1-88 Meter box number C-165 Plant Wegn

Barometric pressure, P_b = 30.02 in. Hg Dry gas meter number 670775 Pretest Y .994

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	$Y_i \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
1.5	10	10.30	74	98	77	87.5	15.01	5	.992	1.86
1.5	10	10.35	74	104	77	90.5	14.47	5	.992	1.72
1.5	10	10.42	74	106	77	91.5	14.66	5	.988	1.61
									Y = .991	

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

where

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

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

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

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

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

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

ΔH = Pressure differential across orifice, in. H_2O.

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

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

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number — Date 8-26-88 Meter box number C-185 Plant —

Barometric pressure, P_b = 29.96 in. Hg Dry gas meter number 670775 Pretest Y .987

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	$Y_i \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
1.5	10	10.32	74	100	77	88.5	15.00	5	.992	1.86
1.5	10	10.30	74	102	77	89.5	14.84	5	.995	1.82
1.5	10	10.32	74	104	77	90.5	14.75	5	.995	1.79
									Y = .994	/ 1.82

[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.

Date 2-10-88 Thermocouple number Outlet

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

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

other _____

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
A	ICE BATH	33°F	32°F	.03%
B	OVEN	152°F	150°F	.01%
C	OVEN	175°F	175°F	0%
D	AMBIENT	55°F	55°F	0%
	7-14-88	60°F	60°F	0%

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

[b]Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.

RAMCON ENVIRONMENTAL CORPORATION

Date 2-10-88 Thermocouple number Inlet

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

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

other _____

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °F	Thermocouple Potentiometer Temperature, °F	Temperature Difference,[c] %
A	ICE BATH	33°F	33°F	0%
B	OVEN	150°F	151°F	.007%
C	OVEN	175°F	173°F	.01%
D	AMBIENT	55°F	54°F	.02%
	9-14-88	ditto	ditto	0%

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

[b]Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.

RAMCON

Lear Siegler Stack Sampler

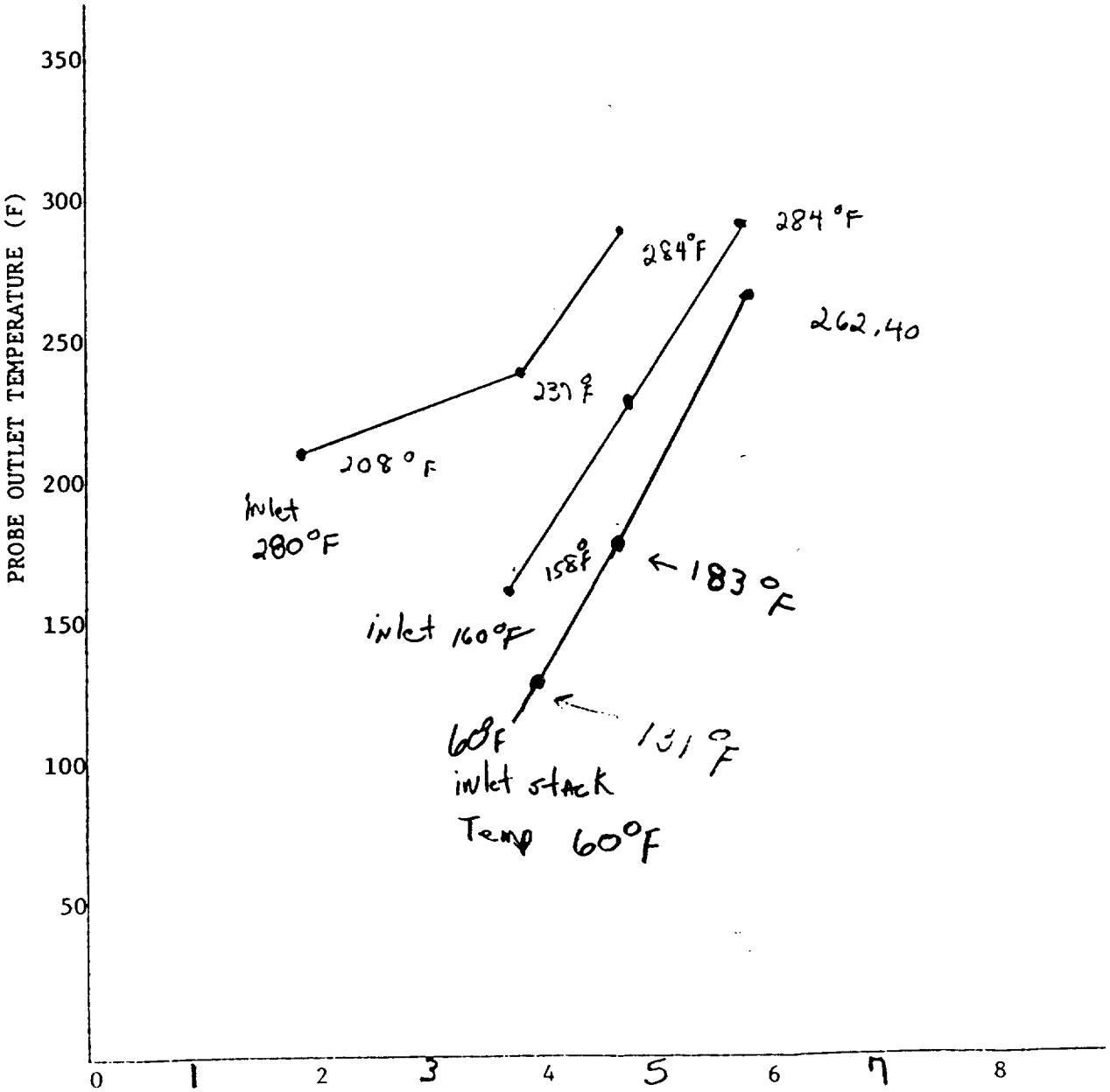
Heating Probe Calibration

Probe No. 41 Probe Length 4'

Date of Calibration 1-21-88 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



RAMCON ENVIRONMENTAL CORPORATION

Date 2-9-88 Thermocouple number 41

Ambient temperature 54 °C Barometric pressure 29.95 in. Hg

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

other _____

Reference point number[a]	Source[b] (specify)	Reference Thermometer Temperature, °C	Thermocouple Potentiometer Temperature, °C	Temperature Difference,[c] %
A	Ice Water	32° F	31°F	.03%
B	Boiling Water	212°F	211°F	.005%
C	Oil	380°F	377°F	.008%
D	Ambient	54°F	53°F	.02%
	9-14-88	60°F	60°F	0%

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

[b]Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.

RAMCON ENVIRONMENTAL CORPORATION

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. 41 Date [illegible]

Calibrated by: [illegible]

"A" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp (s) cm H_2O (in. H_2O)	$C_p(s)$	DEVIATION $C_{p(s)}-\bar{C}_p(A)$
1	[illegible]	[illegible]	.611	[illegible]
2	[illegible]	.91	[illegible]	[illegible]
3	0.41	.62	.836	[illegible]
		$\bar{C}_p$ (SIDE A)	[illegible]	

"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	0.9[illegible]	1.3[illegible]	[illegible]	[illegible]
2	[illegible]0	.92	[illegible]	[illegible]
3	0.41	.62	[illegible]	[illegible]
		$\bar{C}_p$ (SIDE B)	[illegible]	

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

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

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

Form No. EED-17-1

X. RAMCON PERSONNEL

RAMCON Environmental Stack Test Team

Sumner Buck - President

Sumner Buck is the President of RAMCON Environmental. He is a graduate of the EPA 450 "Source Sampling for Particulate Pollutants" course and the 474 "Continuous Emissions Monitoring" course all given at RTP. Mr. Buck is a qualified V.E. reader with current certification. Mr. Buck has personally sampled over 400 stacks including over 300 asphalt plants. He is 42 years old and a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis.

Sam Turner - Field Supervisor

Sam Turner has five years experience in the Air Division and is our field supervisor. He has sampled over 30 large boiler stacks and approximately 200 asphalt plants. He is a graduate of State Technical Institute of Memphis, and holds an Associate Degree in Environmental Engineering. He also has current certification as a V.E. reader.

XI. VISIBLE EMISSIONS

SOURCE NAME: Corun & Gatch

ADDRESS:

CITY: | STATE: Md | ZIP:

PHONE: | SOURCE ID NUMBER:

PROCESS EQUIPMENT: | OPERATING MODE:

CONTROL EQUIPMENT: Baghouse | OPERATING MODE:

DESCRIBE EMISSION POINT: Stack Exit

HEIGHT ABOVE GROUND LEVEL: 40' | HEIGHT RELATIVE TO OBSERVER: 40'

DISTANCE FROM OBSERVER: 10' | DIRECTION FROM OBSERVER: NE

DESCRIBE EMISSIONS: Steam

EMISSION COLOR: White | PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☒ YES ☐ | IS WATER DROPLET PLUME ATTACHED ☒ DETACHED ☐

AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: 50 YARDS FROM STACK

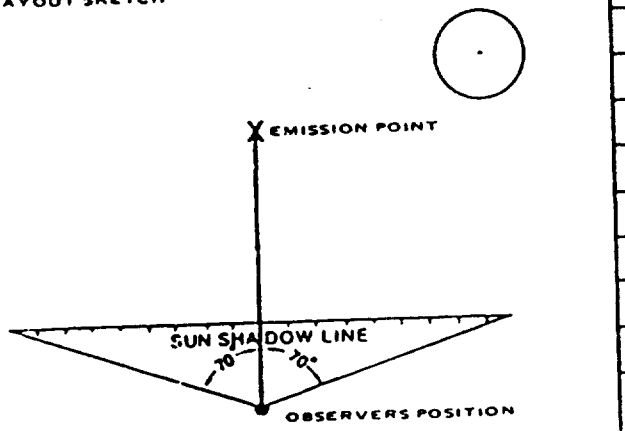
DESCRIBE BACKGROUND: Blue Sky

BACKGROUND COLOR: Blue | SKY CONDITIONS: Clear

WIND SPEED: 5-10 | WIND DIRECTION: South East

AMBIENT TEMPERATURE: 65 | RELATIVE HUMIDITY:

SOURCE LAYOUT SKETCH



OBSERVATION DATE: 9-14-88 | START TIME: 7:43 | STOP TIME: 8:47

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

AVERAGE OPACITY FOR HIGHEST PERIOD: 0 | NUMBER OF READINGS ABOVE: 0 WERE 0

RANGE OF OPACITY READINGS: 0 MINIMUM | MAXIMUM 0

COMMENTS:

OBSERVER'S NAME (PRINT): Sam Turner

OBSERVER'S SIGNATURE: Sam T. Turner | DATE: 9-14-88

ORGANIZATION: Roncon EO

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE | DATE

TITLE

CERTIFIED BY | DATE

VERIFIED BY | DATE

SOURCE NAME: Corn Products

ADDRESS:

CITY: Fairfield | STATE: MD | ZIP:

PHONE: | SOURCE ID NUMBER:

PROCESS EQUIPMENT: | OPERATING MODE:

CONTROL EQUIPMENT: Baghouse | OPERATING MODE:

DESCRIBE EMISSION POINT: Stack Exit

HEIGHT ABOVE GROUND LEVEL: 90' | HEIGHT RELATIVE TO OBSERVER: 90'

DISTANCE FROM OBSERVER: 10' | DIRECTION FROM OBSERVER: NE

DESCRIBE EMISSIONS: Steam

EMISSION COLOR: White | PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☑ YES ☐ | IS WATER DROPLET PLUME: ATTACHED ☑ DETACHED ☐

AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: 50-100 / From Stack

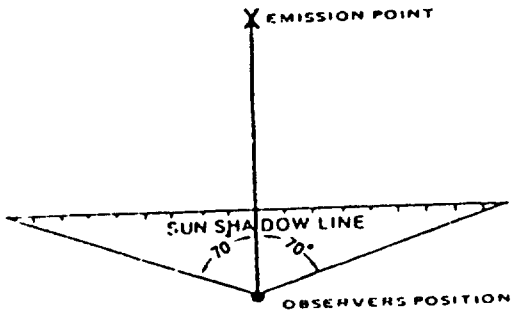
DESCRIBE BACKGROUND: Blue Sky

BACKGROUND COLOR: Blue | SKY CONDITIONS: Clear

WIND SPEED: 5-10 | WIND DIRECTION: SE

AMBIENT TEMPERATURE: 60' | RELATIVE HUMIDITY:

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE: 9-15-88 | START TIME: 8:00:30 | STOP TIME: 8:53

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

AVERAGE OPACITY FOR HIGHEST PERIOD: 0 | NUMBER OF READINGS ABOVE: 0 | % WERE: 0

RANGE OF OPACITY READINGS: 0 MINIMUM | MAXIMUM 0

COMMENTS:

OBSERVER'S NAME (PRINT): W.L. Turner

OBSERVER'S SIGNATURE: W.L. Turner | DATE: 9/15/88

ORGANIZATION: Ramcon Env.

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE: | DATE:

TITLE:

CERTIFIED BY: S.G. Tr | DATE:

VERIFIED BY: | DATE:

TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
CUSTOMS HOUSE
701 BROADWAY
NASHVILLE, TENNESSEE 37219-5403

JUN 2 1 1988

Sam Turner
RAMCON
223 Scott
Memphis, TN 38112

RE: Certificate Number 0955

Dear Mr. Turner:

Enclosed you will find your certification card for successfully completing the June 7-9, 1988 Visible Emissions Evaluation School held in Memphis, Tennessee. In order to be certified as a qualified Visible Emissions Evaluator for all the methods approved by the Tennessee Air Pollution Control Board, one must meet an intensive array of criteria.

The individual reading criteria is as follows:

1. EPA Method 9 (6 Minute Average) requires a deviation of less than 7.5 on white and black smoke, and that the reader miss no reading by more than 15% opacity.

2. Tennessee Visible Emissions Evaluation Method 1 (Roads and Parking Areas) requires a worst-two-minute deviation of 8.8 or less.

3. TVEE Method 2 (Aggregate or Time Count) has the same criteria requirements as EPA Method 9.

4. TVEE Method 3 (Zero Percent Opacity) requires that the value assigned to a zero reading during a certification run shall not exceed 10% opacity, nor shall the combination of other zero readings exceed 10% opacity (i.e. two readings of five percent opacity).

5. TVEE Method 4 (Fugitive Dust Emissions from Non-Stack Emission Points) has the same criteria requirements as EPA Method 9.

Based on these criteria you are certified by the State of Tennessee to read EPA Method 9, and TVEE Methods 1, 2, 3, and 4.

This certification is valid until December 08, 1988.

You must complete the requirements for recertification prior to this expiration date to retain your status as a qualified Visible Emissions Evaluator.

It was a pleasure having your participation in our Visible Emissions School. The Tennessee Division of Air Pollution Control would welcome any comments, or suggestions you may have concerning the operation of the school. Please forward any comments to the Division at (615)741-3931 or at the above address.

Sincerely yours,

Carl Koontz

Carl Koontz, Instructor
Visible Emissions Evaluation School
Division of Air Pollution Control

Enclosure