Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: March 11, 1991 FILE REF: 4530

TO: Files - AM/3

FROM: Andy Seeber - AM/3

SUBJECT: Review of Stack Test at Brown Co. Asphalt, DePere

Received; 12/5/90

I. SOURCE

Brown Co. Highway Dept.
2198 Glendale Ave.
Green Bay, WI 54303
Permit # 405 041 120 - N01 Issued: April 20, 1989
FID # 405041120, Stack S10, Process P 30
Test Date: October 2, 1990
Test Firm: Ramcon Environmental Corp.
223 Scott St.
Memphis, TN 38112
Crew Chief: Mr. Tom Crook (901) 458-7000

II. SOURCE DESCRIPTION

The source tested was a Barber-Greene batch mix asphalt plant rated at 200 TPH. During the test the plant production was 150 TPH. The plant was fired with natural gas. Particulate emissions are controlled by a Barber-Greene high efficiency scrubber. The design pressure drop across the venturi is in excess of 15" of water.

III. DISCUSSION OF RESULTS

The test results are shown in Table 1. The average emission concentration of 0.636 lb/10^3 lb. exhaust gas is over the emission limit of 0.30 lb/10^3 lb. exhaust gas.

They did not supply enough raw data to accurately calculate the formaldehyde results.

Ramcon Environmental used EPA Method 5, including the backhalf, modified to cyclonic flows. I checked over the results and corrected minor errors in the emission data. The report contained calibration data for the sampling equipment and production data for the plant. When this plant is tested again, it should be tested while operating at capacity.

v:\9103\am9broca.ars

cc: Mike DeBrock - LMD
Joe Perez - AM/3
U.S. EPA Region V

TABLE I

SUMMARY OF TEST RESULTS

October 2, 1990

Test Run	Time	Lbs/1000/Lbs Stack Gas	Isokinetic Variation	Actual Emissions
1	11:10 to 12:23	.446 ~~0.438~~ lbs/1000/lbs	99%	45.6 ~~44.8~~ lbs/hr
2	14:01 to 15:08	.623 ~~0.616~~ lbs/1000/lbs	106%	58.3 ~~57.6~~ lbs/hr
3	16:28 to 17:33	.838 ~~0.831~~ lbs/1000/lbs	110%	78.3 ~~77.6~~ lbs/hr
	Average:	.636 ~~0.628~~ lbs/1000/lbs	105%	60.7 ~~60.0~~ lbs/hr

On the basis of these test results, the average emissions of the three test runs was not below the .3 lbs/1000 lbs of stack gas allowable emissions limitation set by the State of Wisconsin. Therefore, the plant is not operating in compliance with State 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.

BROWN COUNTY HIGHWAY DEPARTMENT
GREEN BAY, WISCONSIN

ILLINOIS METHOD
SUMMARY OF TEST DATA

		10-2-90 RUN #1	10-2-90 RUN #2	10-2-90 RUN #3
SAMPLING TRAIN DATA				
	start	11:10	14:01	16:28
	finish	12:23	15:08	17:33
1. Sampling time, minutes	θ	60.0	60.0	60.0
2. Sampling nozzle diameter, in.	D_n	.4250	.4250	.4250
3. Sampling nozzle cross-sect. area, ft^2	A_n	.000985	.000985	.000985
4. Isokinetic variation	I	99%	106%	110%
5. Sample gas volume - meter cond., cf.	V_m	40.870	45.392	48.903
6. Average meter temperature, ^oR	T_m	548	549	550
7. Avg. oriface pressure drop, in. H_2O	dH	1.56	1.73	1.72
8. Total particulate collected, mg.	M_n	~~729.40~~ 742.80	~~1134.60~~ 1143.4	~~1644.90~~ 1653.1
VELOCITY TRAVERSE DATA				
9. Stack area, ft^2	A	63.62	63.62	63.62
10. Absolute stack gas pressure, in. Hg.	P_s	29.49	29.49	29.49
11. Barometric pressure, in. Hg.	P_{bar}	29.49	29.49	29.49
12. Avg. absolute stack temperature, R^o	T_s	616	620	620
13. Average $-\sqrt{\text{vel. head}}$, (C_p= .85)	$-\sqrt{d\bar{P}}$	0.12	0.11	0.11
14. Average stack gas velocity, ft./sec.	V_s	7.79	7.16	7.16
STACK MOISTURE CONTENT				
15. Total water collected by train, ml.	V_{ic}	320.00	349.00	378.00
16. Moisture in stack gas, %	B_{ws}	27.94	27.64	27.59
EMISSIONS DATA				
17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	1086	996	996
18. Stack gas flow rate, cfm	acfm	29736	27331	27331
19. Particulate concentration, gr/dscf	C_s	.2937 ~~0.2884~~	.4094 ~~0.4045~~	.5497 ~~0.5453~~
20. Particulate concentration, lb/hr	E	45.57 ~~44.75~~	58.25 ~~57.56~~	78.27 ~~77.64~~
21. Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000
ORSAT DATA				
22. Percent CO_2 by volume	CO_2	5.10	5.10	5.10
23. Percent O_2 by volume	O_2	12.00	12.00	12.00
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	82.90	82.90	82.90

Format: summryR3

RAMCON

ENVIRONMENTAL CORPORATION

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
BROWN COUNTY HIGHWAY DEPARTMENT
GREEN BAY, WISCONSIN
October 2, 1990

Roger Kolb
Brown County Highway Dept.

G. Sumner Buck, III
President

Tommy Crook
Team Leader

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

RAMCON
ENVIRONMENTAL CORPORATION

November 14, 1990

Mr. Roger Kolb
Brown County Highway Department
2198 Glendale Avenue
Greenbay, WI 54303

Re: Particulate Emissions Test: Green Bay, Wisconsin

Dear Mr. Kolb:

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 pounds of stack gas emitted on the three test runs do not meet the .3 pounds per 1,000 pounds of stack gas emission standard set by the State of Wisconsin. Therefore, the plant is not operating in compliance with State Standards.

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

Ms. Carrol Crawford
Wisconsin DNR
Lake Michigan District
P.O. Box 10448
Green Bay, WI 54307

You will need to keep one copy of the report at the plant. We're sorry your plant does not meet Wisconsin emissions standards at this time, but we're sure it will after a few modifications. 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

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

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I. INTRODUCTION

On October 2, 1990, personnel from RAMCON Environmental Corporation conducted a source emissions test for particulate emissions compliance at Brown County Highway Department's Barber-Greene batch mix mix asphalt plant located in Green Bay, Wisconsin. RAMCON personnel conducting the test were Tommy Crook, Team Leader, and Jimmy Briner. Heather Baldick was responsible for the laboratory analysis including taring the beakers and filters and recording final data in the laboratory record books. Custody of the samples was limited to Mr. Crook and Ms. Baldick.

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 emissions limit set by the State of Wisconsin.

II. TEST RESULTS

Table I summarizes the test results. The allowable emissions for the State of Wisconsin is .3 lbs/1000 lbs of wet gas and is specified in Wisconsin Administrative Code NR 415.05(1)(i), September, 1986, No. 369.

Ms. Carol Crawford of Wisconsin's Department of Natural Resources observed the testing conducted by RAMCON Environmental. Jimmy Briner of RAMCON Environmental conducted the opacity test which ranged from 15% to 20% on all three test runs.

TABLE I

SUMMARY OF TEST RESULTS

October 2, 1990

Test Run	Time	Lbs/1000/Lbs Stack Gas	Isokinetic Variation	Actual Emissions
1	11:10 to 12:23	0.~~438~~ .446 lbs/1000/lbs	99%	~~44.8~~ 45.6 lbs/hr
2	14:01 to 15:08	0.~~616~~ .623 lbs/1000/lbs	106%	~~57.6~~ 58.3 lbs/hr
3	16:28 to 17:33	0.~~831~~ .828 lbs/1000/lbs	110%	~~77.6~~ 78.3 lbs/hr
	Average:	0.~~628~~ .636 lbs/1000/lbs		~~60.0~~ 60.7 lbs/hr

On the basis of these test results, the average emissions of the three test runs was not below the .3 lbs/1000 lbs of stack gas allowable emissions limitation set by the State of Wisconsin. Therefore, the plant is not operating in compliance with State Standards.

III. TEST PROCEDURES

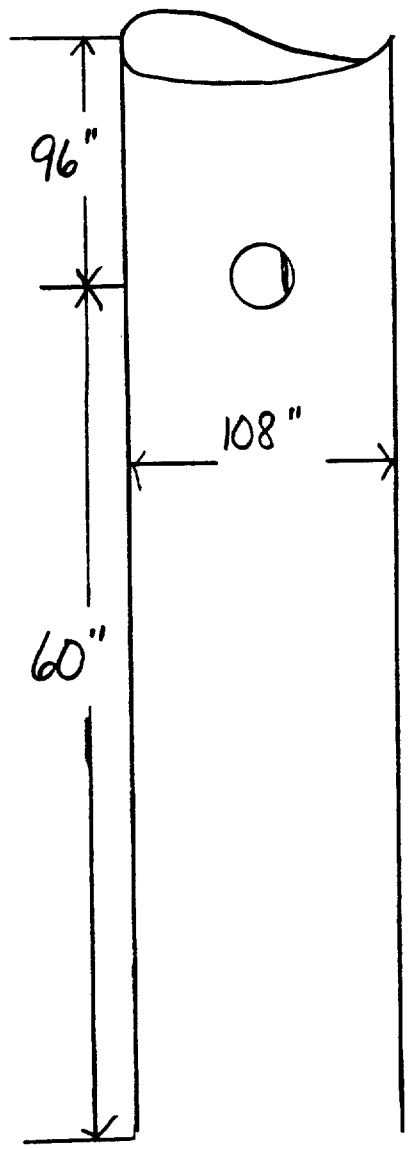
A. Method Used: Method 5 source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

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

C. Sampling Site: The emissions test was conducted after a scrubber on a round stack with a diameter of 108". The sampling ports were placed 96" down (0.9 diameters upstream) from the top of the stack and 60" up (0.6 diameters downstream) from the last flow disturbance. Twenty four points were sampled, twelve through each traverse for 2.5 minutes each for a total testing time of 60 minutes.

Points on a Diameter	Probe Mark
1	*8.3"
2	13.2"
3	18.7"
4	25.1"
5	33.0"
6	44.3"
7	75.7"
8	87.0"
9	94.9"
10	101.3"
11	106.8"
12	111.7"

*Measurements include a 6" standoff.



IV. THE SOURCE

IV. THE SOURCE

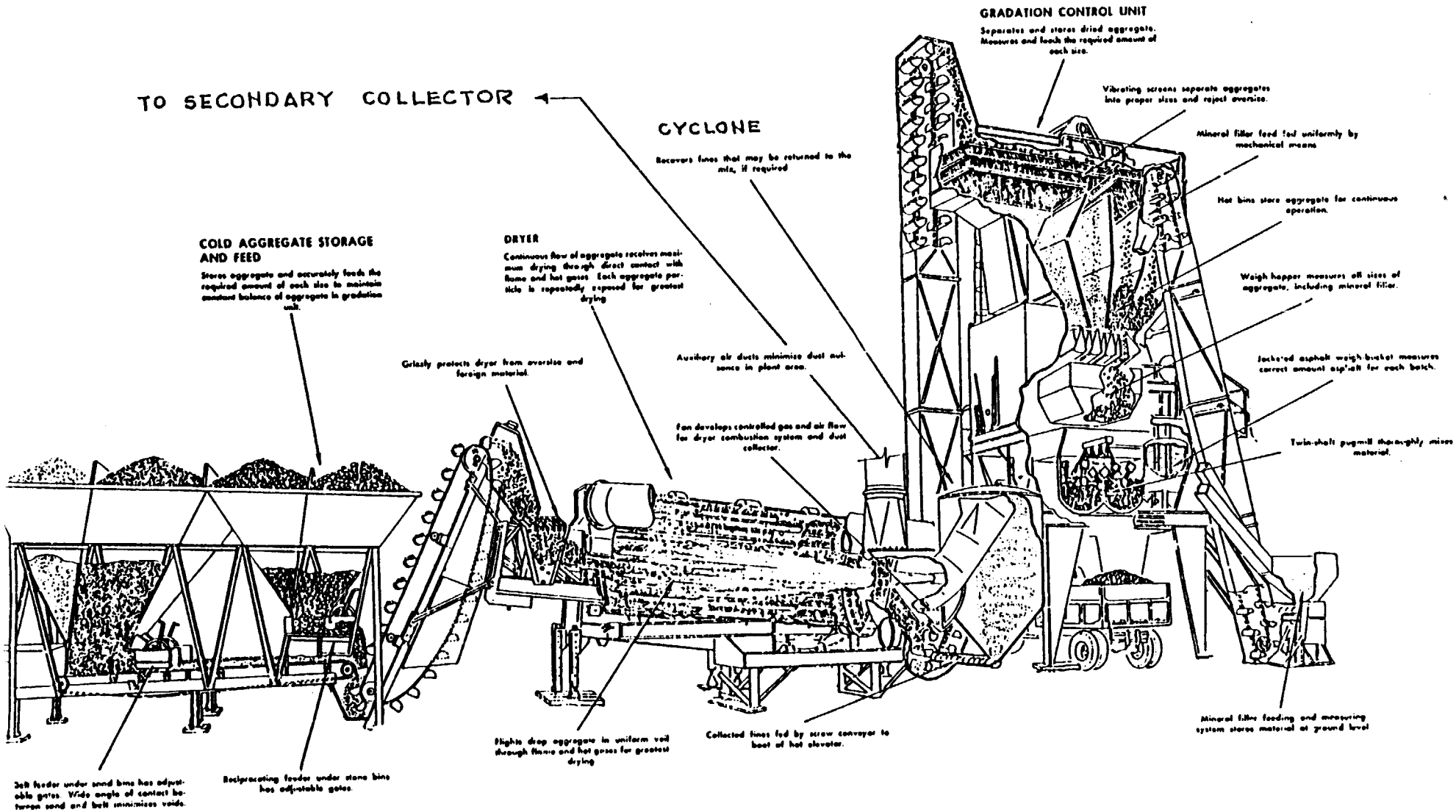
Brown County Highway Department employs a Barber-Greene batch mix asphalt plant which is used to manufacture hot mix asphalt for road pavement. The process consists of blending prescribed portions of cold feed materials (sand, gravel, screenings, chips, etc.) uniformly and adding sufficient hot asphalt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

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

The mixer uses a burner fired with 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 Barber-Greene. The exhaust gases are blown through the scrubber and discharged to the atmosphere through the stack. The design pressure drop across the venturi is in excess of 15 inches of water. The particulate matter, which is removed by the scrubber, is fed into a scrubber pond where it drops out of suspension.

Figure 4-1

ASPHALT BATCH MIX PLANT - AN EXPLODED VIEW



Source: Asphalt Plant Manual, The Asphalt Institute, 1967

Form REC#03

DATA ON FACILITY BEING STACK TESTED

COMPANY NAME BROWN COUNTY COMPANY REP. _____ PHONE ( ) _____

LOCATION OF FACILITY GREEN BAY ORIGINAL START-UP DATE _____ DESIGNED CAPACITY _____

OEM _____ MODEL NO. _____ TYPE _____ AC TYPE _____

1 Time (24 HR) NOTE: check small box in column when moisture sample is taken	2 Fuel Use #Fuel Oil ___ Nat. Gas X Propane ___ Coal ___ other	3 Burner Setting	4 Blower Pressure	5 Production Rate Mix Aggregate TPH	5 Production Rate RAP TPH	6 Asphalt Cement %	7 Mix Temp. °F	8 Exhaust Gas Temp. °F	9 Venturi Scrubber ___ Baghouse Pressure Drop in w.g.	9 Venturi Scrubber ___ Baghouse Water Pressure psi	10 Ambient Temp. °F	11 Relative Humidity %	12 Exhaust Damper Position
00 AM	Nat-Gas	4 1/4	40 psi	5/8 150	~~150~~	~~5.40~~ 5.40	300°	160	3	32			4 1/2
11:15 AM	Nat-Gas	4 1/4	40 psi	5/8 150		5.40	300°	160	3	32			4 1/2
11:30 AM	Nat-Gas	4 1/4	40 psi	5/8 150		5.40	300°	160	3	32			4 1/2
11:45 AM	Nat-Gas	4 1/4	40 psi	5/8 150		5.40	300°	160	3	32			4 1/2
12:00 PM	Nat-Gas	4 1/4	40 psi	5/8 150		5.40	300°	160	3	32			4 1/2
12:15 PM	Nat-Gas	4 1/4		5/8 150		5.40	300°	160	3	32			4 1/2
12:40 PM	Nat-Gas	4 1/4		5/8 150		5.40	300°	160	3	32			4 1/2
12:55 PM	Nat-Gas	4 1/4		5/8 150		5.40	300°	160	3	32			4 1/2
4:30 PM	Nat-Gas	4 1/4		5/8 150		5.40	300°	160	3	32			4 1/2
4:45 PM	Nat-Gas	4 1/4		5/8 - 150		5.40	300°	160	3	32			4 1/2
5:00 PM	Nat-Gas	4 1/4		5/8 - 150		5.40	300°	160	3	32			4 1/2
5:15 PM	Nat-Gas	4 1/4		5/8 - 150		5.40	300°	160	3	32			4 1/2
				AVG 150									

(6)

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 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 Brown County

Sample Location

Relative humidity in lab 50 %

Density of Acetone (pa) .7843 mg/ml

Blank volume (V_a) 310 ml

Date/Time wt. blank 10-9-90 13:00

Date/Time wt. blank 10-10-90 13:10

Gross wt. 163.9421 mg

Gross wt. 163.9425 mg

Ave. Gross wt. 163.9423 mg

Tare wt. 163.9418 mg

Weight of blank (m_{ab}) 0.0005 mg

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

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

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	310	310	310
Date/Time of wt 10-9-90 13:00 Gross wt	g	160.8715	162.8202	155.6193
Date/Time of wt 10-10-90 13:10 Gross wt	g	160.8710	162.8202	155.6187
Average Gross wt	g	160.8713	162.8202	155.6190
Tare wt	g	160.8148	162.6998	155.1704
Less acetone blank wt (W_a)	g	0.0005	0.0005	0.0005
Wt of particulate in acetone rinse (m_a)	g	0.0560	0.1199	0.4481

Filter Numbers	#	RJ4556	RJ4557	RJ4558
Date/Time of wt 10-9-90 13:20 Gross wt	g	1.2275	1.5673	1.7489
Date/Time of wt 10-10-90 13:30 Gross wt	g	1.2269	1.5667	1.7487
Average Gross wt	g	1.2272	1.5670	1.7488
Tare wt	g	0.5538	0.5523	0.5520

Weight of particulate on filters(s) (m_f)	g	0.6734	1.0147	1.1968
Weight of particulate in acetone rinse	g	0.0560	0.1199	0.4481
Total weight of particulate (m_n) Front Half	g	0.7294	1.1346	1.6449
" " " " Back Half		.0134	.0138	.0132
" " " " Total Part.		.7428	1.1484	1.6581

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 A Baldick Signature of reviewer

Brown Co.

WISCONSIN BACK-HALF

METHYLENE CHLORIDE BLANK

Vol. of Blank: 150 ML

Date/time of wt. 10-17-90 14:00 Gross wt. 159.8450 g

Date/time of wt. 10-19-90 14:25 Gross wt. 159.8452 g

Avg. Gross wt. 159.8451 g

Tare wt. 159.8445 g

Meth. blank .0006

D.I. H_2O BLANK

Vol. of Blank: 300 ML

Date/time of wt. 10-17-90 14:00 Gross wt. 120.2814 g

Date/time of wt. 10-19-90 14:25 Gross wt. 120.2813 g

Avg. Gross wt. 120.2814 g

Tare wt. 120.2800 g

Res. .0014

WISCONSIN BACK-HALF

COMPANY NAME: Brown Co.
Methylene Chloride Extraction for EPA Method 5 (back half)

Relative humidity in lab 50 %
Density of Methylene Chloride 1.3255 g/ml

			RUN 1	RUN 2	RUN 3
Methylene Chloride rinse volume		ml	150	150	150
Volume of Solution			535	535	535
Date/time of wt 10-17 14:05	Gross wt.	g	164.0514	125.4427	161.5357
Date/time of wt 10-19 14:30	Gross wt.	g	164.0509	125.4426	161.5352
	Avg. Gross wt.	g	164.0512	125.4427	161.5352
	Tare wt.	g	164.0416	125.4323	161.5292
Less Methylene Chloride Blank			0.0006	0.0006	0.0006
Wt./particulate: Methylene Chloride rinse		g	0.0090	0.0098	0.0054
Water evaporation					
Date/time of wt. 10-17 14:05	Gross wt.	g	138.5264	159.7064	126.4387
Date/time of wt. 10-19 14:30	Gross wt.	g	138.5261	159.7067	126.4384
	Avg. Gross wt.	g	138.5263	159.7066	126.4386
	Tare wt.	g	138.5194	159.7001	126.4283
Less H_2O blank wt.		g	0.0025	0.0025	0.0025
Weight of particulate from water ($m_{_}$)		g	0.0044	0.0040	0.0078
Wt./particulate: Methylene Chloride rinse		g	0.0090	0.0098	0.0054
Total weight of particulate (m_n)		g	0.0134	0.0138	0.0132

NOTE: In no case should a blank residue 0.02 mg/g or 0.001% of the weight of Methylene Chloride used be subtracted from the sample weight.

Remarks:

Signature of Analyst: Heather Baldick

Signature of Reviewer: [illegible]

Brown County Hwy

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: 12.0 = 20.9 - [1.7489 x 5.1]

RUN #2: 12.0 = 20.9 - [1.7489 x 5.1]

RUN #3 12.0 = 20.9 - [1.7489 x 5.1]

RUN 1:	$CO_2\%$	0	$CO_2\%$	0	$CO_2\%$	0	AVG.	Ø5.1
	$O_2\%$	12	$O_2\%$	12	$O_2\%$	12	AVG.	12
	$N_2\%$		$N_2\%$		$N_2\%$		AVG.	82.9
RUN 2:	$CO_2\%$	0	$CO_2\%$	0	$CO_2\%$	0	AVG.	Ø5.1
	$O_2\%$	12	$O_2\%$	12	$O_2\%$	12	AVG.	12
	$N_2\%$		$N_2\%$		$N_2\%$		AVG.	82.9
RUN 3:	$CO_2\%$	0	$CO_2\%$	0	$CO_2\%$	0	AVG.	Ø5.1
	$O_2\%$	12	$O_2\%$	12	$O_2\%$	12	AVG.	12
	$N_2\%$		$N_2\%$		$N_2\%$		AVG.	82.9

AMERICAN INTERPLEX
CORPORATION
LABORATORIES

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

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

October 15, 1990

ATTN: Mr. Joe Sewell

Control No. 28628

Description of Sample: Three (3) impinger solutions and one (1) blank received on 10/9/90

Results:

Sample Identification	Formaldehyde, mg	m^3	Volume, ml
Brown Co. Hwy., Run #1	<0.007	.0896	35
Brown Co. Hwy., Run #2	0.056	.1435	37
Brown Co. Hwy., Run #3	<0.007	.1681	31
Brown Co. Hwy. Blank	<0.01		57

Method: NIOSH Method 3500

AMERICAN INTERPLEX CORPORATION

By Steven Lovell
Steven Lovell
Laboratory Director

SL/bp

VII. CALCULATIONS

BROWN COUNTY HIGHWAY DEPARTMENT
GREEN BAY, WISCONSIN

ILLINOIS METHOD
SUMMARY OF TEST DATA

		10-2-90 RUN #1	10-2-90 RUN #2	10-2-90 RUN #3
SAMPLING TRAIN DATA				
	start	11:10	14:01	16:28
	finish	12:23	15:08	17:33
1. Sampling time, minutes	θ	60.0	60.0	60.0
2. Sampling nozzle diameter, in.	D_n	.4250	.4250	.4250
3. Sampling nozzle cross-sect. area, ft^2	A_n	.000985	.000985	.000985
4. Isokinetic variation	I	99%	106%	110%
5. Sample gas volume - meter cond., cf.	V_m	40.870	45.392	48.903
6. Average meter temperature, ^oR	T_m	548	549	550
7. Avg. oriface pressure drop, in. H_2O	dH	1.56	1.73	1.72
8. Total particulate collected, mg.	M_n	~~729.40~~ 742.80	~~1134.60~~ 1143.4	~~1644.90~~ 1653.1
VELOCITY TRAVERSE DATA				
9. Stack area, ft^2	A	63.62	63.62	63.62
10. Absolute stack gas pressure, in. Hg.	P_s	29.49	29.49	29.49
11. Barometric pressure, in. Hg.	P_{bar}	29.49	29.49	29.49
12. Avg. absolute stack temperature, R^o	T_s	616	620	620
13. Average $-\sqrt{\text{vel. head}}$, (C_p= .85)	$-\sqrt{dP}$	0.12	0.11	0.11
14. Average stack gas velocity, ft./sec.	V_s	7.79	7.16	7.16
STACK MOISTURE CONTENT				
15. Total water collected by train, ml.	V_{ic}	320.00	349.00	378.00
16. Moisture in stack gas, %	B_{ws}	27.94	27.64	27.59
EMISSIONS DATA				
17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	1086	996	996
18. Stack gas flow rate, cfm	acfm	29736	27331	27331
19. Particulate concentration, gr/dscf	C_s	0.2884	0.4045	0.5453
20. Particulate concentration, lb/hr	E	44.75	57.56	77.64
21. Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000
ORSAT DATA				
22. Percent CO_2 by volume	CO_2	5.10	5.10	5.10
23. Percent O_2 by volume	O_2	12.00	12.00	12.00
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	82.90	82.90	82.90

Format: summryR3

BROWN COUNTY HIGHWAY DEPARTMENT
GREEN BAY, WISCONSIN

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:

$$V_{m(std)} = (17.64)(1.000)(40.870)\left[\frac{(29.49) + \frac{1.56}{13.6}}{548}\right] = 38.948 \text{ dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(1.000)(45.392)\left[\frac{(29.49) + \frac{1.73}{13.6}}{549}\right] = 43.197 \text{ dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(1.000)(48.903)\left[\frac{(29.49) + \frac{1.72}{13.6}}{550}\right] = 46.452 \text{ dscf}$$

BROWN COUNTY HIGHWAY DEPARTMENT
GREEN BAY, WISCONSIN

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:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{\cancel{729.40}\ 742.8}{38.948}\right] = \cancel{0.2884}\ .2937 \text{ gr./dscf.}$$

Run 2:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{\cancel{1134.60}\ 1148.4}{43.197}\right] = \cancel{0.4045}\ .4094 \text{ gr./dscf.}$$

Run 3:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{\cancel{1644.90}\ 1658.1}{46.452}\right] = \cancel{0.5453}\ .5497 \text{ gr./dscf.}$$

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:

$$M_d = 0.44(\ 5.10\%) + 0.32(12.00\%) + 0.28(\ .00\% + 82.90\%) = 29.30\ \frac{lb}{lb\text{-}mole}$$

Run 2:

$$M_d = 0.44(\ 5.10\%) + 0.32(12.00\%) + 0.28(\ .00\% + 82.90\%) = 29.30\ \frac{lb}{lb\text{-}mole}$$

Run 3:

$$M_d = 0.44(\ 5.10\%) + 0.32(12.00\%) + 0.28(\ .00\% + 82.90\%) = 29.30\ \frac{lb}{lb\text{-}mole}$$

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) (304.0) = 14.3 cu.ft
$V_{wsg(std)}$ = (0.04715) (16.0) = 0.8 cu.ft

Run 2:

$V_{wc(std)}$ = (0.04707) (335.0) = 15.8 cu.ft
$V_{wsg(std)}$ = (0.04715) (14.0) = 0.7 cu.ft

Run 3:

$V_{wc(std)}$ = (0.04707) (360.0) = 16.9 cu.ft
$V_{wsg(std)}$ = (0.04715) (18.0) = 0.8 cu.ft

BROWN COUNTY HIGHWAY DEPARTMENT
GREEN BAY, WISCONSIN

Moisture Content of Stack Gases

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

Where:

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

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

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

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

Run 1:

$$B_{ws} = \frac{14.3 + 0.8}{14.3 + 0.8 + 38.948} \times 100 = 27.94\ \%$$

Run 2:

$$B_{ws} = \frac{15.8 + 0.7}{15.8 + 0.7 + 43.197} \times 100 = 27.64\ \%$$

Run 3:

$$B_{ws} = \frac{16.9 + 0.8}{16.9 + 0.8 + 46.452} \times 100 = 27.59\ \%$$

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 $\boxed{(g/g\text{-mole})\text{-}(mm\ Hg)}$ / $(^oK)(\ mm\ \boxed{H_2O})^{1/2}$
C_p	=	Pitot tube coefficient, (dimensionless).
dP	=	Velocity head of stack gas, in. H_2O.
P_{bar}	=	Barometric pressure at measurement site, (in. Hg).
P_g	=	Stack static pressure, (in. Hg).
P_s	=	Absolute stack gas pressure, (in. Hg) = $P_{bar} + P_g$
P_{std}	=	Standard absolute pressure, (29.92 in. Hg).
t_s	=	Stack temperature, (^of).
T_s	=	Absolute stack temperature, (^oR). = 460 + t_s.
M_s	=	Molecular weight of stack gas, wet basis, (lb/lb-mole).

Run 1:

$$V = (85.49)\ (\ .85)\ (\ 0.12) \sqrt{\frac{616}{(29.49)(26.14)}} = 7.79 \text{ ft/sec.}$$

Run 2:

$$V = (85.49)\ (\ .85)\ (\ 0.11) \sqrt{\frac{620}{(29.49)(26.18)}} = 7.16 \text{ ft/sec.}$$

Run 3:

$$V = (85.49)\ (\ .85)\ (\ 0.11) \sqrt{\frac{620}{(29.49)(26.18)}} = 7.16 \text{ ft/sec.}$$

BROWN COUNTY HIGHWAY DEPARTMENT
GREEN BAY, WISCONSIN

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°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:

$$Q_{sd}=3600(1-\ .2794\ )(\ 7.79)(\ 63.62)\left[\frac{528}{616}\right]\left[\frac{29.49}{29.92}\right] = 1086161.2\ \frac{dscf}{hr}$$

Run 2:

$$Q_{sd}=3600(1-\ .2764\ )(\ 7.16)(\ 63.62)\left[\frac{528}{620}\right]\left[\frac{29.49}{29.92}\right] = 996008.8\ \frac{dscf}{hr}$$

Run 3:

$$Q_{sd}=3600(1-\ .2759\ )(\ 7.16)(\ 63.62)\left[\frac{528}{620}\right]\left[\frac{29.49}{29.92}\right] = 996697.0\ \frac{dscf}{hr}$$

BROWN COUNTY HIGHWAY DEPARTMENT
GREEN BAY, WISCONSIN

Emissions Rate from Stack

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

Where:

E = Emissions rate, lb/hr.

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

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

Run 1:

$$E = \frac{(0.\overset{2937}{\cancel{2884}})\ (1086161.2)}{7000} = \overset{45.57}{\cancel{44.75}}\ \text{lb. / hr.}$$

Run 2:

$$E = \frac{(0.\overset{4094}{\cancel{4045}})\ (996008.8)}{7000} = \overset{58.25}{\cancel{57.56}}\ \text{lb. / hr.}$$

Run 3:

$$E = \frac{(0.\overset{5497}{\cancel{5453}})\ (996697.0)}{7000} = \overset{78.27}{\cancel{77.64}}\ \text{lb. / hr.}$$

EMISSIONS: POUNDS PER 1,000 POUNDS STACK GAS-WISCONSIN METHOD

$$E'' = (E \times 1000) \div (Q_{sd}/M_d)(M_s/528°F)(29.92/21.85)$$

Where: E" = Emissions per 1,000 pounds stack gas

E = Emissions in pounds per hour

Qsd = Stack gas flow rate in dscf/hr

Md = Mole fraction dry = 1 - % Moisture/100

Ms = Wet molecular weight

528°F = Standard temperature (68°F + 460°R)

29.92 = Standard Pressure

21.85 = Unit Conversion

Run #1: $\dfrac{\overset{45.57}{\cancel{44.75}} \times 1{,}000}{\underset{(.7206)}{(1{,}086{,}161.2)}\ \underset{(528)}{(26.14)}\ \underset{(21.85)}{(29.92)}}$ = $\overset{.446}{\cancel{0.438}}$ lbs/1000/lbs wet gas

Run #2: $\dfrac{\overset{58.25}{\cancel{57.56}} \times 1{,}000}{\underset{(.7236)}{(996{,}008.8)}\ \underset{(528)}{(26.18)}\ \underset{(21.85)}{(29.92)}}$ = $\overset{.623}{\cancel{0.616}}$ lbs/1000/lbs wet gas

Run #3: $\dfrac{\overset{78.27}{\cancel{77.64}} \times 1{,}000}{\underset{(.7241)}{(996{,}697.0)}\ \underset{(528)}{(26.18)}\ \underset{(21.85)}{(29.92)}}$ = $\overset{.838}{\cancel{0.831}}$ lbs/1000/lbs wet gas

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

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:

$$I = (100)(616)\left[\frac{(0.002669)(320) + \frac{40.870}{548}\left[29.49 + \frac{1.56}{13.6}\right]}{60\ (60.0)\ (18.19)\ (29.49)\ (.000985)} \right] = 99\%$$

Run 2:

$$I = (100)(620)\left[\frac{(0.002669)(349) + \frac{45.392}{549}\left[29.49 + \frac{1.73}{13.6}\right]}{60\ (60.0)\ (18.88)\ (29.49)\ (.000985)} \right] = 106\%$$

Run 3:

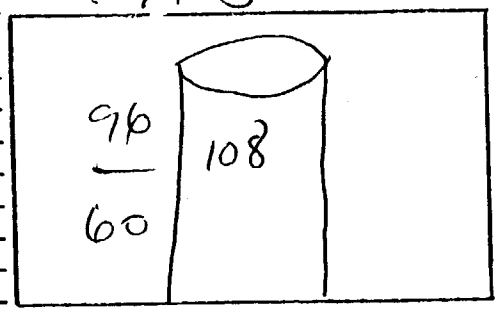
$$I = (100)(620)\left[\frac{(0.002669)(378) + \frac{48.903}{550}\left[29.49 + \frac{1.72}{13.6}\right]}{60\ (60.0)\ (19.54)\ (29.49)\ (.000985)} \right] = 110\%$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant BROWN COUNTY HWY 19.3

Location GREEN BAY WI.
Operator T.C. FOUK
Date 10-2-90
Run No. 1
Sample Box No. 1
Meter Box No. C-100
Meter H @ 1.56
C Factor .996
Pitot Tube Coefficient Cp .847



Schematic of Stack Cross Section

		IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
Ambient Temperature 60			
Barometric Pressure 29.49	FINAL	504	216
Assumed Moisture, % .20	INITIAL	200	200
Probe Length, m(ft) 10'	DIFFERENCE	304	16

Nozzle Identification No. .0009851
Avg. Calibrated Nozzle Dia., (in.) .425/.425/.42
Probe Heater Setting 4
Leak Rate, m^3/min. (cfm) 0 AT 10" Hg
Probe Liner Material STAINLESS STEEL
Static Pressure, mm Hg (in. Hg) +.1
Filter No. RT 4554

TRAV, PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H_2O		PRESSURE DIFF. ORF. MTR in H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	11:10 / 11:12.5	10	154	65	.17	3.4	927.475 / 930.0	80	70	250	60
2	11:15	4	155	90	.05	.97	931.4	90	70	250	60
3	11:17.30	4	156	90	.05	.97	932.8	90	70	250	60
4	11:20	4	158	90	.05	.97	934.5	90	70	250	60
5	11:22.30	4	156	90	.05	.97	936.0	100	80	250	60
6	11:25	5	156	90	.05	.97	937.4	100	80	250	60
7	11:27.30	5	156	80	.05	.97	939.2	100	80	250	60
8	11:30	8	155	70	.10	1.9	941.2	100	80	250	60
9	11:32.30	8	159	75	.10	1.9	943.4	100	80	250	60
10	11:35	8	159	50	.10	1.9	945.1	100	80	250	60
11	11:37.30	10	156	50	.10	1.9	947.5	100	80	250	60
12	11:40	10	156	50	.10	1.9	949.7	100	80	250	60
B 1	11:53 / 11:55.5	10	156	90	.13	2.5	950.7	100	80	250	60

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 10-2-90 LOCATION Green Bay 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) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	11:58	8	156	90	.10	1.9	952.5	100	80	250	60
3	12:00.30	8	156	90	.10	1.9	954.7	100	80	250	60
4	12:03	10	155	90	.10	1.9	956.8	100	80	250	60
5	12:05.30	8	155	72	.05	.97	958.6	100	80	250	60
6	12:08	8	155	60	.05	.97	960.4	100	80	250	60
7	12:10.30	8	155	75	.05	.97	961.8	100	80	250	60
8	12:13	8	155	40	.10	1.9	963.7	100	80	250	60
9	12:15.30	8	155	75	.10	1.9	965.0	100	80	250	60
10	12:18	8	155	75	.10	1.9	966.2	100	80	250	60
11	12:20.30	10	155	60	.05	.97	967.4	100	80	250	60
12	12:23	10	156	60	.05	.97	968.345	100	80	250	60

RAMCON ENVIRONMENTAL CORPORATION

Plant BROWN COUNTY HWY 19.3

Location GREEN BAY WI
Operator T. CROOK
Date 10-2-90
Run No. 2
Sample Box No. C-100 1
Meter Box No. C-100
Meter H @ 1.56
C Factor .996
Pitot Tube Coefficient Cp .847

Ambient Temperature 60
Barometric Pressure 29.49
Assumed Moisture, % 20
Probe Length, m(ft) 10 FT
Nozzle Identification No. .000585
Avg. Calibrated Nozzle Dia., (in.) .425/.425/.425
Probe Heater Setting 4
Leak Rate, m³/min. (cfm) 0 AT 8"
Probe Liner Material STAINLESS
Static Pressure, mm Hg (in.Hg) +.01
Filter No. RT 4557

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	535	214
INITIAL	200	200
DIFFERENCE	335	14

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H_2O		PRESSURE DIFF. ORF. MTR in H_2O	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
SIDE A 1	14:01 / 14:03.30	5	160	65	.10	1.9	968.531 / 970.6	85	80	250	60
2	14:06	5	160	90	.10	1.9	972.6	90	80	250	60
3	14:08.30	5	160	90	.05	.97	974.2	100	80	250	60
4	14:11	5	160	90	.13	2.5	976.4	100	80	250	60
5	14:13.30	5	160	90	.10	1.9	978.6	100	80	250	60
6	14:16	5	160	90	.15	2.9	981.2	100	80	250	60
7	14:18.30	5	160	80	.05	.97	982.7	100	80	250	60
8	14:21	5	160	70	.05	.97	984.4	100	80	250	60
9	14:23.30	5	160	75	.14	2.7	986.9	100	80	250	60
10	14:26	5	160	50	.14	2.7	989.5	100	80	250	60
11	14:28.30	5	160	50	.10	1.9	991.6	100	80	250	60
12	14:31	5	160	50	.05	.97	993.3	100	80	250	60
SIDE B 1	14:38 / 14:40.30	5	160	90	.13	2.5	995.6	100	80	250	60

(30)

Form #REC 05

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 10-2-90 LOCATION Brown County TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)		ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME Vm ($ft.^3$)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	14:43	5	160	90	.10	1.9	997.8	100	80	250	60
3	14:45 30	5	160	90	.10	1.9	999.8	100	80	250	60
4	14:48	5	160	90	.13	2.5	002.3	100	80	250	60
5	14:50 30	5	160	72	.10	1.9	003.9	100	80	250	60
6	14:53	5	160	60	.05	.97	005.5	100	80	250	60
7	14:55 30	5	160	75	.05	.97	007.2	100	80	250	60
8	14:58	5	160	40	.05	.97	008.8	100	80	250	60
9	15:00 30	5	160	75	.10	1.9	010.9	100	80	250	60
10	15:03	5	160	75	.10	1.9	013.1	100	80	250	60
11	15:05 30	5	160	60	.05	.97	014.8	100	80	250	60
12	15:08	5	160	60	.05	.97	016.423	100	80	250	60

RAMCON ENVIRONMENTAL CORPORATION

Plant BROWN COUNTY HWY 19.3

Location GREEN BAY WI
Operator T.C ROOK
Date 10-2-90
Run No. 3
Sample Box No. 1
Meter Box No. C-100
Meter H @ 1.54
C Factor .996
Pitot Tube Coefficient Cp .847

Ambient Temperature 60
Barometric Pressure 29.49
Assumed Moisture, % .20
Probe Length, m(ft) 10 FT
Nozzle Identification No. .0009851
Avg. Calibrated Nozzle Dia., (in.) .425/.425/.42
Probe Heater Setting 4
Leak Rate, m³/min. (cfm) DAT 8"
Probe Liner Material STAINLESS STEEL
Static Pressure, mm Hg (in. Hg) +.01
Filter No. RJ-4558

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	860	218
INITIAL	700	200
DIFFERENCE	360	18

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H20		PRESSURE DIFF. ORF. MTR in H20	GAS SAMPLE VOLUME ft³	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
SIDE A 1	16:28 / 16:30 SP	3	161	85	.05	.97	016.555 / 017.5	85	80	250	60
2	16:33	3	160	90	.05	.97	019.4	100	80	250	60
3	16:35 SP	5	160	90	.10	1.9	021.4	100	80	250	60
4	16:38	5	160	90	.15	2.5	024.3	100	80	250	60
5	16:40.30	5	160	90	.14	2.7	026.8	100	80	250	60
6	16:43	5	160	90	.10	1.9	029.1	100	80	250	60
7	16:45.30	5	160	80	.10	1.9	031.3	100	80	250	60
8	16:48	5	160	70	.10	1.9	033.5	100	80	250	60
9	16:50.30	5	161	75	.13	2.5	036.0	100	80	250	60
10	16:53	5	161	50	.13	2.5	038.5	100	80	250	60
11	16:55.30	5	161	50	.10	1.9	041.0	100	80	250	60
12	16:58	5	161	50	.05	.97	042.4	100	80	250	60
SIDE B 1	17:03 / 17:05 SP	5	160	90	.05	.97	043.8	100	80	250	60

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Form #REC 05

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 10-2-90 LOCATION Brown County TEST NO. 3

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)		ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME Vm ($ft.^3$)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	17:08	5	161	90	.10	1.9	046.0	100	80	250	60
3	17:10.30	5	161	90	.10	1.9	048.1	100	80	250	60
4	17:13	5	160	90	.13	2.5	050.5	100	80	250	60
5	17:15.30	5	160	72	.10	1.9	052.9	100	80	250	60
6	17:18	5	160	60	.10	1.9	054.9	100	80	250	60
7	17:20.30	5	160	75	.05	.97	056.9	100	80	250	60
8	17:23	5	160	40	.05	.97	058.5	100	80	250	60
9	17:25.30	5	160	75	.10	1.9	060.1	100	80	250	60
10	17:28	5	160	75	.10	1.9	062.3	100	80	250	60
11	17:30.30	5	160	60	.05	.97	063.8	100	80	250	60
12	17:33	5	160	60	.05	.97	065.458	100	80	250	60

RAMCON ENVIRONMENTAL CORPORATION

Plant BROWN COUNTY

Location GREEN BAY
Operator T.C. BLOIS
Date 10-2-90
Run No. 1
Sample Box No.
Meter Box No. VOST BOX
Meter H @
C Factor
Pitot Tube Coefficient Cp

Ambient Temperature 60
Barometric Pressure 29.19
Assumed Moisture, %
Probe Length, m(ft)
Nozzle Identification No.
Avg. Calibrated Nozzle Dia., (in.)
Probe Heater Setting
Leak Rate, m^3/min. (cfm)
Probe Liner Material
Static Pressure, mm Hg (in. Hg)
Filter No.

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL		
INITIAL		
DIFFERENCE		

Schematic of Stack Cross Section

FORMALDEHYDE

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H_2O	PRESSURE DIFF. ORF. MTR in H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
	11:10 / 11:15	1				000	60	60		
	11:20	1					64	62		
	11:25	1					79	75		
	11:30	1					79	75		
	11:35	1					80	90		
	11:40	1					80	90		
	11:45	1					90	95		
	11:50	1					90	95		
	11:55	1					90	95		
	12:00	1					90	95		
	12:05	1					90	95		
	12:10	1				3.258	90	95		
								93.5		

3.165 DSCF 543.5
.0896 m^3

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RAMCON ENVIRONMENTAL CORPORATION

Plant BROWN COUNTY

Location GREEN BAY
Operator T. CROOK
Date 10-2-90
Run No. 2
Sample Box No.
Meter Box No. VOST BOX
Meter H @
C Factor
Pitot Tube Coefficient Cp

Ambient Temperature 60
Barometric Pressure 29.49 FINAL
Assumed Moisture, % INITIAL
Probe Length, m(ft) DIFFERENCE
Nozzle Identification No.
Avg. Calibrated Nozzle Dia., (in.)
Probe Heater Setting
Leak Rate, m^3/min. (cfm)
Probe Liner Material
Static Pressure, mm Hg (in. Hg)
Filter No.

IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g

FORMALDEHYDE

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H_2O	PRESSURE DIFF. ORF. MTR in H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
	14:00 / 14:05					000	60	60		
	14:10						75	80		
	14:15						80	90		
	14:20						90	95		
	14:25						90	95		
	14:30						90	95		
	14:35						90	95		
	14:40						90	95		
	14:45						90	95		
	14:50						90	95		
	14:55						90	95		
	15:00					5.258	90	95		
								87.9		

5.067 DSCF = 547.9
.1435 m

Form #REC-05

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RAMCON ENVIRONMENTAL CORPORATION

Plant BROWN COUNTY

Location GREEN BAY
Operator T. CRONK
Date 10-2-90
Run No. 5
Sample Box No.
Meter Box No. WEST BOX
Meter H @
C Factor
Pitot Tube Coefficient Cp

Ambient Temperature 60
Barometric Pressure 29.49
Assumed Moisture, %
Probe Length, m(ft)
Nozzle Identification No.
Avg. Calibrated Nozzle Dia., (in.)
Probe Heater Setting
Leak Rate, m^3/min. (cfm)
Probe Liner Material
Static Pressure, mm Hg (in. Hg)
Filter No.

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL		
INITIAL		
DIFFERENCE		

Schematic of Stack Cross Section

FORMALDEHYDE

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H_2O	PRESSURE DIFF. ORF. MTR in H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
	16:30 / 16:35					000	70	70		
	16:40						80	90		
	16:45						90	95		
	16:50						90	95		
	16:55						90	95		
	17:00						90	95		
	17:05						90	95		
	17:10						90	95		
	17:15					~~6.185~~	90	95		
	17:20						90	95		
	17:25						90	95		
	17:30					6.185	90	95		
								90.0		

5.938 .168 m^3 90.0

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NAME: BROWN COUNTY HIGHWAY DEPARTMENT TEST DATE: OCTOBER 2, 1990

ILLINOIS TANGENTIAL FLOW METHOD
CYCLONIC FLOW VELOCITY CORRECTIONS

RUN # 1

Point #	Cyclonic Angle	dP Measured	dP Corrected
A-01	65°	.17	.07
02	90°	.05	.00
03	90°	.05	.00
04	90°	.05	.00
05	90°	.05	.00
06	90°	.05	.00
07	80°	.05	.01
08	70°	.10	.03
09	75°	.10	.03
10	50°	.10	.06
11	50°	.10	.06
12	50°	.10	.06
B-01	90°	.13	.00
02	90°	.10	.00
03	90°	.10	.00
04	90°	.10	.00
05	72°	.05	.02
06	60°	.05	.03
07	75°	.05	.01
08	40°	.10	.08
09	75°	.10	.03
10	75°	.10	.03
11	60°	.05	.03
12	60°	.05	.03

NAME: BROWN COUNTY HIGHWAY DEPARTMENT TEST DATE: OCTOBER 2, 1990

ILLINOIS TANGENTIAL FLOW METHOD
CYCLONIC FLOW VELOCITY CORRECTIONS

RUN # 2

Point #	Cyclonic Angle	dP Measured	dP Corrected
A-01	65°	.10	.04
02	90°	.10	.00
03	90°	.05	.00
04	90°	.13	.00
05	90°	.10	.00
06	90°	.15	.00
07	80°	.05	.01
08	70°	.05	.02
09	75°	.14	.04
10	50°	.14	.09
11	50°	.10	.06
12	50°	.05	.03
B-01	90°	.13	.00
02	90°	.10	.00
03	90°	.10	.00
04	90°	.13	.00
05	72°	.10	.03
06	60°	.05	.03
07	75°	.05	.01
08	40°	.05	.04
09	75°	.10	.03
10	75°	.10	.03
11	60°	.05	.03
12	60°	.05	.03

NAME: BROWN COUNTY HIGHWAY DEPARTMENT TEST DATE: OCTOBER 2, 1990

ILLINOIS TANGENTIAL FLOW METHOD
CYCLONIC FLOW VELOCITY CORRECTIONS

RUN # 3

Point #	Cyclonic Angle	dP Measured	dP Corrected
A-01	75°	.05	.01
02	90°	.05	.00
03	90°	.10	.00
04	90°	.13	.00
05	90°	.14	.00
06	90°	.10	.00
07	80°	.10	.02
08	70°	.10	.03
09	75°	.13	.03
10	50°	.13	.08
11	50°	.10	.06
12	50°	.05	.03
B-01	90°	.05	.00
02	90°	.10	.00
03	90°	.10	.00
04	90°	.13	.00
05	72°	.10	.03
06	60°	.10	.05
07	75°	.05	.01
08	40°	.05	.04
09	75°	.10	.03
10	75°	.10	.03
11	60°	.05	.03
12	60°	.05	.03

IX. CALIBRATION

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number _____ Date 10-8-90 Meter box number C-100 Plant _____

Barometric pressure, P_b = 29.95 in. Hg Dry gas meter number _____ Pretest Y _____

	Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i $\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
5.238	1	~~10~~ 5	251.704 / 256.943	77	100 / 110	82 / 82	93.5	8.40		.98	1.55
10.308	2	10	241.156 / 251.604	77	100 / 110	82 / 82	93	11:93		.99	1.57
10.424	3	10	230.555 / 240.979	77	100 / 110	88 / 82	93	9:78		.98	1.58
										Y = .98	1.56

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

where

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

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

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

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

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

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

ΔH = Pressure differential across orifice, in. H_2O.

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

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

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

Form #REC-01

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number _____ Date 9-22-90 Meter box number C-100 Plant _____

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

	Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i $\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
5.272	1.0	~~10~~ 5	920.342 / 925.619	77	101 / 117	81 / 81	95	8.32		.978	Opq 1.57
10.283	2.0	10	907.338 / 910.138	77	103 / 119	81 / 81	96	12.01		1.0	1.58
10.192	3.0	10	899.536 / 901.715	77	102 / 118	82 / 81	96.5	9.77		1.01	1.52
										Y = .996	1.56

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

where

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

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

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

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

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

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

ΔH = Pressure differential across orifice, in. H_2O.

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

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

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-7-89 Thermocouple number inlet/outlet

Ambient temperature 20 °C Barometric pressure 29.88 in. Hg

Calibrator [illegible] 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 10-2-90	60	60	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 10-2-90	60	60	0

[a]Type of calibration system used.

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

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-5-89 Thermocouple number 10

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 °F	Thermocouple potentiometer temperature, °C °F	Temperature difference,[b] %
A	Ice Bath	32	32	0
B	Boiling water	212	211	.005
C	Boiling oil	381	380	.003
D	Ambient 10-2-90	60	60	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

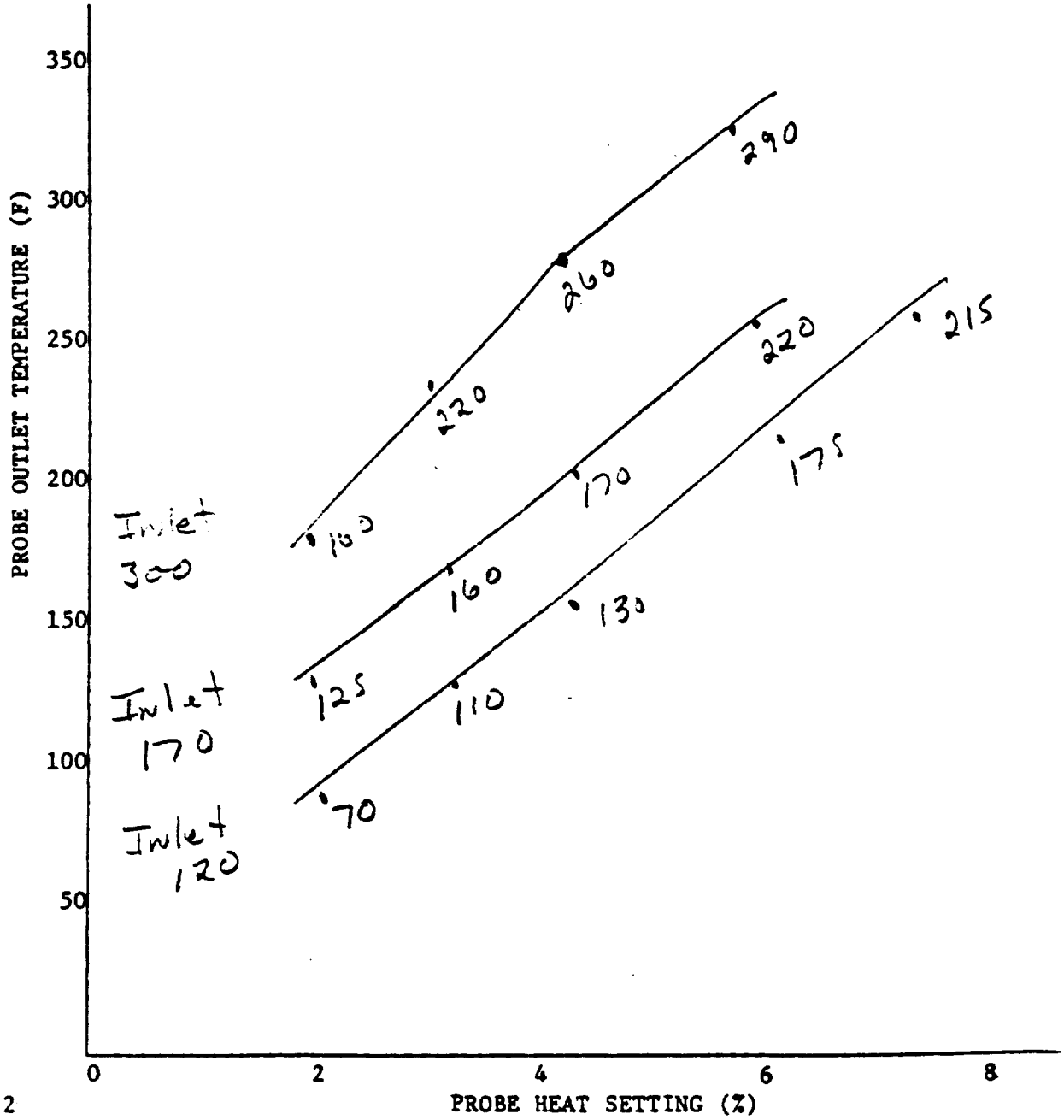
Heating Probe Calibration

Probe No. 10 Probe Length 10'

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

Name of Company to be tested _____

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



Form No. EED-17-2

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. 10' Date 5-11-90

Calibrated by: S Turner

"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	2.1	2.95	.844	0.004
2	1.45	2.0	.851	0.003
3	0.9	1.25	.848	0.000
		$\bar{C}_p$ (SIDE A)	.847	

"B" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	$\Delta p(s)$ cm H_2O in. H_2O)	$C_p(s)$	DEVIATION $C_{p(s)}-\bar{C}_p(B)$
1	2.1	2.9	.851	0.004
2	1.45	1.95	.862	0.003
3	0.95	1.25	.848	0.000
		$\bar{C}_p$ (SIDE B)	.847	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} |C_p(s)-\bar{C}_p(\text{A OR B})|}{3} \leftarrow \text{MUST BE} \leq 0.01 \quad .00$$

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

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

Form No. EED-17-1

X. RAMCON PERSONNEL

RAMCON Environmental Stack Test Team

Sumner Buck - President

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

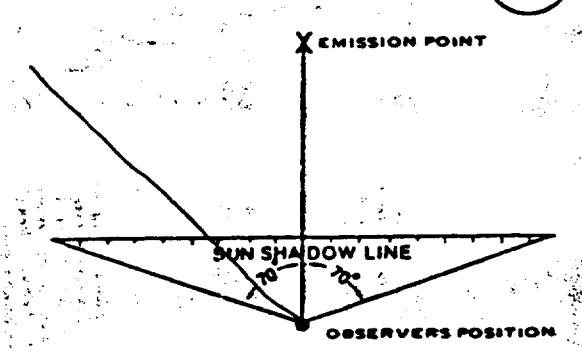
Tommy Crook - Team Leader

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

XI. VISIBLE EMISSIONS

SOURCE NAME	Brown County Hwy.
ADDRESS	Green Bay, Wis.
CITY	Green Bay
STATE	Wis.
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	
OPERATING MODE	
CONTROL EQUIPMENT	
OPERATING MODE	
DESCRIBE EMISSION POINT	~~Stack~~ Stack
HEIGHT ABOVE GROUND LEVEL	
HEIGHT RELATIVE TO OBSERVER	
DISTANCE FROM OBSERVER	
DIRECTION FROM OBSERVER	North
DESCRIBE EMISSIONS	Lofting
EMISSION COLOR	Grey & 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	30' from Stack
DESCRIBE BACKGROUND	SKY
BACKGROUND COLOR	Blue
SKY CONDITIONS	Clear
WIND SPEED	0-5
WIND DIRECTION	North EAST
AMBIENT TEMPERATURE	60
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE	START TIME	STOP TIME
10/2/90	11:10	12:10

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

AVERAGE OPACITY FOR HIGHEST PERIOD	18.75%
NUMBER OF READINGS ABOVE	20 % WERE 0
RANGE OF OPACITY READINGS	15% MINIMUM 20% MAXIMUM
COMMENTS	Run #1
OBSERVER'S NAME (PRINT)	Jimmy Briner
OBSERVER'S SIGNATURE	Jimmy Briner
DATE	10/2/90
ORGANIZATION	RAMCON
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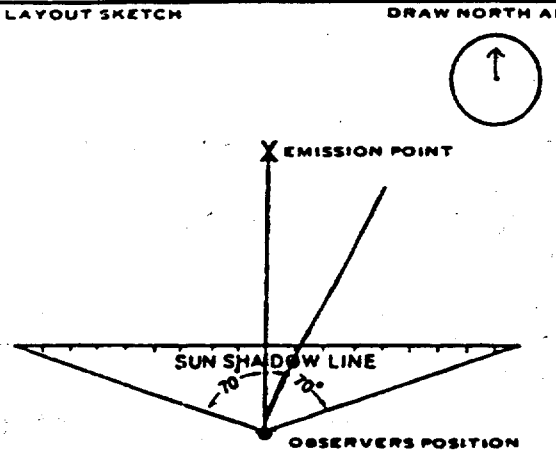
SIGNATURE	
TITLE	
DATE	
CERTIFIED BY	Carl Koontz
DATE	8/13/90
VERIFIED BY	
DATE	

SOURCE NAME	Brown County Hwy.
ADDRESS	Green Bay, Wis.
CITY	Green Bay
STATE	Wis.
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	
OPERATING MODE	
CONTROL EQUIPMENT	
OPERATING MODE	
DESCRIBE EMISSION POINT	~~30' from Stack~~ STACK
HEIGHT ABOVE GROUND LEVEL	
HEIGHT RELATIVE TO OBSERVER	
DISTANCE FROM OBSERVER	
DIRECTION FROM OBSERVER	North
DESCRIBE EMISSIONS	Lofting
EMISSION COLOR	Gray & 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	30' from Stack
DESCRIBE BACKGROUND	SKY
BACKGROUND COLOR	Blue
SKY CONDITIONS	Clear
WIND SPEED	0-5
WIND DIRECTION	North EAST
AMBIENT TEMPERATURE	60
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE	START TIME	STOP TIME
10/2/90	14:01	15:01

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

AVERAGE OPACITY FOR HIGHEST PERIOD: 15.625%

NUMBER OF READINGS ABOVE: 20 % WERE 0

RANGE OF OPACITY READINGS: 15% MINIMUM 20% MAXIMUM

COMMENTS: Run #2

OBSERVER'S NAME (PRINT): Jimmy Briner

OBSERVER'S SIGNATURE: [signature] DATE: 10/2/90

ORGANIZATION: KAMCON

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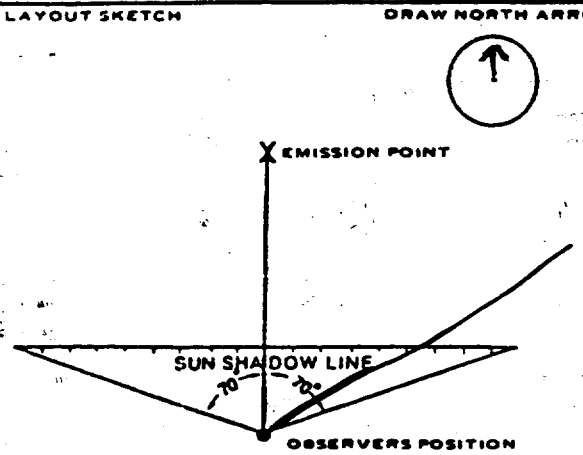
TITLE DATE

CERTIFIED BY: CARL Koontz DATE: 8/13/90

VERIFIED BY DATE

SOURCE NAME	Brown County Hwy.
ADDRESS	Green Bay, Wis.
CITY	Green Bay
STATE	Wis.
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	
OPERATING MODE	
CONTROL EQUIPMENT	
OPERATING MODE	
DESCRIBE EMISSION POINT	~~Stack~~ STACK
HEIGHT ABOVE GROUND LEVEL	
HEIGHT RELATIVE TO OBSERVER	
DISTANCE FROM OBSERVER	
DIRECTION FROM OBSERVER	North
DESCRIBE EMISSIONS	Lofting
EMISSION COLOR	Grey & 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	30' from Stack
DESCRIBE BACKGROUND	SKY
BACKGROUND COLOR	Blue
SKY CONDITIONS	Clear
WIND SPEED	5-10
WIND DIRECTION	North-East
AMBIENT TEMPERATURE	60
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE	START TIME	STOP TIME
10/2/90	16:28	17:33

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5	15	15	15	15	35	15	15	15	15
6	15	15	15	15	36	15	15	15	15
7	[redacted]				37	15	15	15	15
8	[redacted]				38	15	15	15	15
9	[redacted]				39	15	20	15	15
10	[redacted]				40	15	15	15	15
11	[redacted]				41	15	15	15	15
12	[redacted]				42	20	15	15	15
13	15	15	15	15	43	15	15	15	15
14	15	15	20	15	44	15	15	15	15
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16	15	15	15	15	46	15	15	20	15
17	15	15	15	15	47	15	15	15	15
18	15	15	15	15	48	15	15	15	15
19	15	15	15	15	49	15	15	15	15
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21	15	15	15	15	51	15	15	15	15
22	20	15	15	15	52	15	15	15	15
23	15	15	15	20	53	15	15	15	15
24	15	15	15	15	54	15	15	15	15
25	15	20	15	15	55	15	15	15	15
26	15	15	15	15	56	15	15	15	15
27	15	15	15	15	57	15	15	15	20
28	15	15	15	15	58	15	15	15	15
29	15	15	15	15	59	15	15	15	15
30	15	20	15	15	60	15	20	15	15

AVERAGE OPACITY FOR HIGHEST PERIOD: 15.625

NUMBER OF READINGS ABOVE: 20 % WERE 0

RANGE OF OPACITY READINGS: 15 MINIMUM 20 MAXIMUM

COMMENTS: Run #3

OBSERVER'S NAME (PRINT): Jimmy Brinze

OBSERVER'S SIGNATURE: [signature] DATE: 10/2/90

ORGANIZATION: KAMCON

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SIGNATURE

TITLE DATE

CERTIFIED BY: Carl Krantz DATE: 8/13/90

VERIFIED BY DATE