CORRESPONDENCE/MEMORANDUM

STATE OF WISCONSIN

Date: April 21, 1989

File Ref:

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.

To: Files

From: Brad Pyle AM/3

Subject: Review of stack test for Baraboo Asphalt Company, Baraboo, WI

I. Source

Baraboo Asphalt Company
P.O. Box A, HWY 12
Baraboo, WI 53913

Test Date: August 9,1988

Test firm: Ramcon Environmental Corp.
Ramcon Building
223 Scott St.
Memphis TN. 38112

Test personnel: Dave Armstrong
Frank Kuhn

Source FID #: 157007510, P31, S11

II. Source Description

The source tested was a Bituma-Store, Inc. 44X250, drum mix asphalt plant with a Bituma Model SB-42CFM baghouse. The plant was operating near its 250 ton per hour capacity. The plant was introducing about 40% recycle but is capable of 60%. It was burning natural gas but can fire #2 heating oil as a back up. Pressure drop across the baghouse was 4.9 inches of water.

III. Sampling Operation

The test was performed to fulfill conditions in permit # 87-CDW-413 issued to this source in February of 1988.

The stack test was performed using EPA Method 5 as stated in the Federal Register, Vol 42, #160, August 18, 1977. The test site was on the 48"X48" outlet stack. Five sampling ports were placed 48" down from the top of the stack and 192" up from the last flow disturbance. Thirty points were sampled, six through each port, for two minutes each, for a total test time of 60 minutes per test run.

Mr. Jon Heinrich was the Department witness at this stack test.

IV. Summary of Results

Particulates

Run Number	Emission Rate lb/hr	Emission Concentration gr/DSCF	lb/1000lb	Isokinetic Ratio %
1	8.44	0.0507	0.084	111.7
2	5.24	0.0340	0.052	103.1
3	4.02	0.0272	0.043	107.5
avg.	5.90	0.0370	0.059	107.4

V. Applicable limit

Particulate- 0.04 grains per dry standard cubic foot
Opacity- 20%

VI. Discussion of Results

The average particulate emission rate was 0.037 grains per dry standard cubic foot (gr/DSCF) which is under the limit 0.04 gr/DSCF. The emission concentration for run #1 was 0.0507 gr/DSCF and the isokinetic ratio was 111.7%. These values exceed their individual limits but when averaged with the remaining runs they are within those limits.

The average isokinetic ratio was 107.4% which is within the limits of 90% to 110% set by the Department to judge the validity of stack test data. The average opacity was about 5%.

I checked Ramcons data and found that the test personnel had used a different nozzle diameter for each run. I checked their results with the Department computer and found them to be correct. The test report contained calibration data for the sampling equipment and production data for the plant.

cc: Jon Heinrich
Joe Perez AM/3
US EPA Region V

NAME OF SOURCE: Baraboo Asphalt

LOCATION OF SOURCE: Baraboo

PROCESS TESTED: ?

DATE OF TEST: 080988

RUN NUMBER: 1

N NUMBER OF SAMPLING POINTS= 30

VM DGM VOL,METER COND DRY= 33.5 CFD

PB BAR PRESS,STATION= 29.5 IN HG

VL TOTAL VOL OF WATER COLLECTED= 223 ML

%CO2 % CARBON DIOXIDE BY VOL,DRY BASIS= 6 %

%O2 % OXYGEN BY VOL,DRY BASIS= 10.4 %

%CO % CARBON MONOXIDE BY VOL, DRY BASIS= 0 %

%N2 % NITROGEN BY VOL,DRY BASIS= 83.6 %

CP PITOT TUBE COEFFICIENT= .795

PS STACK PRESS= 29.5 IN HG

AS AREA OF THE SAMPLING SITE= 16 SQ FEET

MT TOTAL DRY PARTICULATE= .1044 GM

T TOTAL SAMPLING TIME= 60 MIN

AN AREA OF THE NOZZLE= .000413 SQ FEET

Baraboo Asphalt,?,RUN: 1

PARTICULATE FIELD DATA

SAMPLING POINT NUMBER	STACK TEMP DEG F	VELOCITY PRESS IN H2O	SQ ROOT VEL PRESS	ORIFICE METER PRESS DROP IN H2O	DRY GAS METER TEMP DEG F INLET	OUTLET
1	245.0	0.980	0.98995	1.700	84.0	82.0
2	250.0	0.480	0.69282	0.820	88.0	82.0
3	248.0	0.500	0.70711	0.860	88.0	82.0
4	248.0	0.760	0.87178	1.300	90.0	82.0
5	248.0	1.000	1.00000	1.700	90.0	82.0
6	248.0	1.200	1.09545	2.100	90.0	82.0
7	246.0	0.450	0.67082	0.760	90.0	82.0
8	246.0	0.200	0.44721	0.340	94.0	82.0
9	248.0	0.260	0.50990	0.440	96.0	82.0
10	248.0	0.480	0.69282	0.820	98.0	82.0
11	246.0	0.720	0.84853	1.200	100.0	82.0
12	248.0	0.630	0.79373	1.100	100.0	82.0
13	246.0	0.240	0.48990	0.410	100.0	82.0
14	248.0	0.080	0.28284	0.140	100.0	82.0
15	248.0	0.100	0.31623	0.170	100.0	84.0
16	246.0	0.200	0.44721	0.340	100.0	84.0
17	246.0	0.230	0.47958	0.390	100.0	84.0
18	246.0	0.360	0.60000	0.620	100.0	84.0
19	245.0	0.170	0.41231	0.290	100.0	84.0
20	246.0	0.070	0.26458	0.120	100.0	84.0
21	248.0	0.020	0.14142	0.120	100.0	84.0
22	246.0	0.080	0.28284	0.140	100.0	84.0
23	246.0	0.080	0.28284	0.140	100.0	84.0
24	246.0	0.080	0.28284	0.140	100.0	84.0
25	244.0	0.140	0.37417	0.240	100.0	84.0
26	246.0	0.080	0.28284	0.140	100.0	86.0
27	246.0	0.100	0.31623	0.170	100.0	86.0
28	246.0	0.170	0.41231	0.290	100.0	86.0
29	244.0	0.200	0.44721	0.340	102.0	86.0
30	242.0	0.360	0.60000	0.620	102.0	86.0

AVERAGE	TS=	SR(VP)=	OP=	TM=
VALUES	706.4667 DEG R	.5345156	.5986667 IN H2O	550.2333 DEG R

Baraboo Asphalt,?,RUN: 1

CALCULATED RESULTS

TS STACK TEMPERATURE = 246.4667 DEG F

VMSTD DGM VOL,STD COND DRY= 31.7424 SCFD

VWSTD VOL OF WATER VAPOR,STD COND= 10.49661 SCF

%M % MOISTURE IN STACK GAS BY VOL,STD COND= 24.85051 %

MD MOLE FRACTION OF DRY GAS= .7514949

MWD MOLECULAR WT OF STACK GAS,DRY BASIS= 29.376 LB/LB-MOLE

MWS MOLECULAR WT OF STACK GAS,WET BASIS= 26.549 LB/LB-MOLE

VS AVE STACK GAS VELOCITY,STACK COND= 34.50274 FPS

QACT ACTUAL STACK GAS FLOW RATE= 33122.63 CFM

QSTD AVE STACK GAS FLOW RATE,STD COND DRY= 18342.29 SCFMD

%EA AVE % EXCESS AIR= 89.11433 %

PMRA AVE PMR BY RATIO OF AREAS METHOD= 8.916759 LB/HR

PMRC AVE PMR BY CONC METHOD= 7.979983 LB/HR

PMR(AVE) AVE PMR,STD COND DRY= 8.448371 LB/HR

C EMISSION CONC,STD COND DRY= .0507489 GR/SCFD

DGR AVE STACK GAS RATE,STD COND DRY= 83844.31 LB/HR

LB/MLB EMISSION CONC,STD COND DRY= .1007626 LB/MLB OF DRY GAS

WGR AVE STACK GAS RATE,STD COND WET= 100833.1 LB/HR

LB/MLB EMISSION CONC,STD COND WET= 8.378568E-02 LB/MLB OF WET GAS

%ISR % ISOKINETIC RATIO= 111.7391 %

NAME OF SOURCE: Baraboo

LOCATION OF SOURCE: Baraboo

PROCESS TESTED: ?

DATE OF TEST: 080988

RUN NUMBER: V

N NUMBER OF SAMPLING POINTS= 30

VM DGM VOL,METER COND DRY= 32.05 CFD

PB BAR PRESS,STATION= 29.5 IN HG

VL TOTAL VOL OF WATER COLLECTED= 250 ML

%CO2 % CARBON DIOXIDE BY VOL,DRY BASIS= 5 %

%O2 % OXYGEN BY VOL,DRY BASIS= 12.2 %

%CO % CARBON MONOXIDE BY VOL, DRY BASIS= 0 %

%N2 % NITROGEN BY VOL,DRY BASIS= 82.8 %

CP PITOT TUBE COEFFICIENT= .795

PS STACK PRESS= 29.5 IN HG

AS AREA OF THE SAMPLING SITE= 16 SQ FEET

MT TOTAL DRY PARTICULATE= .0669 GM

T TOTAL SAMPLING TIME= 60 MIN

AN AREA OF THE NOZZLE= .000443 SQ FEET

Baraboo,?,RUN: 1

PARTICULATE FIELD DATA

SAMPLING POINT NUMBER	STACK TEMP DEG F	VELOCITY PRESS IN H2O	SQ ROOT VEL PRESS	ORIFICE METER PRESS DROP IN H2O	DRY GAS METER TEMP DEG F INLET	DRY GAS METER TEMP DEG F OUTLET
1	245.0	0.980	0.98995	1.700	84.0	82.0
2	250.0	0.480	0.69282	0.820	88.0	82.0
3	248.0	0.500	0.70711	0.860	88.0	82.0
4	248.0	0.760	0.87178	1.300	90.0	82.0
5	248.0	1.000	1.00000	1.700	90.0	82.0
6	248.0	1.200	1.09545	2.100	90.0	82.0
7	246.0	0.450	0.67082	0.760	90.0	82.0
8	246.0	0.200	0.44721	0.340	94.0	82.0
9	248.0	0.260	0.50990	0.440	96.0	82.0
10	248.0	0.480	0.69282	0.820	98.0	82.0
11	246.0	0.720	0.84853	1.200	100.0	82.0
12	248.0	0.630	0.79373	1.100	100.0	82.0
13	246.0	0.240	0.48990	0.410	100.0	82.0
14	248.0	0.080	0.28284	0.140	100.0	82.0
15	248.0	0.100	0.31623	0.170	100.0	84.0
16	246.0	0.200	0.44721	0.340	100.0	84.0
17	246.0	0.230	0.47958	0.390	100.0	84.0
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19	245.0	0.170	0.41231	0.290	100.0	84.0
20	246.0	0.070	0.26458	0.120	100.0	84.0
21	248.0	0.020	0.14142	0.120	100.0	84.0
22	246.0	0.080	0.28284	0.140	100.0	84.0
23	246.0	0.080	0.28284	0.140	100.0	84.0
24	246.0	0.080	0.28284	0.140	100.0	84.0
25	244.0	0.140	0.37417	0.240	100.0	84.0
26	246.0	0.080	0.28284	0.140	100.0	86.0
27	246.0	0.100	0.31623	0.170	100.0	86.0
28	246.0	0.170	0.41231	0.290	100.0	86.0
29	244.0	0.200	0.44721	0.340	102.0	86.0
30	242.0	0.360	0.60000	0.620	102.0	86.0
AVERAGE VALUES	TS= 706.4667 DEG R		SR(VP)= .5345156	OP= .5986667 IN H2O	TM= 550.2333 DEG R	

Baraboo,?,RUN: 1

CALCULATED RESULTS

TS STACK TEMPERATURE = 246.4667 DEG F

VMSTD DGM VOL,STD COND DRY= 30.36848 SCFD

VWSTD VOL OF WATER VAPOR,STD COND= 11.7675 SCF

%M % MOISTURE IN STACK GAS BY VOL,STD COND= 27.92744 %

MD MOLE FRACTION OF DRY GAS= .7207255

MWD MOLECULAR WT OF STACK GAS,DRY BASIS= 29.288 LB/LB-MOLE

MWS MOLECULAR WT OF STACK GAS,WET BASIS= 26.13555 LB/LB-MOLE

VS AVE STACK GAS VELOCITY,STACK COND= 34.77458 FPS

QACT ACTUAL STACK GAS FLOW RATE= 33383.59 CFM

QSTD AVE STACK GAS FLOW RATE,STD COND DRY= 17729.88 SCFMD

%EA AVE % EXCESS AIR= 126.3044 %

PMRA AVE PMR BY RATIO OF AREAS METHOD= 5.326954 LB/HR

PMRC AVE PMR BY CONC METHOD= 5.166502 LB/HR

PMR(AVE) AVE PMR,STD COND DRY= 5.246728 LB/HR

C EMISSION CONC,STD COND DRY= .0339914 GR/SCFD

DGR AVE STACK GAS RATE,STD COND DRY= 80802.14 LB/HR

LB/MLB EMISSION CONC,STD COND DRY= 6.493303E-02 LB/MLB OF DRY GAS

WGR AVE STACK GAS RATE,STD COND WET= 100044.9 LB/HR

LB/MLB EMISSION CONC,STD COND WET= 5.244374E-02 LB/MLB OF WET GAS

%ISR % ISOKINETIC RATIO= 103.1056 %

NAME OF SOURCE: Baraboo

LOCATION OF SOURCE: Baraboo

PROCESS TESTED: ?

DATE OF TEST: 080988

RUN NUMBER: 3

N NUMBER OF SAMPLING POINTS= 30

VM DGM VOL,METER COND DRY= 35.2 CFD

PB BAR PRESS,STATION= 29.5 IN HG

VL TOTAL VOL OF WATER COLLECTED= 275 ML

%CO2 % CARBON DIOXIDE BY VOL,DRY BASIS= 4 %

%O2 % OXYGEN BY VOL,DRY BASIS= 13.9 %

%CO % CARBON MONOXIDE BY VOL, DRY BASIS= 0 %

%N2 % NITROGEN BY VOL,DRY BASIS= 82.1 %

CP PITOT TUBE COEFFICIENT= .795

PS STACK PRESS= 29.5 IN HG

AS AREA OF THE SAMPLING SITE= 16 SQ FEET

MT TOTAL DRY PARTICULATE= .058 GM

T TOTAL SAMPLING TIME= 60 MIN

AN AREA OF THE NOZZLE= .000491 SQ FEET

Baraboo,?,RUN: 3

PARTICULATE FIELD DATA

SAMPLING POINT NUMBER	STACK TEMP DEG F	VELOCITY PRESS IN H2O	SQ ROOT VEL PRESS	ORIFICE METER PRESS DROP IN H2O	DRY GAS METER TEMP DEG F INLET	DRY GAS METER TEMP DEG F OUTLET
1	248.0	0.390	0.62450	0.730	92.0	90.0
2	250.0	0.250	0.50000	0.470	98.0	90.0
3	252.0	0.120	0.34641	0.230	100.0	90.0
4	252.0	0.100	0.31623	0.190	100.0	90.0
5	252.0	0.080	0.28284	0.150	100.0	90.0
6	252.0	0.080	0.28284	0.150	100.0	90.0
7	250.0	0.250	0.50000	0.470	100.0	90.0
8	254.0	0.100	0.31623	0.190	100.0	90.0
9	254.0	0.080	0.28284	0.150	102.0	90.0
10	254.0	0.060	0.24495	0.110	104.0	90.0
11	252.0	0.080	0.28284	0.150	104.0	90.0
12	250.0	0.100	0.31623	0.190	104.0	90.0
13	254.0	0.140	0.37417	0.260	102.0	90.0
14	254.0	0.080	0.28284	0.150	104.0	90.0
15	254.0	0.120	0.34641	0.230	104.0	90.0
16	254.0	0.120	0.34641	0.230	106.0	90.0
17	252.0	0.080	0.28284	0.150	106.0	90.0
18	250.0	0.100	0.31623	0.190	106.0	90.0
19	254.0	0.290	0.53852	0.550	104.0	90.0
20	258.0	0.200	0.44721	0.380	108.0	90.0
21	258.0	0.250	0.50000	0.470	110.0	92.0
22	256.0	0.350	0.59161	0.660	110.0	92.0
23	254.0	0.410	0.64031	0.770	110.0	92.0
24	254.0	0.410	0.64031	0.770	110.0	92.0
25	256.0	0.550	0.74162	1.000	108.0	92.0
26	256.0	0.710	0.84261	1.300	110.0	92.0
27	256.0	0.840	0.91652	1.600	110.0	92.0
28	256.0	0.920	0.95917	1.700	112.0	94.0
29	256.0	0.970	0.98489	1.800	114.0	94.0
30	256.0	1.200	1.09545	2.300	116.0	94.0
AVERAGE	TS=		SR(VP)=	OP=	TM=	
VALUES	713.6 DEG R		.5047674	.5896667 IN H2O	558 DEG R	

Baraboo,?,RUN: 3

CALCULATED RESULTS

TS STACK TEMPERATURE = 253.6 DEG F

VMSTD DGM VOL,STD COND DRY= 32.88825 SCFD

VWSTD VOL OF WATER VAPOR,STD COND= 12.94425 SCF

%M % MOISTURE IN STACK GAS BY VOL,STD COND= 28.24252 %

MD MOLE FRACTION OF DRY GAS= .7175748

MWD MOLECULAR WT OF STACK GAS,DRY BASIS= 29.196 LB/LB-MOLE

MWS MOLECULAR WT OF STACK GAS,WET BASIS= 26.03397 LB/LB-MOLE

VS AVE STACK GAS VELOCITY,STACK COND= 33.06892 FPS

QACT ACTUAL STACK GAS FLOW RATE= 31746.16 CFM

QSTD AVE STACK GAS FLOW RATE,STD COND DRY= 16618.73 SCFMD

%EA AVE % EXCESS AIR= 178.7919 %

PMRA AVE PMR BY RATIO OF AREAS METHOD= 4.166803 LB/HR

PMRC AVE PMR BY CONC METHOD= 3.876797 LB/HR

PMR(AVE) AVE PMR,STD COND DRY= 4.0218 LB/HR

C EMISSION CONC,STD COND DRY= 2.721155E-02 GR/SCFD

DGR AVE STACK GAS RATE,STD COND DRY= 75500.31 LB/HR

LB/MLB EMISSION CONC,STD COND DRY= 5.326865E-02 LB/MLB OF DRY GAS

WGR AVE STACK GAS RATE,STD COND WET= 93820.67 LB/HR

LB/MLB EMISSION CONC,STD COND WET= 4.286689E-02 LB/MLB OF WET GAS

%ISR % ISOKINETIC RATIO= 107.4806 %

RAMCON
ENVIRONMENTAL CORPORATION

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
BARABOO ASPHALT COMPANY
BARABOO, WISCONSIN
August 9, 1988

Jerry Traxler
Baraboo Asphalt Company

G. Sumner Buck, III
President

Dave Armstrong
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

August 23, 1988

Mr. Jerry Traxler
Baraboo Asphalt Company
P. O. Box A, Hwy. 12
Baraboo, WI 53913

Re: Particulate Emissions Tests - Baraboo, Wisconsin

Dear Mr. Traxler:

Enclosed you will find four copies of our report on the particulate emissions tests we conducted at Baraboo Asphalt in Baraboo, Wisconsin. Based on our test results, your plant does pass both EPA New Source Performance Standards and those set by the State of Wisconsin. The average grain loading of the three test runs was below the allowable emissions standard set by EPA and the State of Wisconsin. 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. Jon Heinrich
Wisconsin DNR
3911 Fish Harchery Rd.
Fitchburg, WI 53711

You will need to keep one copy of the report at the plant.

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

TABLE OF CONTENTS

I. INTRODUCTION

On August 9, 1988, personnel from RAMCON Environmental Corporation (REC) conducted a source emissions test for particulate emissions compliance at Baraboo Asphalt Company's Bituma drum mix asphalt plant located in Baraboo, Wisconsin. RAMCON personnel conducting the test were Dave Armstrong, Team Leader, and Frank Kuhn. Bruce Shrader 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. Armstrong, and Mr. Shrader.

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 Wisconsin.

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 Wisconsin is .04 gr/dscf.

Mr. Jon Heinrich of Wisconsin Department of Natural Resources observed the testing conducted by RAMCON. Mr. John Traxler of Carl Koontz & Associates, conducted the visible emissions test (Reference Method 9).

TABLE I

SUMMARY OF TEST RESULTS
August 9, 1988

Test Run	Time	Grain Loading	Isokinetic Variation	Actual Emissions
1	10:10 to 11:20	0.0506 gr/DSCF	109.9%	8.09 lbs/hr
2	12:25 to 13:29	0.0344 gr/DSCF	108.9%	4.87 lbs/hr
3	14:30 to 15:35	0.0275 gr/DSCF	100.6%	4.14 lbs/hr
	Average:	0.0375 gr/DSCF		5.7 lbs/hr

On the basis of these test results, the average grain loading of the three test runs was below the .04 gr/DSCF emissions limitation set by US EPA and the State of Wisconsin Therefore, the plant is operating in compliance with State and Federal Standards.

III. TEST PROCEDURES

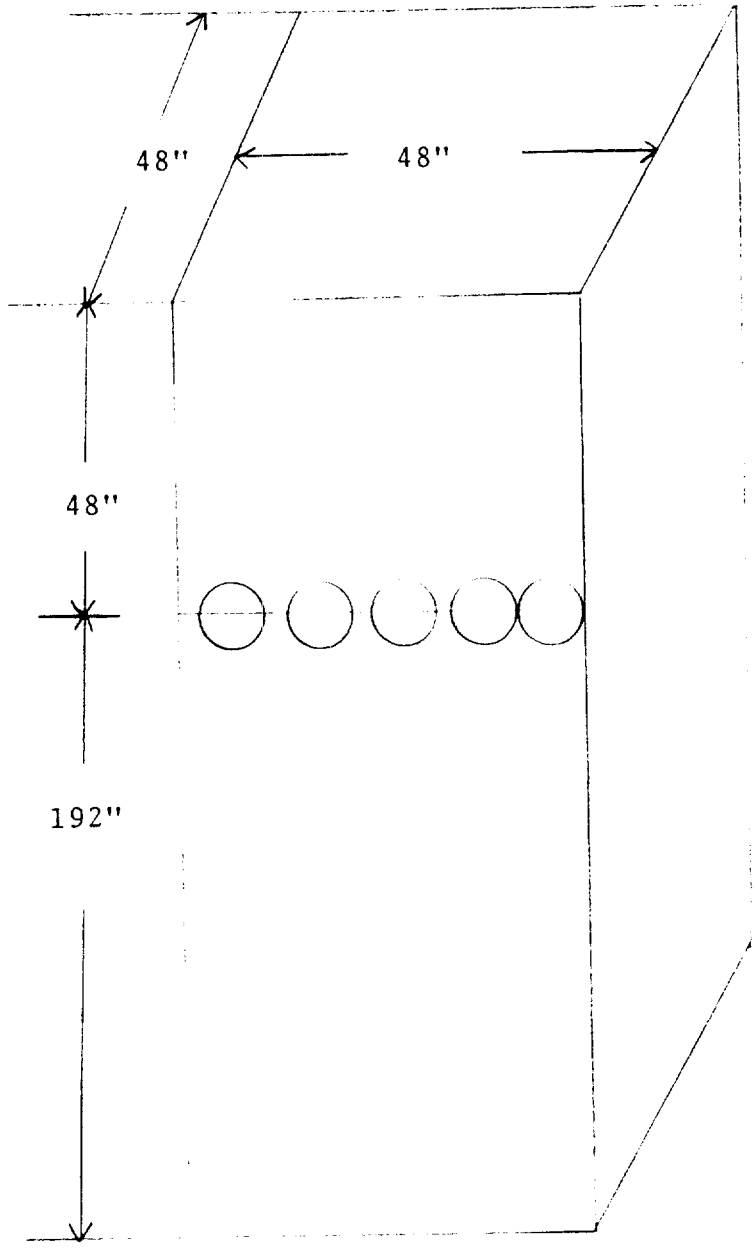
A. Method Used: The source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

B. Problems Encountered: No problems were encountered that affected testing. However, due to extremely wet conditions at the time of startup, the plant had to work to stabilize. After the plant had operated for a while and reached a stable operating temperature it began to perform much better. The first test run is atypical of normal plant operating conditions for this reason, and should be discounted. RAMCON Environmental recommends acceptance of runs two and three as demonstration of compliance with N.S.P.S. and State emissions standards.

C. Sampling Site: The emissions test was conducted after a baghouse on a rectangular stack measuring 48" x 48" with an equivalent diameter of 48". Five sampling ports were placed 48" down (1.0 diameters upstream) from the top of the stack and 192" up (4.0 diameters downstream) from the last flow disturbance. Thirty points were sampled, six through each port for 2 minutes each for a total test time of sixty minutes per test run.

Points on a Diameter	Probe Mark
1	*14.0"
2	22.0"
3	30.0"
4	38.0"
5	46.0"
6	54.0"

*Measurements include a 10.0" standoff.



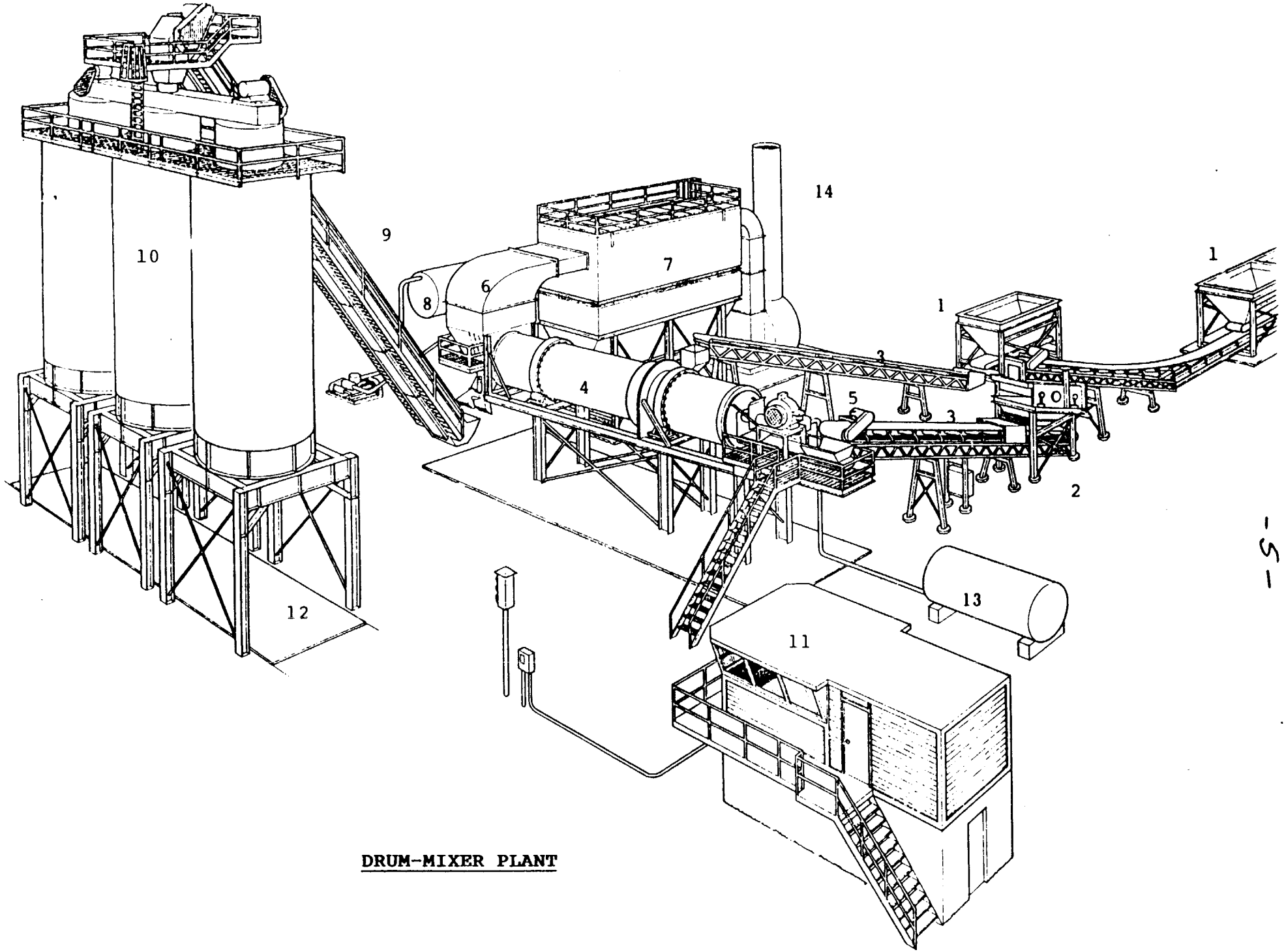
IV. THE SOURCE

IV. THE SOURCE

Baraboo Asphalt Co., Inc. employs an Bituma 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 natural gas 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 Bituma. 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

PLANT DATA

COMPANY NAME BARABOO ASPHALT CO INC

COMPANY REP. PHIL TRAXLER DATE 8-9-88 PHONE # 608 356 3311

DATA SOURCE PLANT CONTROL PANEL

PLANT LOCATION Hy 12 BARABOO WIS

PLANT MFG. BITUMA PLANT MODEL # 250 PLANT TYPE DRUM MIX

MIX SPECIFICATION # 60% VIRGIN SURFACE OIL SPECIFICATION # AC - 100 PEN
40% RECYCLE

Time 24 Hour	Fuel Oil / Nat. Gas ✓ / Propane / Coal	Burner Setting	Aggregate TPH	Recycle TPH	Liquid Asphalt TPH	Mix Temp. °F	Venturi / Baghouse Pressure Drop Inches Water
09:15		4½	97	58	6.4	277	3.20
09:30		6½	129	85	8.9	289	4.60
09:45		5¾	130	89	9.0	284	5.00
10:00		5½	129	86	9.1	278	4.80
10:15		5¾	128	84	9.1	278	4.80
10:30		5 3/4	128	85	9.0	275	4.60
10:45		6	129	80	8.8	272	4.60
11:00		5. 3/4	125	85	8.6	273	4.80
11:15		6. ½	132	85	9.5	271	5.00
12:15		5 3/4	131	86	9.1	279	4.80
12:30		6 ¼	131	85	9.1	279	4.10
12:45		6 ¼	133	84	9.2	271	4.8
13:00		6 3/4	133	82	9.1	272	4.8
13:15		6 ½	132	80	9.2	273	4.8
13:27		6 ¼	132	81	9.1	282	4.0
14:20		5 3/4	135	76	9.2	278	5.10
14:35		6 3/4	135	82	9.2	265	4.60
14:50		6 ¼	136	75	9.2	274	5.00
~~14:50~~							
15:05		6 3/4	134	82	9.2	259	5.10
15:20		6 3/4	136	81	9.3	286	4.60
15:32		6 ¼	135	81	9.4	277	4.40

DATA SUMMARY

Plant

1. Manufacturer of plant BiTuMA.
2. Designed maximum operating capacity 250 TPH @ 5 % moisture.
3. Actual operation rate 224 TPH @ 4.4 % moisture.
4. Startup date 8-9-88.
5. Type of fuel used in dryer Natural Gas.
6. Quanity of fuel consumption _____.

Aggregate

7. Name/type of mix STATE of WIS GR-3 SURFACE (w) 40% RECYCLE
8. Percent asphalt in mix 5.50 %.
9. Temperature of asphalt 286° F.
10. Sieve/Screening analysis: % Passing;

1"	_____	3/8"	75-100 (85%)	#50	10-30 (22%)
3/4"	_____	#4	45-85 (62%)	#	_____
1/2"	95-100 (98%)	#8	30-60 (51%)	#200	5-12 (6%)

Baghouse

11. Manufacturer BITUMA.
12. No. of bags 490. Type of bags 100% NOMEX
13. Air to cloth ratio 5.5:1 @ 42,000 CFM Designed ACFM _____.
14. Square feet of bags 7,617.
15. Type of cleaning; pulse jet _____, reverse air _____, plenum pulse _____, other REVERSE PULSE.
16. Cleaning cycle time 1 SEC.
17. Interval between cleaning cycle 24 SEC.
18. Pressure drop across baghouse 4.4" WC psi
19. Pulse pressure on cleaning cycle 50 psi.

COMPANY NAME BARABOO ASPHALT CO INC DATE 8-9-88

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 Barrabee Asphalt — Relative humidity in lab 45 %

Sample Location Hot mix asphalt Plant — Density of Acetone (pa) .7853 mg/ml

Blank volume (V_a) 200 ml

Date/Time wt. blank 8-15-88 — Gross wt. 146.4138 mg

Date/Time wt. blank 8-16-88 — Gross wt. 146.4130 mg

Ave. Gross wt. 146.4134 mg

Tare wt. 146.4131 mg

Weight of blank (m_{ab}) .0003 mg

Acetone blank residue concentration (C_a) (C_a) = (M_{ab}) / (V_a) (P_a) = (.000001 mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} P_a$ = (.00001)(200)(.7853) = (.0003)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	200	200	200
Date/Time of wt 8-15-88 Gross wt	g	159.2273	155.4785	155.8761
Date/Time of wt 8-16-88 Gross wt	g	159.2276	155.4784	155.8767
Average Gross wt	g	159.2275	155.4785	155.8767
Tare wt	g	159.1453	155.4248	155.8311
Less acetone blank wt (W_a)	g	.0003	.0003	.0003
Wt of particulate in acetone rinse (m_a)	g	.0822	.0534	.0453

		Filter Numbers	FK2936	FK2937	FK2938
Date/Time of wt 8-15-88 Gross wt	g		0.5468	0.5405	0.5371
Date/Time of wt 8-16-88 Gross wt	g		0.5468	0.5404	0.5371
Average Gross wt	g		.5468	.5404	.5371
Tare wt	g		0.5246	0.5269	0.5244

Weight of particulate on filters(s) (m_f)	g	.0222	.0135	.0127
Weight of particulate in acetone rinse	g	.0822	.0534	.0453
Total weight of particulate (m_n)	g	.1044	.0669	.0580

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 BS Signature of reviewer

VII. CALCULATIONS

BARABOO ASPHALT COMPANY, INC.
BARABOO, WISCONSIN

SUMMARY OF TEST DATA

		8/9/88 RUN #1	8/9/88 RUN #2	8/9/88 RUN #3
SAMPLING TRAIN DATA				
	start	10:10	12:25	14:30
	finish	11:20	13:29	15:35
1. Sampling time, minutes	θ	60.0	60.0	60.0
2. Sampling nozzle diameter, in.	D_n	.2750	.2850	.3000
3. Sampling nozzle cross-sect. area, ft^2	A_n	.000413	.000443	.000491
4. Isokinetic variation	I	109.9	108.9	100.6
5. Sample gas volume - meter cond., cf.	V_m	33.842	32.370	35.561
6. Average meter temperature, ^oR	T_m	550	558	565
7. Avg. oriface pressure drop, in. H_2O	dH	0.59	0.59	0.67
8. Total particulate collected, mg.	M_n	104.40	66.90	58.00
VELOCITY TRAVERSE DATA				
9. Stack area, ft^2	A	16.00	16.00	16.00
10. Absolute stack gas pressure, in. Hg.	P_s	29.50	29.50	29.50
11. Barometric pressure, in. Hg.	P_{bar}	29.50	29.50	29.50
12. Avg. absolute stack temperature, R^o	T_s	706	714	710
13. Average $-\sqrt{\text{vel. head}}$, (C_p= .80)	$-\sqrt{dP}$	0.54	0.50	0.53
14. Average stack gas velocity, ft./sec.	V_s	35.06	32.93	34.86
STACK MOISTURE CONTENT				
15. Total water collected by train, ml.	V_{ic}	223.00	250.00	275.00
16. Moisture in stack gas, %	B_{ws}	24.85	28.28	28.43
EMISSIONS DATA				
17. Stack gas flow rate, dscf/hr.(000's)	Q_{sd}	1119	991	1053
18. Stack gas flow rate, cfm	acfm	33658	31613	33466
19. Particulate concentration, gr/dscf	C_s	0.0506	0.0344	0.0275
20. Particulate concentration, lb/hr	E	8.09	4.87	4.14
21. Particulate concentration, lb/mBtu	E'	0.00000	0.00000	0.00000
ORSAT DATA				
22. Percent CO_2 by volume	CO_2	6.00	5.00	4.00
23. Percent O_2 by volume	O_2	10.40	12.20	13.90
24. Percent CO by volume	CO	.00	.00	.00
25. Percent N_2 by volume	N_2	83.60	82.80	82.10

Format: summryR3

BARABOO ASPHALT COMPANY, INC.
BARABOO, 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:

$$V_{m(std)} = (17.64)(.990)(33.842)\left[\frac{(29.50) + \frac{0.59}{13.6}}{550}\right] = 31.746 \text{ dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(.990)(32.370)\left[\frac{(29.50) + \frac{0.59}{13.6}}{558}\right] = 29.930 \text{ dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(.990)(35.561)\left[\frac{(29.50) + \frac{0.67}{13.6}}{565}\right] = 32.479 \text{ dscf}$$

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Total Contaminants by Weight: GRAIN LOADING

Particulate concentration C_s' gr./dscf.

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

Where:

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

M_n = Total amount of particulate matter collected, mg.

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

Run 1:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{104.40}{31.746}\right] = 0.0506 \text{ gr./dscf.}$$

Run 2:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{66.90}{29.930}\right] = 0.0344 \text{ gr./dscf.}$$

Run 3:

$$C_s' = \left[0.0154 \frac{gr}{mg}\right] \left[\frac{58.00}{32.479}\right] = 0.0275 \text{ gr./dscf.}$$

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Dry Molecular Weight

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

Where:

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

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

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

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

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

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

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

0.32 = Molecular weight of O_2 divided by 100.

0.44 = Molecular weight of CO_2 divided by 100.

Run 1:

$$M_d = 0.44(\ 6.00\%) + 0.32(10.40\%) + 0.28(\ .00\% + 83.60\%) = 29.38\ \frac{lb}{lb\text{-mole}}$$

Run 2:

$$M_d = 0.44(\ 5.00\%) + 0.32(12.20\%) + 0.28(\ .00\% + 82.80\%) = 29.29\ \frac{lb}{lb\text{-mole}}$$

Run 3:

$$M_d = 0.44(\ 4.00\%) + 0.32(13.90\%) + 0.28(\ .00\% + 82.10\%) = 29.20\ \frac{lb}{lb\text{-mole}}$$

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Water Vapor Condensed

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

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

Where:

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

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

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

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

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

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

p_w = Density of water, 0.002201 lb/ml.

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

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

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

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

Run 1:

$V_{wc(std)}$	=	(0.04707)	(210.0)	=	9.9 cu.ft
$V_{wsg(std)}$	=	(0.04715)	(13.0)	=	0.6 cu.ft

Run 2:

$V_{wc(std)}$	=	(0.04707)	(240.0)	=	11.3 cu.ft
$V_{wsg(std)}$	=	(0.04715)	(10.0)	=	0.5 cu.ft

Run 3:

$V_{wc(std)}$	=	(0.04707)	(260.0)	=	12.2 cu.ft
$V_{wsg(std)}$	=	(0.04715)	(15.0)	=	0.7 cu.ft

BARABOO ASPHALT COMPANY, INC.
BARABOO, 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:

$$B_{ws} = \frac{9.9 + 0.6}{9.9 + 0.6 + 31.746} \times 100 = 24.85\ \%$$

Run 2:

$$B_{ws} = \frac{11.3 + 0.5}{11.3 + 0.5 + 29.930} \times 100 = 28.28\ \%$$

Run 3:

$$B_{ws} = \frac{12.2 + 0.7}{12.2 + 0.7 + 32.479} \times 100 = 28.43\ \%$$

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BARABOO, WISCONSIN

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:

$M_s = 29.38 (1 - 24.85) + 18 (24.85) = 26.55$ (lb./lb.-mole)

Run 2:

$M_s = 29.29 (1 - 28.28) + 18 (28.28) = 26.10$ (lb./lb.-mole)

Run 3:

$M_s = 29.20 (1 - 28.43) + 18 (28.43) = 26.02$ (lb./lb.-mole)

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Stack Gas Velocity

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

Where:

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

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

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:

$$V = (85.49)\,(\ .80)\,(\ 0.54) \sqrt{\frac{706}{(29.50)(26.55)}} = 35.06 \text{ ft/sec.}$$

Run 2:

$$V = (85.49)\,(\ .80)\,(\ 0.50) \sqrt{\frac{714}{(29.50)(26.10)}} = 32.93 \text{ ft/sec.}$$

Run 3:

$$V = (85.49)\,(\ .80)\,(\ 0.53) \sqrt{\frac{710}{(29.50)(26.02)}} = 34.86 \text{ ft/sec.}$$

Format: vsR3

BARABOO ASPHALT COMPANY, INC.
BARABOO, 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, ($528^o R$).

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:

$$Q_{sd}=3600(1-\ .2485\ )(\ 35.06)(\ 16.00)\left[\frac{528}{706}\right]\left[\frac{29.50}{29.92}\right]=\ 1119059.1\ \frac{dscf}{hr}$$

Run 2:

$$Q_{sd}=3600(1-\ .2828\ )(\ 32.93)(\ 16.00)\left[\frac{528}{714}\right]\left[\frac{29.50}{29.92}\right]=\ 991860.6\ \frac{dscf}{hr}$$

Run 3:

$$Q_{sd}=3600(1-\ .2843\ )(\ 34.86)(\ 16.00)\left[\frac{528}{710}\right]\left[\frac{29.50}{29.92}\right]=\ 1053699.8\ \frac{dscf}{hr}$$

BARABOO ASPHALT COMPANY, INC.
BARABOO, WISCONSIN

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:

$$E = \frac{(0.0506)\ (1119059.1)}{7000} = 8.09 \text{ lb. / hr.}$$

Run 2:

$$E = \frac{(0.0344)\ (991860.6)}{7000} = 4.87 \text{ lb. / hr.}$$

Run 3:

$$E = \frac{(0.0275)\ (1053699.8)}{7000} = 4.14 \text{ lb. / hr.}$$

BARABOO ASPHALT COMPANY, INC.
BARABOO, WISCONSIN

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:

$$I = (100)(706)\left[\frac{(0.002669)(223.00) + \frac{33.842}{550}\left[29.50 + \frac{0.59}{13.6}\right]}{60\ (60.0)\ (35.06)\ (29.50)\ (.000413)} \right] = 109.9\%$$

Run 2:

$$I = (100)(714)\left[\frac{(0.002669)(250.00) + \frac{32.370}{558}\left[29.50 + \frac{0.59}{13.6}\right]}{60\ (60.0)\ (32.93)\ (29.50)\ (.000443)} \right] = 108.9\%$$

Run 3:

$$I = (100)(710)\left[\frac{(0.002669)(275.00) + \frac{35.561}{565}\left[29.50 + \frac{0.67}{13.6}\right]}{60\ (60.0)\ (34.86)\ (29.50)\ (.000491)} \right] = 100.6\%$$

Format: iR3

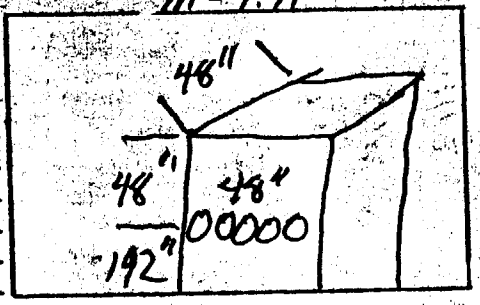
VIII. FIELD DATA

11 9/9/88

RAMCON ENVIRONMENTAL CORPORATION

Plant Barrboo Asphalt (Ritchie) M = 1.71

Location Barrboo, Wise.
Operator Dave Armstrong
Date 8/5/88
Run No. 1
Sample Box No. 1
Meter Box No. C-282 / 700205
Meter H @ 1.15
C Factor .987
Pitot Tube Coefficient Cp .795



Schematic of Stack Cross Section

	IMPINGER VOLUME ml	SILICA GEL WEIGHT g
Ambient Temperature 84°F		
Barometric Pressure 29.50 FINAL	410	313
Assumed Moisture, % 25% INITIAL	200	300
Probe Length, m(ft) 5 Ft. DIFFERENCE	210	13

Nozzle Identification No. 10004125
Avg. Calibrated Nozzle Dia., (in.) .275/.275/.275
Probe Heater Setting 5
Leak Rate, m^3/min. (cfm) @ 1.003 @ 5"
Probe Liner Material 3/4 Stainless Steel
Static Pressure, mm Hg (in. Hg) .05
Filter No. FK-2936 / 5246

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	1010/1012	4	245	.98	1.7	8.354/10.53	84	82	240	45
2	1014	4	250	.48	.82	11.90	88	82	240	45
3	1016	4	248	.50	.86	13.01	88	82	240	45
4	1018	4.5	248	.76	1.3	14.62	90	82	240	45
5	1020	4.5	248	1.0	1.7	16.53	90	82	245	45
6	1022	5	248	1.2	2.1	18.66	90	82	245	45
B 1	1027/1029	3	246	.45	.76	20.12	90	82	250	45
2	1031	2	246	.20	.34	21.11	94	82	255	45
3	1033	2	248	.26	.44	22.05	96	82	270	45
4	1035	3	248	.48	.82	23.28	98	82	235	40
5	1037	4	246	.72	1.2	24.81	100	82	240	40
6	1039	3.5	248	.63	1.1	26.36	100	82	245	40
C 1	1042/1044	2	246	.24	.41	27.32	100	82	255	40

Form #REC-06 $CO_2 \approx 16\%$

RAMCON emissions test log sheet, cont. DATE 8/9/84 LOCATION Baraboo, Wisc. 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	1046	2	248	.08	.14	27.98	100	82	265	45
3	1048	2	248	.10	.17	28.62	100	84	230	45
4	1050	2	246	.20	.34	29.54	100	84	235	45
5	1052	2	246	.23	.39	30.37	100	84	250	45
6	1054	2.5	246	.36	.62	31.47	100	84	265	45
D 1	1055/1057	2	245	.17	.29	32.25	100	84	230	40
2	1059	2	246	.07	.12	32.77	100	84	240	40
3	1101	2	248	.07	.12	33.25	100	84	240	40
4	1103	2	246	.08	.14	33.81	100	84	255	40
5	1105	2	246	.08	.14	34.64	100	84	270	40
6	1107	2	246	.08	.14	35.02	100	84	240	40
E 1	1108/1110	2	244	.14	.24	35.78	100	84	245	40
2	1112	2	246	.08	.14	36.51	100	86	255	40
3	1114	2	246	.10	.17	37.43	100	86	250	40
4	1116	2	246	.17	.29	38.59	100	86	265	40
5	1118	3	244	.20	.34	40.31	102	86	240	40
6	1120	3	242	.36	.62	42.196	102	86	245	40

JH 8/19/88

RAMCON ENVIRONMENTAL CORPORATION

Plant Baraboo Asphalt

Location Baraboo, Wisc.
Operator DAVE PEMSTEAD
Date 8/9/88
Run No. 2
Sample Box No. 1
Meter Box No. C-282 / 700205
Meter H @ 1.15
C Factor .987
Pitot Tube Coefficient Cp .795

m = 1.48

		IMPINGER VOLUME ml	SILICA GEL WEIGHT g
Ambient Temperature 85°F			
Barometric Pressure 29.50	FINAL	440	312
Assumed Moisture, % 30	INITIAL	200	302
Probe Length, m(ft) 5 FT.	DIFFERENCE	240	10

Nozzle Identification No. 0004439
Avg. Calibrated Nozzle Dia., (in.) .285/.285/.285
Probe Heater Setting 5
Leak Rate, m^3/min. (cfm) .005 @ 5"
Probe Liner Material 316 Stainless Steel
Static Pressure, mm Hg (in. Hg) .05
Filter No. FK-2937 / 15269

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		FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
								Inlet	Outlet		
A	1	12.25 / 1227	2	248	.39	.73	42.366 / 43.50	92	90	235	40
	2	1229	2	250	.25	.47	44.36	98	90	240	40
	3	1231	2	252	.12	.23	44.95	100	90	245	40
	4	1233	2	252	.10	.19	45.66	100	90	250	40
	5	1235	2	252	.08	.15	46.28	100	90	265	40
	6	1237	2	252	.08	.15	47.13	100	90	240	40
B	1	1238 / 1240	2	250	.25	.47	48.09	100	90	250	40
	2	1242	1.5	254	.10	.19	48.74	100	90	265	40
	3	1244	1.5	254	.08	.15	49.37	102	90	230	40
	4	1246	1.5	254	.06	.11	50.03	104	90	240	40
	5	1248	1.5	252	.08	.15	50.68	104	90	240	40
	6	1250	1.5	250	.10	.19	51.33	104	90	250	46
C	1	1251 / 1253	2	254	.14	.26	51.87	102	90	265	40

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Form #REC-06 $CO^2 = 5\%$

RAMCON emissions test log sheet, cont. DATE 8/9/88 LOCATION Rhinelander, Wisc. 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 V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	1255	1.5	254	.08	~~.11~~ .15	53.53	104	90	230	40
3	1257	2	254	.12	.23	53.34	104	90	240	40
4	1259	2	254	.12	.23	54.15	106	90	250	40
5	1301	1.5	252	.08	~~.11~~ .15	54.98	106	90	250	40
6	1303	2	250	.10	.19	55.82	106	90	260	40
D 1	1304/1306	2.5	254	.29	.55	56.85	104	90	240	45
2	1308	3	258	.20	.38	58.08	108	90	245	45
3	1310	3	258	.25	.47	59.32	110	92	255	45
4	1312	3	256	.35	.66	60.56	110	92	250	45
5	1314	3	254	.41	.77	61.83	110	92	240	45
6	1316	3	254	.41	.77	62.98	110	92	235	45
E 1	1317/1319	3.5	256	.55	1.0	64.45	108	92	240	45
2	1321	4	256	.71	1.3	66.14	110	92	245	45
3	1323	4	256	.84	1.6	68.01	110	92	255	45
4	1325	4	256	.92	1.7	70.46	112	94	245	45
5	1327	4.5	256	.97	1.8	72.00	114	94	240	45
6	1329	5	256	1.2	2.3	74.736	116	94	240	45

1-82

JH 8/19/88

RAMCON ENVIRONMENTAL CORPORATION

Plant Baraboo Asphalt

Location Baraboo, Wisc.
Operator Dave Armstrong
Date 8/9/88
Run No. 3
Sample Box No. 1
Meter Box No. C-282
Meter H @ 1.15
C Factor .987
Pitot Tube Coefficient Cp .795

M= 2+16 2.27

Ambient Temperature 90°F
Barometric Pressure 29.5
Assumed Moisture, % 30
Probe Length, m(ft) 5 Ft.
Nozzle Identification No. 10004909
Avg. Calibrated Nozzle Dia., (in.) .300/.300/.300
Probe Heater Setting 5
Leak Rate, m³/min. (cfm) .003 @ 5"
Probe Liner Material 316 Stainless Steel
Static Pressure, mm Hg (in.Hg) .05
Filter No. FK-2938/.5244

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	460	318
INITIAL	200	303
DIFFERENCE	260	15

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (Ts) °F	VELOCITY HEAD (Ps) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft³	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	1430/1432	4	245	.82	1.8	74.900/76.71	100	98	240	50
2	1434	4	255	.59	1.3	78.52	106	98	245	50
3	1436	3	256	.37	.80	79.89	108	98	250	50
4	1438	3	256	.50	1.1	81.27	110	98	245	50
5	1440	4	256	.74	1.7	83.12	110	98	245	50
6	1442	4	254	.61	1.4	84.88	112	98	245	50
B 1	1444/1446	2	256	.22	.50	86.04	112	96	250	45
2	1448	2	256	.15	.34	86.91	112	96	255	45
3	1450	2	258	.20	.45	87.89	114	96	260	45
4	1452	3	258	.34	.77	89.15	114	96	240	45
5	1454	3	256	.41	.93	90.50	114	96	245	45
6	1456	1.5	254	.12	.27	91.31	116	96	250	45
C 1	1457/1459	2	256	.20	.45	92.27	112	96	245	45

Form #REC-06

$CO^2 = 4\%$

RAMCON emissions test log sheet, cont. DATE 8/9/88 LOCATION Baraboo, Wisc. 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	1501	2	258	±0.10	.23	93.12	114	96	260	45
3	1503	1.5	246	.08	.18	93.83	114	96	250	45
4	1505	2.5	240	.26	.60	94.86	114	96	240	45
5	1507	2.5	238	.24	.54	95.95	112	96	235	45
6	1509	2.5	235	.30	.68	97.13	112	96	240	45
D 1	1510/1512	1.5	238	.15	.34	98.31	112	96	240	45
2	1514	1.5	242	.18	.41	99.30	112	96	245	45
3	1516	2	244	.22	.50	100.54	114	96	245	45
4	1518	2	246	.26	.59	101.74	114	96	255	45
5	1520	3	246	.30	.68	102.99	114	96	250	45
6	1522	3	244	.32	.73	104.18	114	96	250	45
E 1	1523/1525	2	250	.17	.39	105.24	114	96	240	45
2	1527	2	254	.19	.43	106.15	116	96	240	45
3	1529	2	256	.24	.54	107.16	116	96	245	45
4	1531	2.5	256	.28	.64	108.32	116	96	250	45
5	1533	2	250	.20	.45	109.34	116	96	250	45
6	1535	2	252	.20	.45	110.461	116	96	255	45

IX. CALIBRATIONS

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 8-27-88 Meter box number C-282-700205

Barometric pressure, P_b = 30.12 in. Hg Calibrated by D. Armstrong

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Avg[a] (t_d), °F	Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
0.5	5	916.540 / 921.700	73	90 / 98	80 / 78	86	10.20	.991	1.20
1.0	5	933.57 / 938.426	73	90 / 98	78 / 78	86.5	7.11	1.02	1.13
1.5	10	952.009 / 962.089	73	90 / 98	80 / 78	86	11.31	1.01	1.29
2.0	10								
3.0	10								
4.0	10								
							Avg	1.007	1.21

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

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	Y_i	$\Delta H@_i$
0.5	0.0368		
1.0	0.0737		
1.5	0.110		
2.0	0.147		
3.0	0.221		
4.0	0.294		

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

RAMCON ENVIRONMENTAL CORPORATION

Date 9-5-87 Thermocouple number Inlet

Ambient temperature 83 °F Barometric pressure 30.52 in. Hg

Calibrator C. Mitchell 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	33	0
B	oven	150	150	0
C	oven	175	175	0
D	Ambient	83	83	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 9-5-87 Thermocouple number Hotbox #2

Ambient temperature 84 °F Barometric pressure 30.52 in. Hg

Calibrator C. Mitchell 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	33	0
B	Oven	150	150	0
C	Oven	175	175	0
D	Ambient	84	84	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.

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 3/18/88 Thermocouple number 53

Ambient temperature 68° °C Barometric pressure 30.28 in. Hg

Calibrator [illegible] 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°	33°	0%
B	Ambient	68°	68°	0%
C	Oven	180°	180°	0%
D	Heated Oil	331°	331°	0.001%

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

[b] Type of calibration system used.

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

RAMCON

Lear Siegler Stack Sampler

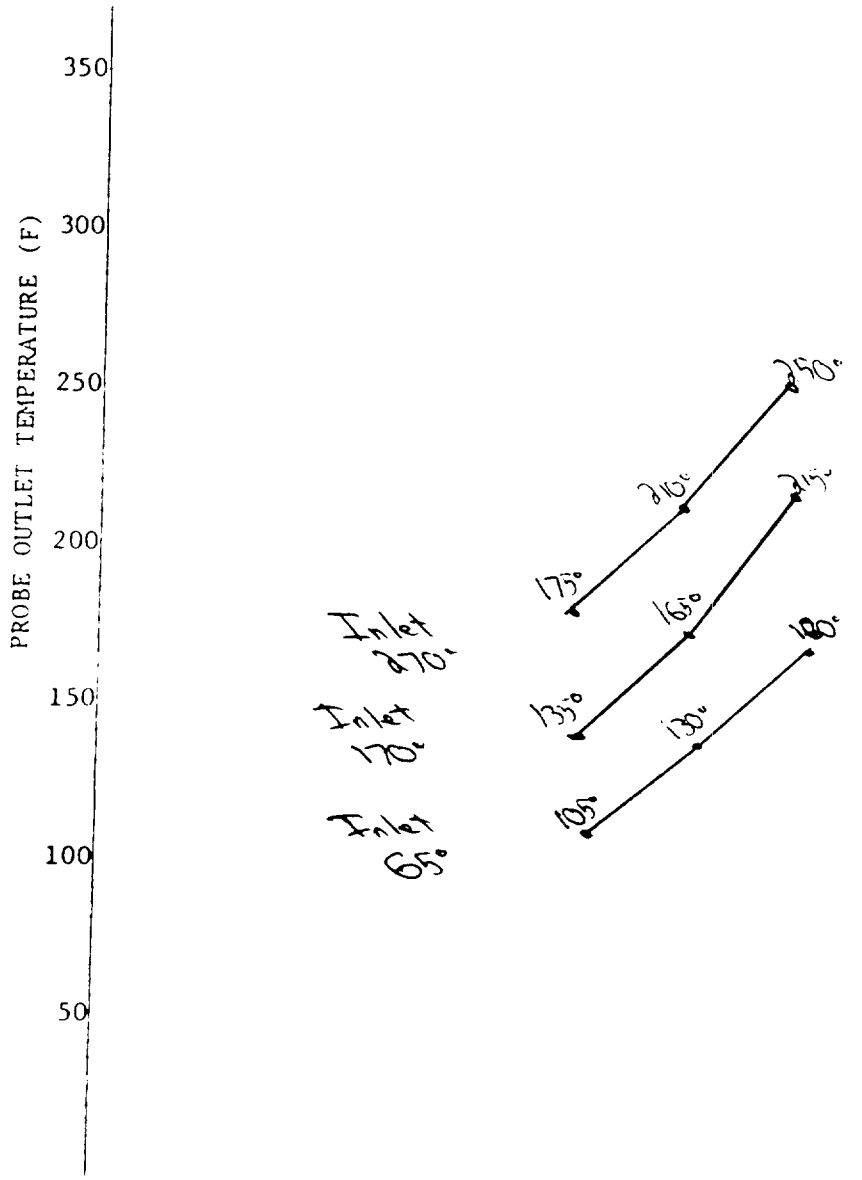
Heating Probe Calibration

Probe No. 53 Probe Length 5ft

Date of Calibration 2/14/89 Signature Shawn Sheerwood

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

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. 5 Date 2-4-86

Calibrated by: Sam T. 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	1.2	1.90	.795	< .01
2	0.80	1.25	.80	< .01
3	0.55	.88	.791	< .01
		$\bar{C}_p$ (SIDE A)	.795	

"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	1.2	1.85	.805	< .01
2	0.80	1.25	80	< .01
3	0.55	.87	.795	< .01
		$\bar{C}_p$ (SIDE B)	.80	

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

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

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

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 44 years old and a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis.

Dave Armstrong - Team Leader

Dave Armstrong has been employed by RAMCON for three years. He has undergone extensive training in Methods 1 through 9. He is qualified as a team leader and has personally sampled over 150 stacks including over 100 asphalt plants. He is currently certified as a V.E. reader.

XI. VISIBLE EMISSIONS

TEST #1

VISIBLE EMISSION OBSERVATION FORM

No. 1

COMPANY NAME: BARABOO ASPHALT CO., INC.
STREET ADDRESS: P.O. Box 441 Hwy 12 N
CITY: BARABOO | STATE: WI | ZIP: 53913
PHONE (KEY CONTACT): 608-356-3311 | SOURCE ID NUMBER:

PROCESS EQUIPMENT: DRUM MIX ASPHALT | OPERATING MODE: 220 TPH
CONTROL EQUIPMENT: BAG HOUSE | OPERATING MODE:

DESCRIBE EMISSION POINT: ~~end of steam dissipation~~ square 30' high stack
HEIGHT ABOVE GROUND LEVEL: 90' | HEIGHT RELATIVE TO OBSERVER: Start 120' End 120'
DISTANCE FROM OBSERVER: Start 300' End 300' | DIRECTION FROM OBSERVER: Start WNW End

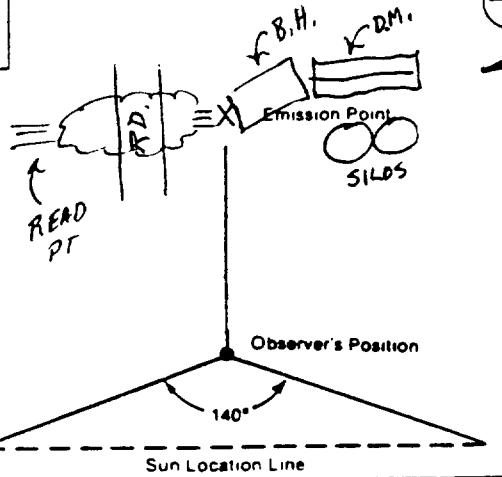
DESCRIBE EMISSIONS: Start LOOPING PLUME End
EMISSION COLOR: Start GRAY-WHITE End | IF WATER DROPLET PLUME: Attached ☐ Detached ☒
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start at steam dissipation End

DESCRIBE PLUME BACKGROUND: Start VERY CLOUDY End
BACKGROUND COLOR: Start WHITE End | SKY CONDITIONS: Start OVERCAST End W/RAIN
WIND SPEED: Start 1-3 mph End | WIND DIRECTION: Start N End
AMBIENT TEMP: Start 85°F End | WET BULB TEMP: | RH, percent:

SOURCE LAYOUT SKETCH

Stack with Plume
Sun
Wind

Draw North Arrow



ADDITIONAL INFORMATION: Natural gas burner, 40% recycle

OBSERVATION DATE: Aug. 9, 1988 | START TIME: 10:00 AM | END TIME:

SEC / MIN	0	15	30	45	COMMENTS
1	5	5	5	5	--
2	5	5	5	5	
3	5	5	5	5	My opinion is
4	5	5	5	5	that the 1st
5	5	5	5	5	30 min. of this
6	5	5	5	5	test should be
7	5	5	5	5	thrown out due
8	5	5	5	5	to foggy, overcast
9	5	5	5	5	with rain conditions
10	5	5	5	5	making impossible
11	5	5	5	5	opacity readings
12	5	5	5	5	
13	5	5	5	5	Gravel & recycle
14	5	5	10	10	are quite wet
15	10	5	5	5	due to 3 days
16	10	5	5	5	rain in last 5 days
17	5	10	10	10	= 4½"
18	5	10	5	5	
19	5	10	5	5	
20	5	10	10	10	
21	5	5	10	10	
22	10	5	5	5	
23	5	5	5	5	
24	10	10	10	10	
25	5	5	5	5	
26	5	5	10	5	
27	5	5	5	10	
28	10	5	5	10	
29	5	5	5	10	
30	10	10	5	10	

OBSERVER'S NAME (PRINT): John Traxler
OBSERVER'S SIGNATURE: John H. Traxler | DATE: 8/9/88
ORGANIZATION: Baraboo Asphalt Co.
CERTIFIED BY: Carl Hagert & Associates | DATE: 4-7-89

CONTINUED ON VEO FORM NUMBER:

VISIBLE EMISSION OBSERVATION FORM

No. 2

COMPANY NAME		
STREET ADDRESS		
CITY	STATE	ZIP
PHONE (KEY CONTACT)	SOURCE ID NUMBER	

PROCESS EQUIPMENT	OPERATING MODE
CONTROL EQUIPMENT	OPERATING MODE

DESCRIBE EMISSION POINT	
HEIGHT ABOVE GROUND LEVEL	HEIGHT RELATIVE TO OBSERVER Start End
DISTANCE FROM OBSERVER Start End	DIRECTION FROM OBSERVER Start End

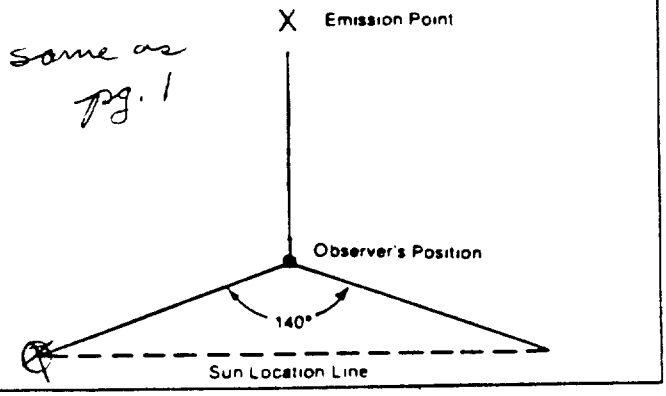
DESCRIBE EMISSIONS Start	End
EMISSION COLOR Start End	IF WATER DROPLET PLUME Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED Start	End

DESCRIBE PLUME BACKGROUND Start	End	
BACKGROUND COLOR Start End	SKY CONDITIONS Start RAIN ENDING End	
WIND SPEED Start End	WIND DIRECTION Start End	
AMBIENT TEMP Start End	WET BULB TEMP	RH, percent

Stack with Plume
Sun
Wind

SOURCE LAYOUT SKETCH

Draw North Arrow



OBSERVATION DATE	START TIME	END TIME
8-9-88		

SEC / MIN	0	15	30	45	COMMENTS
1	10	5	10	10	--
2	5	10	10	10	these readings
3	5	5	5	5	are probably almost
4	5	5	5	5	as bad as pg. 1
5	5	5	5	5	due to overcast.
6	5	5	10	10	
7	5	5	5	5	
8	5	0	0	0	
9	0	5	5	5	
10	5	5	5	5	
11	5	5	5	0	
12	5	5	5	5	
13	5	5	5	5	
14	5	10	5	5	
15	5	5	5	5	
16	5	5	5	10	
17	0	5	5	5	
18	5	10	10	5	
19	5	5	0	0	
20	5	5	5	5	
21	5	5	5	5	
22	5	5	5	5	
23	5	5	5	5	
24	5	5	5	5	
25	5	5	5	5	
26	5	5	5	10	
27	5	5	5	5	
28	0	0	5	5	
29	5	5	5	5	
30	5	5	5	5	

OBSERVER'S NAME (PRINT)	
OBSERVER'S SIGNATURE	DATE 8/9/88
ORGANIZATION	
CERTIFIED BY	DATE

ADDITIONAL INFORMATION

CONTINUED ON VEO FORM NUMBER

VISIBLE EMISSION OBSERVATION FORM

No. 3

COMPANY NAME		
STREET ADDRESS		
CITY	STATE	ZIP
PHONE (KEY CONTACT)	SOURCE ID NUMBER	

PROCESS EQUIPMENT	OPERATING MODE
CONTROL EQUIPMENT	OPERATING MODE

DESCRIBE EMISSION POINT	
HEIGHT ABOVE GROUND LEVEL	HEIGHT RELATIVE TO OBSERVER Start End
DISTANCE FROM OBSERVER Start End	DIRECTION FROM OBSERVER Start End

DESCRIBE EMISSIONS Start End	
EMISSION COLOR Start End	IF WATER DROPLET PLUME Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED Start End	

DESCRIBE PLUME BACKGROUND Start End		
BACKGROUND COLOR Start End	SKY CONDITIONS Start End	
WIND SPEED Start 3-5mph End	WIND DIRECTION Start End	
AMBIENT TEMP Start End	WET BULB TEMP	RH, percent

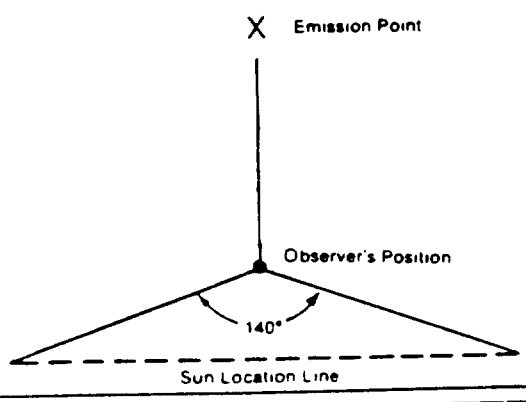
Stack with Plume

Sun

Wind

SOURCE LAYOUT SKETCH

Draw North Arrow



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME
8-9-88		11:30 A.M.

SEC / MIN	0	15	30	45	COMMENTS
1	5	5	5	5	--
2	5	5	5	5	
3	5	5	5	5	
4	5	5	5	5	
5	5	5	5	0	
6	0	0	0	0	
7	0	0	0	5	
8	0	0	5	5	
9	5	5	5	5	
10	5	5	5	5	
11	5	5	0	5	
12	5	5	5	5	
13	5	5	5	0	
14	5	5	5	5	
15	5	5	5	5	
16	5	5	5	5	
17	5	5	5	5	
18	5	5	5	5	
19	5	5	5	5	
20	5	5	0	5	
21	0	0	0	0	
22	5	0	5	5	
23	5	0	5	0	
24	5	5	5	5	
25	0	0	0	0	
26	5	5	0	5	
27	0	0	5	5	
28	0	5	0	0	
29	0	0	0	5	
30	5	5	5	5	

OBSERVER'S NAME (PRINT)	
OBSERVER'S SIGNATURE	DATE 8/9/88
ORGANIZATION	
CERTIFIED BY	DATE
CONTINUED ON VEO FORM NUMBER	

TEST #2. VISIBLE EMISSION OBSERVATION FORM No. 1

COMPANY NAME		
STREET ADDRESS		
CITY	STATE	ZIP
PHONE (KEY CONTACT)	SOURCE ID NUMBER	

PROCESS EQUIPMENT	OPERATING MODE
CONTROL EQUIPMENT	OPERATING MODE

DESCRIBE EMISSION POINT
Square 30' high stack

HEIGHT ABOVE GROUND LEVEL 70'	HEIGHT RELATIVE TO OBSERVER Start 70' End
DISTANCE FROM OBSERVER Start 150' End	DIRECTION FROM OBSERVER Start W End

DESCRIBE EMISSIONS
Start LOOPING PLUME End

EMISSION COLOR Start WHITE End	IF WATER DROPLET PLUME Attached ☐ Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
Start Steam dissipation End

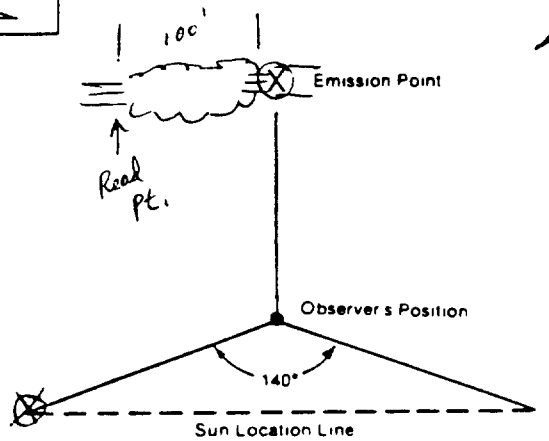
DESCRIBE PLUME BACKGROUND
Start MOSTLY CLOUDY W/ BLUE PATCHES End

BACKGROUND COLOR Start WH/BL End	SKY CONDITIONS Start Most Cloudy End	
WIND SPEED Start 3mph End	WIND DIRECTION Start NNW End	
AMBIENT TEMP Start 90°F End	WET BULB TEMP	RH, percent

SOURCE LAYOUT SKETCH

Stack with Plume
Sun
Wind

Draw North Arrow



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME
8-9-88	12:25	

MIN \ SEC	0	15	30	45	COMMENTS
1	5	0	0	0	--
2	0	0	0	5	
3	0	5	5	5	
4	5	5	0	0	
5	5	5	0	5	
6	0	5	5	0	
7	5	5	5	0	
8	0	5	5	5	
9	5	0	0	0	
10	5	0	0	5	
11	0	5	5	0	
12	5	5	5	0	
13	0	0	0	0	
14	5	0	0	0	
15	0	5	0	5	
16	0	0	5	0	
17	0	0	0	0	
18	0	0	0	0	
19	5	0	5	0	
20	0	5	0	5	
21	0	5	0	0	
22	0	0	5	0	
23	5	5	0	0	
24	5	10	5	5	
25	5	0	0	5	
26	0	5	5	5	
27	0	0	0	0	
28	5	0	5	0	
29	5	0	0	5	
30	5	0	5	5	

OBSERVER'S NAME (PRINT)	
OBSERVER'S SIGNATURE John H. Trafton	DATE 8/9/88
ORGANIZATION	
CERTIFIED BY	DATE
CONTINUED ON VEO FORM NUMBER	

VISIBLE EMISSION OBSERVATION FORM

No. 2

COMPANY NAME		
STREET ADDRESS		
CITY	STATE	ZIP
PHONE (KEY CONTACT)	SOURCE ID NUMBER	

PROCESS EQUIPMENT	OPERATING MODE
CONTROL EQUIPMENT	OPERATING MODE

DESCRIBE EMISSION POINT	
HEIGHT ABOVE GROUND LEVEL	HEIGHT RELATIVE TO OBSERVER Start End
DISTANCE FROM OBSERVER Start End	DIRECTION FROM OBSERVER Start End

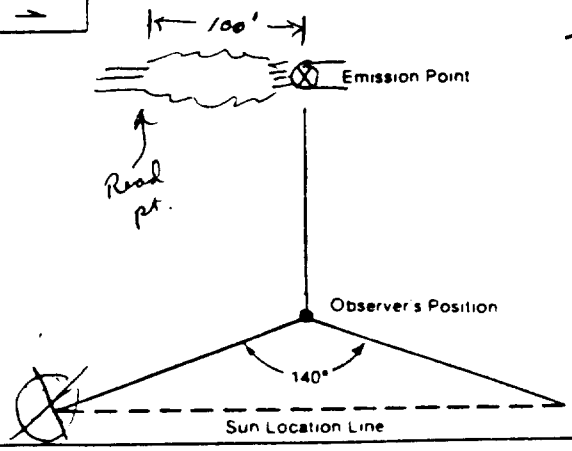
DESCRIBE EMISSIONS Start	End
EMISSION COLOR Start End	IF WATER DROPLET PLUME Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED Start	End

DESCRIBE PLUME BACKGROUND Start	End	
BACKGROUND COLOR Start End	SKY CONDITIONS Start End M. Sunny	
WIND SPEED Start 5 mph End	WIND DIRECTION Start NNW End	
AMBIENT TEMP Start End	WET BULB TEMP	RH, percent

Stack with Plume
Sun
Wind

SOURCE LAYOUT SKETCH

Draw North Arrow



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME
8-9-88		1:25

SEC / MIN	0	15	30	45	COMMENTS
1	5	0	0	5	--
2	5	5	0	5	
3	5	0	10	5	
4	0	5	0	0	
5	5	5	5	5	
6	5	0	0	5	
7	5	5	5	0	
8	0	0	0	0	
9	0	0	0	5	
10	0	5	0	0	
11	0	5	0	0	
12	5	0	0	5	
13	0	0	0	5	
14	5	5	5	0	
15	5	0	5	5	
16	5	5	5	0	
17	0	0	0	5	
18	0	0	5	0	
19	5	0	0	5	
20	0	0	0	0	
21	5	5	5	5	
22	0	5	0	5	
23	0	5	5	0	
24	0	0	0	5	
25	0	0	0	5	
26	5	5	0	0	
27	5	5	0	5	
28	0	0	0	5	
29	0	5	5	5	
30	5	0	5	0	

OBSERVER'S NAME (PRINT)	
OBSERVER'S SIGNATURE John H. Graphe	DATE 8/9/88
ORGANIZATION	
CERTIFIED BY	DATE
CONTINUED ON VEO FORM NUMBER	

TEST #3

VISIBLE EMISSION OBSERVATION FORM

No. 1

COMPANY NAME

STREET ADDRESS

CITY | STATE | ZIP

PHONE (KEY CONTACT) | SOURCE ID NUMBER

PROCESS EQUIPMENT: Drum mixer | OPERATING MODE: 220 tph

CONTROL EQUIPMENT: Baghouse | OPERATING MODE:

DESCRIBE EMISSION POINT: square 30' high stack

HEIGHT ABOVE GROUND LEVEL: 100' | HEIGHT RELATIVE TO OBSERVER: Start 100' End

DISTANCE FROM OBSERVER: Start 100' End | DIRECTION FROM OBSERVER: Start NE End

DESCRIBE EMISSIONS: Start looping almost straight up End

EMISSION COLOR: Start Gr/Wh End | IF WATER DROPLET PLUME: Attached ☐ Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start [illegible] End

DESCRIBE PLUME BACKGROUND: Start Blue sky billowy clouds End

BACKGROUND COLOR: Start Bl/WH End | SKY CONDITIONS: Start mostly sunny End

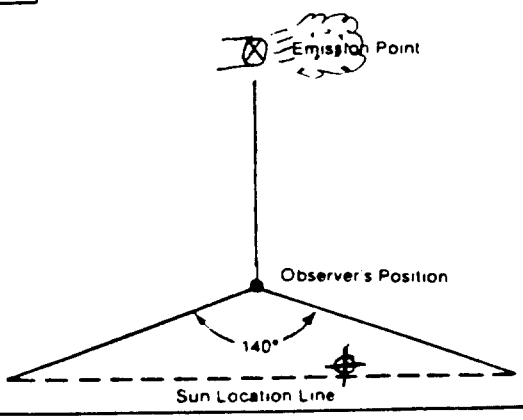
WIND SPEED: Start 1-3mph End | WIND DIRECTION: Start N.W. End

AMBIENT TEMP: Start 95°F End | WET BULB TEMP | RH, percent

SOURCE LAYOUT SKETCH

Stack with Plume
Sun
Wind

Draw North Arrow



ADDITIONAL INFORMATION

OBSERVATION DATE: 8-9-88 | START TIME: 2:32 P.M. | END TIME

SEC / MIN	0	15	30	45	COMMENTS
1	5	5	5	5	--
2	5	5	0	0	
3	5	5	5	5	
4	5	5	5	0	
5	0	5	5	5	
6	5	0	0	0	
7	5	5	5	0	
8	5	0	0	0	
9	0	0	0	0	
10	0	0	5	5	
11	0	0	5	5	
12	5	5	5	5	
13	5	5	5	0	
14	0	0	0	0	
15	5	0	0	0	
16	0	5	5	5	
17	5	0	0	0	
18	0	0	0	0	
19	5	5	5	5	
20	5	5	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	5	5	5	
24	0	0	0	0	
25	0	0	0	0	
26	0	5	5	5	
27	0	0	5	0	
28	5	0	0	0	
29	0	0	0	0	
30	0	0			Stopped burner

OBSERVER'S NAME (PRINT)

OBSERVER'S SIGNATURE: John H. Shaffer | DATE: 8/9/88

ORGANIZATION

CERTIFIED BY | DATE

CONTINUED ON VEO FORM NUMBER

VISIBLE EMISSION OBSERVATION FORM

No. 2

COMPANY NAME		
STREET ADDRESS		
CITY	STATE	ZIP
PHONE (KEY CONTACT)	SOURCE ID NUMBER	

PROCESS EQUIPMENT	OPERATING MODE
CONTROL EQUIPMENT	OPERATING MODE

DESCRIBE EMISSION POINT

HEIGHT ABOVE GROUND LEVEL	HEIGHT RELATIVE TO OBSERVER Start End
DISTANCE FROM OBSERVER Start End	DIRECTION FROM OBSERVER Start End

DESCRIBE EMISSIONS

Start End

EMISSION COLOR Start End	IF WATER DROPLET PLUME Attached ☐ Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED

Start End

DESCRIBE PLUME BACKGROUND

Start End

BACKGROUND COLOR Start End	SKY CONDITIONS Start End	
WIND SPEED Start End 3mph	WIND DIRECTION Start W End	
AMBIENT TEMP Start End	WET BULB TEMP	RH, percent

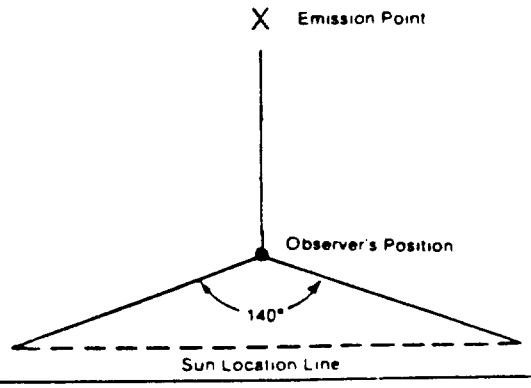
Stack with Plume

Sun

Wind

SOURCE LAYOUT SKETCH

Draw North Arrow



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME
	3:02 PM	3:32 PM

SEC / MIN	0	15	30	45	COMMENTS
1	0	0	0	0	relit burner
2	0	0	0	0	
3	0	0	5	5	
4	5	5	5	0	
5	5	0	5	5	
6	5	0	0	0	
7	0	5	0	5	
8	0	5	0	0	
9	0	5	5	5	
10	0	0	0	5	
11	5	5	0	5	
12	0	0	0	0	
13	0	0	0	0	
14	0	0	5	0	
15	0	0	0	0	
16	0	5	5	0	
17	0	0	5	5	
18	5	5	5	0	
19	5	0	0	0	SLOWED TO 180 TPH
20	0	0	0	0	TEST OVER
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	
25	0	0	0	0	
26	0	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	

OBSERVER'S NAME (PRINT)

OBSERVER'S SIGNATURE John H. Hopkins DATE 8/9/88

ORGANIZATION

CERTIFIED BY DATE

CONTINUED ON VEO FORM NUMBER

CARL KOONTZ & ASSOCIATES

of Nashville, Tennessee

This is to acknowledge that

John Traxler

successfully participated in Visible Emissions training on 4-7-88

and is qualified to evaluate Visible Emissions for a period of six (6) months from the date of certification.

Carl Koontz

Instructor