AP42 Section: 11.1

Reference Number: 348

Title: Stack Emission Test, Payne & Dolan, Inc., Control 59 Asphalt Plant, Wautoma, WI,

Environmental Technology and Engineering Corp., Elm Grove, WI,

July 16, 1996.

Benzene

Sec. II.1
Ref 348

Report to

PAYNE & DOLAN, INC.
Waukesha, Wisconsin

for

STACK EMISSION TEST
CONTROL 59 ASPHALT PLANT
Wautoma, Wisconsin

July 16, 1996

by

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION
13000 West Bluemound Road
Elm Grove, Wisconsin 53122
414-784-2434

SUMMARY

On July 16, 1996, Environmental Technology & Engineering Corporation personnel performed a stack emission test on the Northeast Asphalt, Inc. Control 59 asphalt plant located in Wautoma, Wisconsin. The average of the three particulate tests show the emissions to be well below the limit of 0.039 grains of particulate matter per dry standard cubic foot (gr/dscf) as specified by the State of Wisconsin Department of Natural Resources (DNR) by permit. The numerical test results are summarized below:

Test	Emissions	% of Allowable
1	0.011 gr/dscf	27.5 %
2	0.012	30.0
3	0.013	32.5
AVG	0.012 gr/dscf	30.0 %

In addition, the permit also required testing for formaldehyde emissions. The following table presents the numerical results:

Test	LB/HR	LB/TON
1	0.14 lb/hr	0.0006 lb/ton
2	0.15	0.0006
3	0.15	0.0007
AVG	0.15 lb/hr	0.0006 lb/ton

Testing was also performed to determine the hydrogen chloride emissions. The following table presents the numerical results:

Test	LB/HR	LB/TON
1	0.14 lb/hr	0.0006 lb/ton
2	0.08	0.0003
3	0.10	0.0004
	---	---
AVG	0.11 lb/hr	0.0004 lb/ton

Additional testing was performed to determine the benzene emissions. The following table presents the numerical results:

Test	LB/HR	LB/TON
1	0.17 lb/hr	0.0007 lb/ton
2	0.20	0.0008
3	0.13	0.0005
	---	---
AVG	0.16 lb/hr	0.0007 lb/ton

1.0 GENERAL

On Tuesday, July 16, 1996, Environmental Technology and Engineering Corporation personnel performed a stack emission test on the Northeast Asphalt Control 59 drum mix asphalt plant located in Wautoma, Wisconsin. The test was a provision of Air Pollution Control Permit No. 999187860-NO1. The State of Wisconsin Department of Natural Resources (DNR) has established a particulate emission limit of 0.039 grains per dry standard cubic foot (gr/dscf). The purpose of this test was to demonstrate the compliance status of this plant with the particulate limits set by the DNR. In addition, the permit also required a test to determine the formaldehyde emissions. Additional tests were performed to establish plant specific emission factors for hydrogen chloride (HCl) and benzene.

The plant tested was a drum mix asphalt plant equipped with a baghouse for particulate control. During the test period, the plant production rate was approximately 240 tons per hour. The mix was composed of 100 % virgin material. The plant was fired with waste oil. The field tests, corresponding laboratory analysis and report preparation were coordinated by Bill Dick of ETE Corp. The test procedures, plant operating conditions, and stack opacity were not witnessed by the Wisconsin DNR. Dave Pflug of the Lake Michigan District was notified of the test but was unable to witness.

The following sections of this report document the activities and results of the test program. The report presents all of the relevant data collected and discussions on the interpretation of the data are provided where appropriate. The report, therefore, includes much necessary detail. The results, however, have been summarized in the SUMMARY section at the beginning of this report for those readers not wishing to be burdened by the details.

2.0 RESULTS

2.1 Particulate Emissions

Isokinetic sampling for particulate matter was performed in accordance with the procedures outlined in EPA Method 17 - "Determination of Particulate Emissions from Stationary Sources" - as published in the Federal Register. A brief summary of this method is included in section 3.0 of this report. The tests were performed in the final discharge stack at the location shown in Figure 2-1. This same figure also depicts the location of the exact test points relative to the stack wall. The stack flow parameters recorded during testing and the weights of particulate collected were used to compute the emissions for each test of the three-test sequence. These data were then entered into a computer and printouts showing detailed results are included as Tables 2-1, 2-2, and 2-3.

The results of each of the three individual tests show the emissions to be well below the limit of 0.039 grains of particulate matter per dry standard cubic foot (gr/dscf) as specified by the State of Wisconsin Department of Natural Resources (DNR). The numerical test results are summarized below:

Test	Emissions	% of Allowable
1	0.011 gr/dscf	27.5 %
2	0.012	30.0
3	0.013	32.5
AVG	0.012 gr/dscf	30.0 %

2.2 Formaldehyde Emissions

The formaldehyde emissions were determined concurrently with the particulate testing using EPA Method 0011 (non-isokinetic). A brief description of the method is included in section 3.0 of this report. The numerical results are presented below:

Test	LB/HR	LB/TON
1	1.61 lb/hr	0.0059 lb/ton
2	0.98	0.0035
3	1.46	0.0049
AVG	1.35 lb/hr	0.0048 lb/ton

A summary of the field and lab data is included as Table 2-4.

2.3 Hydrogen Chloride Emissions

The hydrogen chloride emissions were determined concurrently with the particulate testing using EPA Method 26. A brief description of the method is included in section 3.0 of this report. The numerical results are presented below:

Test	LB/HR	LB/TON
1	0.14 lb/hr	0.0006 lb/ton
2	0.08	0.0003
3	0.10	0.0004
AVG	0.11 lb/hr	0.0004 lb/ton

A summary of the field and lab data is included as Table 2-4.

2.4 Benzene Emissions

The benzene emissions were determined concurrently with the particulate testing using EPA Method 18. A brief description of the method is included in section 3.0 of this report. The numerical results are presented below:

Test	LB/HR	LB/TON
1	0.17 lb/hr	0.0007 lb/ton
2	0.20	0.0008
3	0.13	0.0005
AVG	0.16 lb/hr	0.0007 lb/ton

A summary of the field and lab data is included as Table 2-4.

3.0 METHOD OF TEST

3.1 Particulate Matter

The equipment used to sample was the Western Precipitation Division of the Joy Manufacturing Company Emission Parameter Analyzer. Samples were collected and analyzed in accordance with procedures outlined in 40 CFR 60 Appendix A, Method 17 - Determination of Particulate Emissions from Stationary Sources.

The sampling train consisted of a stainless steel probe tip, an in-stack filter, a heated stainless steel lined probe, a glass cyclone and flask, and a heated 125 millimeter Whatman 934-AH fiberglass back-up filter. A series of four impingers followed in an ice bath. The first was a modified Greenburg-Smith impinger with 100 ml of distilled water; the second was a Greenburg-Smith impinger with 100 ml water; the third was a modified Greenburg-Smith impinger dry; the fourth was also a modified Greenburg-Smith impinger containing a tared quantity of silica gel. The gas then passed through a vacuum pump, calibrated dry gas meter, and a calibrated orifice. A schematic drawing of the sampling train is included.

The temperatures at strategic locations within the sampling devices, were monitored by RTDs and read directly from a gauge on the control unit.

The initial gas stream velocity was obtained from a preliminary traverse using an "S" type pitot tube. The initial moisture was estimated from previous tests of similar processes. This data, along with the stack temperature, was used to set a nomograph so that rapid calculations of isokinetic sampling conditions could be made.

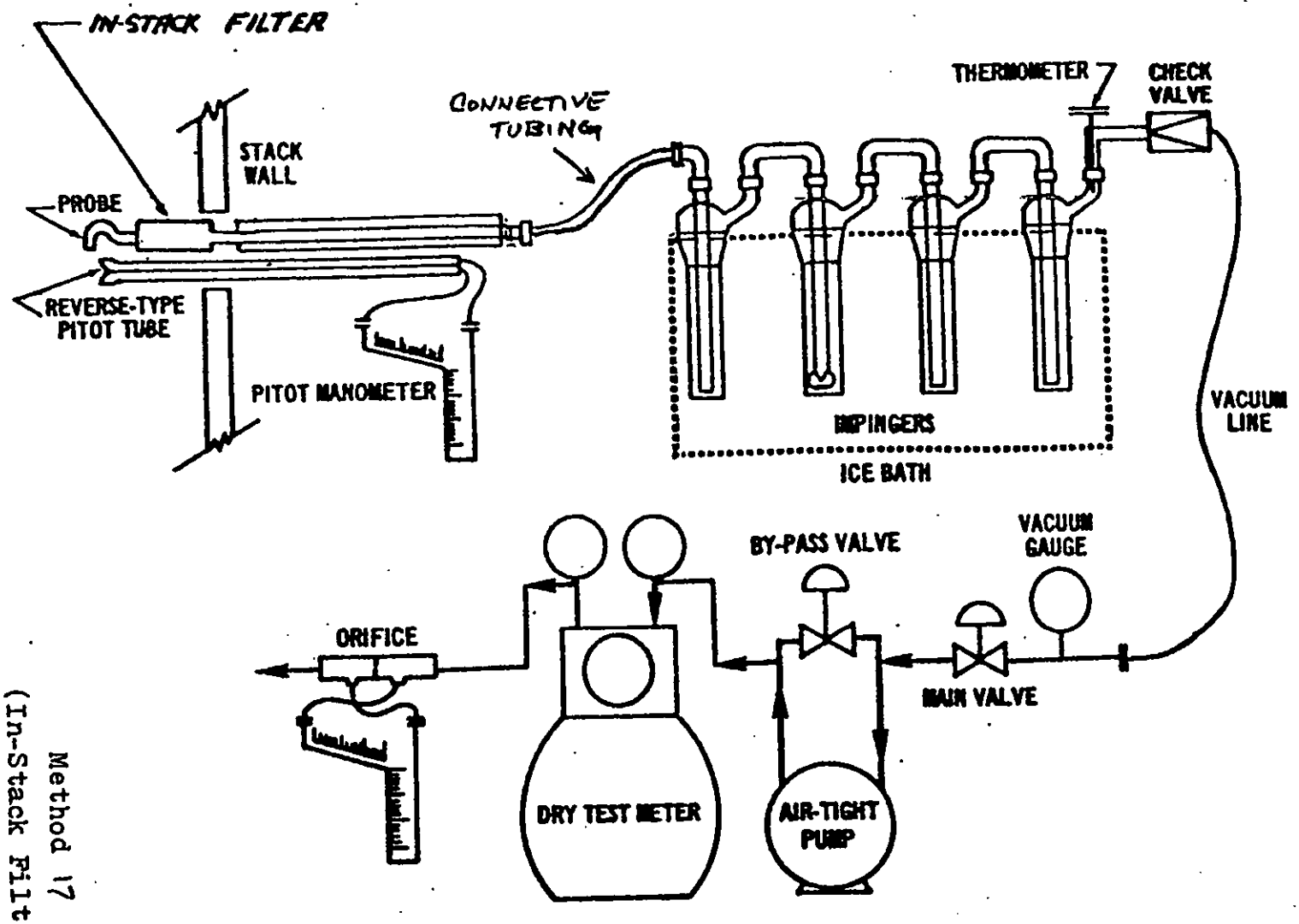
The principle of the method was to collect the sample representative of the exhaust by adjusting the sample collection velocity to match the exhaust gas stream velocity at the point of collection. The velocity at the point of collection was measured with an "S" type pitot tube attached to the probe and the collection velocity was matched to the stack gas velocity by adjusting the flow as indicated by the calibrated orifice.

To determine the molecular weight of the stack gas, samples were drawn into an Orsat analyzer and analyzed for percentage CO2, O2, CO, and N2.

At the completion of the test, the probe tip preceding the filter was washed with acetone which was placed in a tared beaker and evaporated to dryness at room temperature. The filter and beaker were then desiccated to the tared humidity conditions and weighed. The impinger contents were measured and weighed for determination of the actual moisture content of the exhaust gas stream.

The combined weight of the filter catch and the probe tip washing residue was used to determine the particulate emission rates.

A computer was used to calculate the stack velocities, emission concentrations, emission rates and volumetric flow rates using the field and laboratory data.



Method 17
(In-Stack Filter)

Particulate sampling train.

3.2 Formaldehyde

The sampling and analysis were performed using procedures outlined in EPA Method 0011, the method required by the Wisconsin Department of Natural Resources for determining formaldehyde emissions.

Sampling was performed by drawing a known quantity of stack exhaust through appropriate sampling media by means of a battery operated pump. The media consisted of a train of three midget impingers; the first two contained 10 ml of a DNPH solution and were followed by an empty impinger and a water trap. The impingers were set in an ice water bath to accommodate the temperature of the gas stream sampled. The sampling volumes were determined through the use of a calibrated dry gas meter.

Following the sampling, the samples were sealed and returned to the lab for analysis. The samples were analyzed via HPLC methods as described by the EPA. A blank was handled in the field in a method identical to the samples and also submitted for analysis.

3.3 Hydrogen Chloride

The sampling and analysis were performed using procedures outlined in EPA Method 26, the method accepted by the Wisconsin Department of Natural Resources for determining hydrogen chloride emissions.

Sampling was performed by drawing a known quantity of stack exhaust through appropriate sampling media by means of a battery operated pump. The impingers were set in an ice water bath to accommodate the temperature of the gas stream sampled and to remove water vapor. The sampling volumes were determined through the use of a calibrated dry gas meter.

Following the sampling, the samples were sealed and shipped overnight to DAT Technologies, Inc. where they were analyzed by ion chromatography for hydrogen chloride.

3.4 Benzene

Sampling for benzene was performed in accordance with EPA Method 18 - "Measurement of Gaseous Organic Compound Emissions by Gas Chromatography." Samples were drawn from the exhaust gas stream onto solid sorbent tubes (charcoal for benzene) using an SKC pump with a stroke counter to measure the sample volume. A minimum of two tubes were placed in series. At the completion of the tests the tubes were desorbed and analyzed by a gas chromatograph equipped with a flame ionization detector.

Column	DC 200
Temperature	50 C
Carrier Gas	Nitrogen at 20 cc/min

Standard concentrations of the benzene were prepared by injecting a known quantity into a tube and then desorbing and analyzing the tube in the same manner as the samples.

The concentrations of the exhaust gas stream were then determined by comparing the response of the standards to the response to the exhaust duct samples. Sample retention times and peak areas were used to quantify both the benzene emissions.

The compound concentrations were then used in conjunction with the exhaust gas flow rates to determine organic compound emission rates in units of pounds per hour (lb/hr).

4.0 CALIBRATIONS

The probe tip, pitot tube, dry gas meter, and orifice were calibrated prior to the test according to procedures outlined in the Maintenance, Calibration, and Operation of Isokinetic Source-Sampling Equipment as published by the EPA. The values obtained were:

Probe tip diameter	d =	0.250"
Pitot tube coeff.	Cp =	0.84
Orifice coeff.	dH@ =	1.872

The dry gas meter presently installed in the control box is a temperature compensating meter. The correction factor for this dry gas meter is represented by:

$$\text{Gama} = 1.017 + (Td - 70) \times .00012$$

where: Td = Dry Gas Meter Temperature

The most recent calibration was performed June 10, 1996.

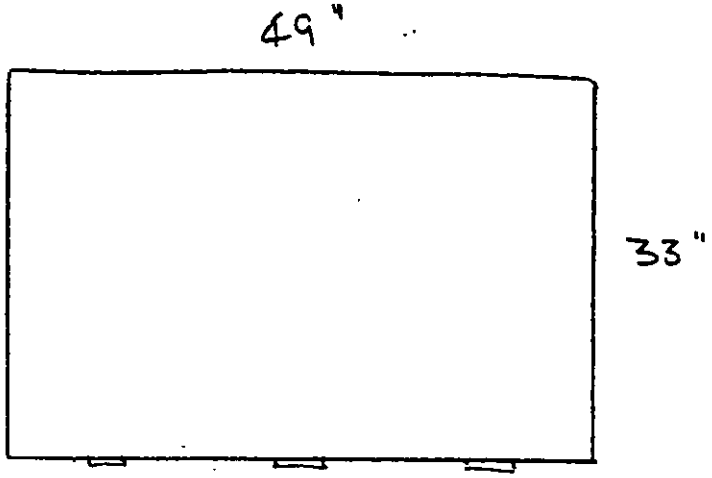
FIGURE 2-1

PLANT NORTHEAST ASPHALT
LOCATION WAUTOMA

PROCESS CONTROL 59

DIMENSIONS 33" x 49"

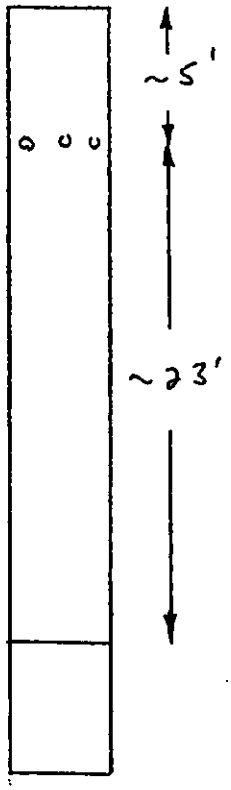
COMMENTS



TEST SECTION

POINT	DISTANCE FROM STACK WALL
1	2.06"
2	6.19"
3	10.31"
4	14.44"
5	18.56"
6	22.69"
7	26.81"
8	30.94"

SAMPLING LOCATION



NORTHEAST ASPHALT CONTROL 59 PLANT WAUTOMA JULY 16, 1996 TABLE 2-1

TEST NO.	1			
BAROMETRIC PRESSURE	29.25	IN HG		
TIP DIAMETER	0.250	IN		
STACK DIMENSIONS	33	IN	49	IN
STACK AREA	11.229	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	24			
METER VOLUME	33.61	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.017			
PARTICULATE COLLECTED	0.0237	GRAMS		
WATER COLLECTED	286	ML		
STATIC PRESSURE	-0.4	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
6.00%	11.00%	0.00%	83.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	270	0.45	0.90	88	46.99
2	272	0.50	1.00	88	49.60
3	272	0.52	1.04	89	50.58
4	271	0.52	1.04	90	50.54
5	270	0.50	1.00	90	49.53
6	270	0.50	1.00	91	49.53
7	270	0.49	0.98	92	49.03
8	270	0.48	0.96	93	48.53
9	270	0.60	1.20	96	54.26
10	270	0.58	1.16	97	53.34
11	270	0.54	1.08	99	51.47
12	270	0.54	1.08	100	51.47
13	271	0.50	1.00	100	49.56
14	271	0.55	1.10	101	51.98
15	271	0.52	1.04	102	50.54
16	270	0.52	1.04	102	50.51
17	269	0.70	1.40	104	58.56
18	269	0.70	1.40	106	58.56
19	268	0.70	1.40	108	58.52
20	268	0.68	1.36	109	57.68
21	269	0.64	1.28	110	56.00
22	270	0.62	1.24	110	55.15
23	270	0.62	1.24	111	55.15
24	269	0.60	1.20	112	54.22
AVERAGE	270		1.13	100	52.55

DRY STANDARD VOLUME	33.63	SCF
PERCENT WATER VAPOR	28.59	% VOL
FLOW RATE	35409	ACFM
	17861	DSCFM
	30350	M3/HR
PARTICULATE CONCENTRATION	0.011	GR/DSCF
PARTICULATE EMISSION RATE	1.69	LB/HR
LB PART PER 1000 LB GAS	0.017	
ISOKINETIC PERCENT	103.4	

NORTHEAST ASPHALT CONTROL 59 PLANT WAUTOMA JULY 16, 1996 TABLE 2-2

TEST NO.	2			
BAROMETRIC PRESSURE	29.25	IN HG		
TIP DIAMETER	0.250	IN		
STACK DIMENSIONS	33	IN	49	IN
STACK AREA	11.229	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	24			
METER VOLUME	33.33	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.017			
PARTICULATE COLLECTED	0.0255	GRAMS		
WATER COLLECTED	323	ML		
STATIC PRESSURE	-0.42	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
6.20%	11.00%	0.00%	82.40%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	260	0.70	1.40	118	58.61
2	262	0.72	1.44	119	59.52
3	263	0.72	1.44	119	59.56
4	265	0.68	1.32	119	57.11
5	267	0.66	1.32	119	57.19
6	268	0.65	1.30	119	56.79
7	266	0.62	1.24	120	55.39
8	266	0.60	1.20	120	54.49
9	268	0.65	1.30	121	56.79
10	269	0.56	1.12	122	52.75
11	269	0.52	1.04	122	50.83
12	270	0.50	1.00	122	49.88
13	270	0.50	1.00	122	49.88
14	270	0.52	1.04	122	50.86
15	270	0.58	1.16	122	53.72
16	270	0.60	1.20	122	54.84
17	270	0.52	1.04	123	50.86
18	270	0.56	1.12	123	52.78
19	270	0.55	1.10	124	52.31
20	270	0.55	1.10	125	52.31
21	270	0.56	1.12	125	52.78
22	270	0.55	1.10	125	52.31
23	270	0.50	1.00	125	49.88
24	269	0.50	1.00	126	49.84
AVERAGE	268		1.17	122	53.80

DRY STANDARD VOLUME	33.44	SCF
PERCENT WATER VAPOR	31.26	% VOL
FLOW RATE	36245	ACFM
	17648	DSCFM
	29987	M3/HR
PARTICULATE CONCENTRATION	0.012	GR/DSCF
PARTICULATE EMISSION RATE	1.82	LB/HR
LB PART PER 1000 LB GAS	0.018	
ISOKINETIC PERCENT	104.0	

NORTHEAST ASPHALT CONTROL 59 PLANT WAUTOMA JULY 16, 1996 TABLE 2-3

TEST NO.	3			
BAROMETRIC PRESSURE	29.25	IN HG		
TIP DIAMETER	0.250	IN		
STACK DIMENSIONS	33	IN	49	IN
STACK AREA	11.229	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	24			
METER VOLUME	33.05	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.017			
PARTICULATE COLLECTED	0.0270	GRAMS		
WATER COLLECTED	324	ML		
STATIC PRESSURE	-0.42	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
6.20%	10.80%	0.00%	83.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	270	0.56	1.12	126	52.74
2	270	0.55	1.10	127	52.27
3	270	0.55	1.10	127	52.27
4	271	0.52	1.04	127	50.85
5	272	0.52	1.04	127	50.89
6	270	0.50	1.00	127	49.83
7	270	0.50	1.00	127	49.83
8	270	0.56	1.12	127	52.74
9	270	0.60	1.20	128	54.59
10	270	0.60	1.20	129	54.59
11	270	0.58	1.16	129	53.67
12	270	0.55	1.10	130	52.27
13	271	0.55	1.10	130	52.30
14	272	0.50	1.00	130	49.90
15	272	0.58	1.16	130	53.75
16	271	0.60	1.20	130	54.63
17	271	0.72	1.44	130	59.84
18	271	0.72	1.44	130	59.84
19	272	0.70	1.40	130	59.04
20	272	0.68	1.36	131	58.19
21	272	0.65	1.30	132	56.90
22	272	0.65	1.30	132	56.90
23	270	0.62	1.24	132	55.49
24	270	0.60	1.20	133	54.59
AVERAGE	271		1.18	129	54.08

DRY STANDARD VOLUME	33.19	SCF
PERCENT WATER VAPOR	31.49	% VOL
FLOW RATE	36436	ACFM
	17614	DSCFM
	29930	M3/HR
PARTICULATE CONCENTRATION	0.013	GR/DSCF
PARTICULATE EMISSION RATE	1.93	LB/HR
LB PART PER 1000 LB GAS	0.019	
ISOKINETIC PERCENT	103.5	

NORTHEAST ASPHALT July 16, 1996 TABLE 2-4
CONTROL 59 WAUTOMA

BENZENE (Benz)

Sample No.	Volume liters	FlowRate m3/hr	Benz ug	Benz mg/m3	Benz lb/hr	Production tph	Benz lb/ton
59-1	9.14	30350	23.7	2.59	0.17	246	0.0007
59-2	10.16	29987	30.0	2.95	0.20	235	0.0008
59-3	9.23	29930	17.6	1.91	0.13	236	0.0005
	AVERAGE EMISSIONS				0.16		0.0007

HYDROGEN CHLORIDE (HCl)

Sample No.	Volume liters	FlowRate m3/hr	HCl ug	HCl mg/m3	HCl lb/hr	Production tph	HCl lb/ton
59-1	54.79	30350	114.00	2.08	0.14	246	0.0006
59-2	58.35	29987	70.00	1.20	0.08	235	0.0003
59-3	70.84	29930	111.00	1.57	0.10	236	0.0004
	AVERAGE EMISSIONS				0.11		0.0004

FORMALDEHYDE (Form)

Sample No.	Volume liters	FlowRate m3/hr	Form ug	Form mg/m3	Form lb/hr	Production tph	Form lb/ton
59-1	56.77	30350	116.63	2.05	0.14	246	0.0006
59-2	56.87	29987	128.73	2.26	0.15	235	0.0006
59-3	56.46	29930	131.85	2.34	0.15	236	0.0007
	AVERAGE EMISSIONS				0.15		0.0006

NORTHEAST ASPHALT
CONTROL 59 PLANT
FORMALDEHYDE RESULTS

TABLE 2-4

Sample No.	Meter Vol. ft3	Meter Temp deg F	Standard Vol liters	Form Captured ug	Form Conc mg/m3	Flow Rate m3/hr	Form ER lb/hr
HCOH-1	2.00	88	56.77	116.63	2.05	30350	0.1375
HCOH-2	2.00	87	56.87	128.73	2.26	29987	0.1496
HCOH-3	2.00	91	56.46	131.85	2.34	29830	0.1541
		AVERAGE			2.22		0.1471

Meter Gama 1.064
Bar.Preasure 29.25

HYDROGEN CHLORIDE RESULTS

Sample No.	Meter Vol. ft3	Meter Temp deg F	Standard Vol liters	HCl Captured ug	HCl Conc mg/m3	Flow Rate m3/hr	HCl ER lb/hr
HCl-1	2.00	88	54.79	114	2.08	30350	0.1392
HCOH-2	2.13	88	58.35	70	1.20	29987	0.0793
HCOH-3	2.60	91	70.84	111	1.57	29830	0.1034
		AVERAGE			1.62		0.1073

Meter Gama 1.027
Bar.Pressure 29.25

Calculations

Standard Volume = Meter Vol * Meter Gama*Bar.Pressure*28.32*528/(29.92*(460+Meter Temp))

Concentration = ug/liters = mg/m3

Emission Rate = mg/m3 * m3/hr/453600

APPENDIX A

FIELD & LABORATORY DATA SHEETS

ASPHALT PLANT STACK TEST DATA

it Name: #59 - Waukonda

Date: July 16, 1996

FID # 999187860

← Inlet

ne*	Burner Setting	PSI Fuel Pressure	Production TPH	Aggregate TPH	% Moisture in Aggregate	RAP TPH	Mix Temp	Stack Temp	Photo-helic	Magne-helic	Fuel Flow Rate	CO ppm	CO2 ppm	O2 %
0	5.6	80	245	233	4.2	0	298	300	.15	5.1	6.8			
5	5.4	80	250	239	3.6	0	301	299	.07	5.4	6.8			
30	5.5	80	240	224	3.1	0	296	294	.135	5.2	6.8			
45	5.4	78	237	223	3.1	0	296	294	.11	52	6.7			
30	5	80	245	233	3.1	0	303	293	.07	5.0	6.6			
45	5	78	245	233	3.1	0	299	294	.10	5.2	6.6			
00	5.2	78	250	239	3.1	0	299	293	.15	5.2	6.7			
15	5.2	78	245	233	3.1	0	296	-	.15	5.2	6.7			
30	5.2	78	250	235	3.1	0	298	298	.14	5.2	6.7			
45	4.8	80	245	234	3.1	0	302	292	.10	5.4	6.8			
:00	5	80	245	235	3.1	0	298	293	.12	5.0	6.7			
:15	5.75	80	246	235	3.1	0	299	292	.12	5.2	6.7			
:30	5.5	80	250	239	3.1	0	298	292	.12	5.2	6.8			

Type Waste Oil Sulfur in Fuel < 0.1 %

t Drum Type _____

* Record data in 15-minute intervals during stack test runs.

COMPLETED TEST DATA WKI

Environmental Technology Engineering Corp.

PARTICULATE FIELD DATA

γ: 1.017 ✓ 10-96

PLANT Northeast A — AMBIENT TEMPERATURE 75 — METER ΔH, 1.872

DATE 7-16-96 — BAROMETRIC PRESSURE — C FACTOR

LOCATION Wantuma — ASSUMED MOISTURE, % 20 — PROCESS WEIGHT RATE ~ 350 TPH

OPERATOR WJD — PROBE LENGTH, in. 4' — ORSAT RESULTS — LEAK CHECKS

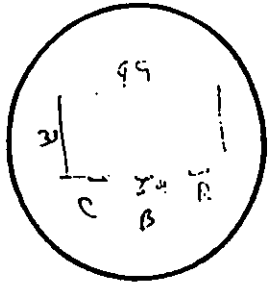
STACK NO. Control 59 — NOZZLE DIAMETER, in. 1/4 — CO2 6.0 — ✓ Pre ~ 21"

RUN NO. 1 — STACK DIAMETER, in. 33 x 99 — O2 11.0 — ✓ Pitot ~ 1"

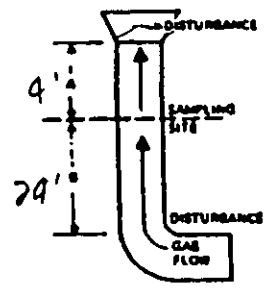
SAMPLE BOX NO. 1 — PROBE HEATER SETTING — CO 0 — ✓ Post ~ 21 @ 20

METER BOX NO. 1 — HEATER BOX SETTING — N2 83. — ✓ Pitot ~ 1

70 ¢



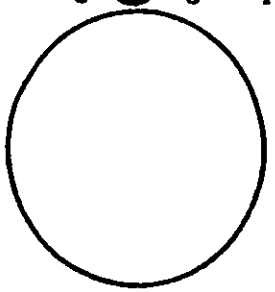
CROSS SECTION



TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{IN}}$), °F	OUTLET ($T_{m_{OUT}}$), F	HCOH γ: 1.064 SAMPLE BOX TEMPERATURE, F	HCl γ: 1.077 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	RENT sec ¢ (2 cr) VELOCITY fps
A 1	0955		270	.45	.90		796.00		88	134.07/90	811.27/90	2	757861
2	51+		272	.50	1.00		97.4		88	136.07/86	813.27/86		778973
3	00	-.35	272	.52	1.04		48.7		89	2.00/88	2.00/88		21112
4	02+		271	.52	1.04		50.1		90				÷.931
5	05		270	.50	1.00		51.5		90				1140.
6	07+		270	.50	1.00		52.9		91				
7	10		270	.49	0.98		542		92			2	
8	13+		270	.48	0.96		55.5		93				
B 9	15/16		270	.60	1.20		56.8		96				
10	18+		270	.58	1.16		58.2		97				
11	21	-.40	270	.54	1.08		59.6		99				
12	23+		270	.54	1.08		61.0		100				
13	26		271	.50	1.00		62.4		100				
14	28+		271	.55	1.10		63.7		101			2	
15	31		271	.52	1.04		65.1		100				
16	33+		270	.52	1.04		66.4		102				
C 17	36/37		269	.70	1.40		67.8		104			3	
18	39+		269	.72	1.40		69.3		106				
19	42	-.45	268	.70	1.40		70.9		108				
20	44+		268	.68	1.36		72.4		109				
21	47		269	.64	1.28		73.9	(33.61)	110				
22	49+		270	.62	1.24		75.3		110				
23	52		270	.62	1.24		76.7		111				
24	54+		269	.60	1.20		78.2		112				
	0957						779.61						

Technology
Engineering Corp.

PARTICULATE FIELD DATA



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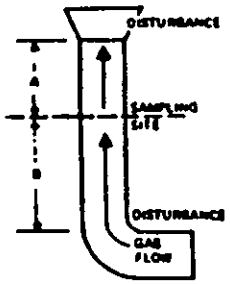


PLANT Northgate Arow
DATE 7-16-96
LOCATION WAUTOMA
OPERATOR WVD
STACK NO. Control 59
RUN NO. 2
SAMPLE BOX NO. 2
METER BOX NO. 1

AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 20
PROBE LENGTH, in. 4'
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 33x49
PROBE HEATER SETTING -
HEATER BOX SETTING -

METER ΔH,
C FACTOR
PROCESS WEIGHT RATE ~750 TPH

ORSAT RESULTS
CO2 4.2
O2 11.0
CO 0
N2 84.8

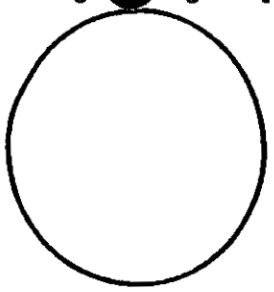
LEAK CHECKS
On Pre < 22"
On Pitot 4.2"
On Post @ 21
On Pitot 4.5"

705

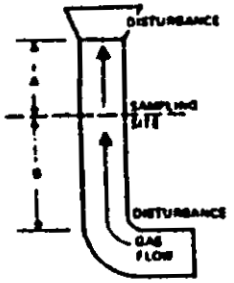
TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER: INLET ($T_{m_{IN}}$), °F	OUTLET ($T_{m_{OUT}}$), F	HCOH SAMPLE BOX TEMPERATURE °F	HCl TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Benz VELOCITY fps
C 1	1015		260	.70	1.40		780.00		118	156.07/86	813.27/86	2	77897
2	17		262	.72	1.44		81.6		119	153.07/88	815.49/90		78792
3	20	-.45	263	.72	1.44		83.2		119	2.03/87	2.08/88		
4	23		263	.66	1.32		84.7		119				32020
5	25		262	.66	1.32		86.2		119				33988
6	27		260	.65	1.30		87.6		119				
7	30		266	.60	1.20		89.1		120			2	
8	32		266	.60	1.20		90.5		120				10160
B 9	35/36		268	.61	1.30		92.0		121				
10	38		269	.56	1.12		93.4		122				
11	41	-.40	269	.52	1.04		94.7		122				
12	43		270	.50	1.00		96.1		122				
13	46		270	.50	1.00		97.4		122				
14	48		270	.52	1.04		98.7		122				
15	51		270	.58	1.16		00.0		122				
16	53		270	.60	1.20		01.3		122			2	
A 17	56/57		270	.52	1.04		02.6		123				
18	59		270	.56	1.12		04.0		123				
19	02		270	.55	1.10		05.3		124				
20	04	-.40	270	.55	1.10		06.6		125				
21	07		270	.56	1.12		08.0	33.33	125				
22	09		270	.55	1.10		09.3		125				
23	12		270	.50	1.00		10.7		125			2	
A	101		269	.50	1.00		12.0		126				
	1117						813.33						

PARTICULATE FIELD DATA

Technology & Engineering Corp.



CROSS SECTION



PLANT Northeast Asph
DATE 7-16-96
LOCATION WANTAGH
OPERATOR WVD
STACK NO. CONTROL 59
RUN NO. 3
SAMPLE BOX NO. 3
METER BOX NO. 1

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 20
PROBE LENGTH, in. 9'
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 33 x 49
PROBE HEATER SETTING -
HEATER BOX SETTING -

METER ΔH,
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS

CO2 6.2
O2 10.8
CO 0
N2 83.0

LEAK CHECKS

@ Pre - 22"
@ Pitot 4.2
@ Post 21
@ Pitot 4.5

706

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{IN}}$), °F	OUTLET ($T_{m_{OUT}}$), °F	HCOH SAMPLE BOX TEMPERATURE °F	HCl TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Stack #1 VELOCITY fps
A 1	1130		270	.56	1.12		814.00		126	158.0/86	815.4/86	2	334.00
2	32+		270	.55	1.10		15.4		127	160.0/96	813.0/96		355.714
3	35	-.40	270	.55	1.10		16.7		127	2.00/91	2.60/91		
4	37+		271	.52	1.04		18.1		127				9.24
5	40		272	.52	1.04		19.4		127				
6	42		270	.50	1.00		20.8		127				
7	45		270	.50	1.00		22.1		127			2	
8	47+		270	.56	1.12		23.4		127				
B 9	50/51		270	.60	1.20		24.7		128				
10	53+		270	.60	1.20		26.1		127				
11	56		270	.58	1.16		27.4		129				
12	58+	-.40	270	.55	1.10		28.8		130				
13	01		271	.55	1.10		30.1		130				
14	03+		272	.50	1.00		31.5		130				
15	06		272	.58	1.16		32.8		130			2	
16	08+		271	.60	1.20		34.2		130				
C 17	11/12		271	.72	1.44		35.5		130				
18	14+		271	.72	1.44		37.0		130				
19	17		272	.70	1.40		38.4		130				
20	19+	-.45	272	.68	1.36		39.9		131				
21	22		272	.65	1.30		41.4	(33.0)	132				
22	24+		272	.65	1.30		42.8		132				
23	27		270	.62	1.24		44.8		132				
24	29+		270	.60	1.20		45.6		133				
	1132						847.00						

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Northeast Asphalt - Wautoma DATE OF TEST 7-16-96

JOB NO. _____ TEST ENGINEER WJP

RUN NO. 1 STACK Baghouse

Sample Box 1 Filter T-704 Wash Bottle —

Beaker No. 1

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	225	100	125
2	174	100	74
3	70	0	70
SIC GEL	708	691	17
		TOTAL	286

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.2358	1.2135	0.0223
Washings (0.0003)	106.3442	106.3425	0.0014
		TOTAL	0.0237

WATER COLLECTED [ ] GRAMS

PARTICULATE COLLECTED [ ] GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Northeast Asphalt - Wautoma DATE OF TEST 7-16-96

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 2 STACK Baghouse

Sample Box 2 Filter T-705 Wash Bottle —

Beaker No. 2

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	323	100	223
2	193	100	93
3	2	0	2
SIL GEL	649	644	5
		TOTAL	323

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.1589	1.1358	0.0231
Washings (0.0003)	110.5835	110.5808	0.0024
		TOTAL	0.0255

WATER COLLECTED [ ] GRAMS

PARTICULATE COLLECTED [ ] GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Northwest Asphalt - Wautoma DATE OF TEST 7-16-96

JOB NO. _____ TEST ENGINEER WJO

RUN NO. 3 STACK Baghouse

Sample Box 3 Filter T-706 Wash Bottle —

Beaker No. 3

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	268	100	168
2	200	100	100
3	51	0	51
SIL GEL	636	631	5
		TOTAL	324

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.1190	1.0939	0.0251
Washings (0.0003)	94.1791	94.1769	0.0019
		TOTAL	0.0270

WATER COLLECTED [ ] GRAMS

PARTICULATE COLLECTED [ ] GRAMS

NOTES:

NORTHERN ASPHALT
BENZENE LAB RESULTS

STD 28.9 µg
AREA 396593

K = 0.000072871 µg/AREA UNIT

NEA 59-1
AREA = 325341
BENZENE = 23.7 µg

NEA 59-2
AREA = 411470
BENZENE = 30.0 µg

NEA 59-3
AREA = 241719
BENZENE = 17.6 µg

DATA SUMMARY FOR CHLORIDE ANALYSIS

Project: 0796019.

Lab Id.:	Client Id.:		Average Total ug	Q
0796019-5	NEA 59-1	Cl	114	
0796019-6	NEA 59-2	Cl	70	
0796019-7	NEA 59-3	Cl	111	
0796019-8	Blank	Cl	1	U

U: Analyte was not detected.

DATA SUMMARY OF FORMALDEHYDE ANALYSIS

Project #0796019

Lab Id.:	Client Id.:	Total ug	Q
0796019-1	**NEA 59-1**	**129.27**	
0796019-2	**NEA 59-2**	**141.37**	
0796019-3	**NEA 59-3**	**144.49**	
0796019-4	**HCOH Blank**	**12.64**	

APPENDIX B

SAMPLE CALCULATIONS

SAMPLE CALCULATION

BAROMETRIC PRESSURE, in Hg (Pb) = 29.200
STACK PRESSURE, in Hg (Pb + Pg/13.6) = 29.178
TIP DIAMETER, in (An = PI*D^2/576) = .2450
STACK AREA, sq ft (A) = 10.560
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf (Vm) = 66.06
WATER COLLECTED, ml (Vf - Vi) = 86.00
PARTICULATE COLLECTED, grams (Mn) = 0.0755
CO2 = 0.60 O2 = 21.00 CO = 0.00 N2 = 78.40
WET MOLECULAR WEIGHT, lb/mole (Ms) = 28.45

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE DEL H inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	110	1.450	4.05	32	72.51
2	110	1.350	3.75	32	69.97
3	110	1.350	3.75	32	69.97
4	110	1.300	3.70	32	68.66
5	110	1.250	3.60	32	67.33
6	110	1.250	3.60	32	67.33
7	110	1.050	2.95	32	61.71
8	110	1.000	2.85	32	60.22
9	110	1.000	2.85	34	60.22
10	110	1.050	2.95	34	61.71
11	110	0.950	2.75	38	58.69
12	115	0.950	2.75	38	58.95
13	115	1.300	3.70	42	68.96
14	115	1.250	3.60	42	67.62
15	115	1.200	3.40	42	66.26
16	115	1.200	3.40	42	66.26
17	115	1.150	3.30	44	64.86
18	115	1.150	3.30	46	64.86
19	115	1.050	2.95	48	61.98
20	115	1.150	3.30	48	64.86
21	115	1.000	2.85	50	60.48
22	115	1.100	3.15	50	63.43
23	115	1.050	2.95	50	61.98
24	115	0.900	2.55	50	57.38
AVG VALUES	113		3.250	40	64.42

TOTAL GAS WITHDRAWN, scf = 69.39
DRY GAS WITHDRAWN, scf (Vmstd) = 65.35
WATER VAPOR WITHDRAWN, scf (Vwstd) = 4.05
PERCENT WATER VAPOR (%H2O) = 5.83
ACTUAL WET FLOW RATE, acfm = 40,819.39
STANDARD DRY FLOW RATE, scfm (Qs) = 34,558.69
PARTICULATE CONCENTRATION, grains/dscf (Cs) = 0.018
PARTICULATE EMISSION RATE, lb/hr (ER) = 5.325
PARTICULATE EMISSIONS, lb/1000 lb (EC) = 0.033
PERCENT OF ISOKINETIC SAMPLING (I) = 101.67

SAMPLE CALCULATIONS

1. DRY MOLECULAR WEIGHT (Md) lb/lb-mole

   Md = .44*% CO2 + .32*%O2 + .282*%N2 + .28*%CO

2. WATER VAPOR PERCENT (%H2O)

   Vw std = 0.04707*(Vf - Vi)

   where: Vw std = standard cubic feet of water vapor
   Vf = Final volume of impingers, ml
   Vi = Initial volume of impingers, ml

   %H2O = Vw std * 100/(Vm std + Vw std)

   where Vm std = standard cubic feet of gas sampled

3. WET MOLECULAR WEIGHT (Ms) lb/lb-mole

   Ms = Md*(1 - %H2O/100) + 18*%H2O/100

4. STACK PRESSURE (Ps) in. Hg

   Ps = Pb + Pg/13.6

   where: Pb = barometric pressure (uncorrected), in. Hg
   Pg = stack gauge pressure, in. H2O
   13.6 = specific gravity of mercury (Hg)

5. AVERAGE STACK VELOCITY (Vs) feet per second

   Vs = Kp*Cp* (DELP) Tsavg/(Ps*Ms)

   where: Kp = 85.49 unit conversion
   Cp = 0.85, pitot tube calibration factor
   DELP = square root of velocity head, in. H2O
   Tsavg = average stack temperature, deg R (460+F)
   Ps = stack pressure
   Ms = wet molecular weight

6. STACK GAS FLOW RATE (Qs) std cubic feet per minute

   Qs = 60*(1 - %H2O/100)*Vs*A*(528*Ps/Tsavg/29.92)

   where: A = stack area, ft2
   528 = std temperature, deg R
   29.92 = std pressure, in. Hg

7. DRY GAS VOLUME (Vm std) std cubic feet

Vm std = GAMA*(Vm-(AL-.02)t)*(Pb+DELH/13.6)/29.92

where: GAMA = dry gas meter calibration factor
Vm = volume of dry gas metered, cubic feet
AL = post test leak rate, cubic feet per minute
t = total time of test, minutes
DELH = average orifice pressure drop, in.H2O

8. PARTICULATE CONCENTRATION (Cs) grains/dry std cubic foot

Cs = Mn * 15.43/Vm std

where: Mn = particulate captured, grams
15.43 = grains per gram

9. EMISSION RATE (ER) pounds per hour

PMRA = Mn*A*60/(t*An*453.6) AREA METHOD lb/hr

PMRC = Cs*Qs*60/(15.43*453.6) CONC. METHOD lb/hr

ER = (PMRA + PMRC)/2

where: An = area of sampling nozzle, square feet

10. EMISSION CONCENTRATION (EC) lb/1000 lb exhaust gas

EC = ER * 386700 * (1-%H2O/100)/(Qs*60*Ms)

where: 386700 = cubic feet per lb mole * 1000

11. ISOKINETIC SAMPLING PERCENTAGE (I) %

I = PMRA/PMRC