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.

AP42 Section: 11.1

Reference Number: 375

Title: Stack Emission Test, Payne And Dolan, Inc., Control 27 Plant, Horicon, WI,

Environmental Technology and Engineering Corporation, Elm Grove, WI,

October 6, 1997.

Sec. 11.1
Ref. 375

SO_2

Report to

PAYNE & DOLAN, INC.

Waukesha, Wisconsin

for

STACK EMISSION TEST
CONTROL 27 PLANT
WDNR Air Pollution Control Permit No. 87-LMW-402
FID NO. 999516760
October 6, 1997

by

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION
13000 West Bluemound Road
Elm Grove, Wisconsin 53122
Phone 414-784-2434
Fax 414-784-2436

ETE

SUMMARY

On October 6, 1997, Environmental Technology & Engineering Corp. personnel performed stack emissions testing at the Payne & Dolan, Inc. Control 27 portable plant located in Horicon, Wisconsin. The tests were performed as a provision of Air Pollution Control Permit No. 87-LMW-407 issued by the State of Wisconsin Department of Natural Resources. Tests were performed in order to determine compliance with the applicable particulate emission limitation. Formaldehyde testing was performed as a condition of a BACT requirement for the plant. Additional tests were performed to determine plant specific emission factors for sulfur dioxide. All measured particulate emissions were well below the limits shown in the following table:

TEST NO.	PARTICULATE	FORMALDEHYDE	SULFUR DIOXIDE
1	0.010 gr/dscf	0.64 lb/hr	15.31 lb/hr
2	0.010	0.86	15.57
3	0.007	0.57	16.62
AVERAGE	0.009 gr/dscf	0.69 lb/hr	15.73 lb/hr
DNR LIMIT	0.039	NA	NA
% OF LIMIT	23.1 %	NA	NA

1.0 GENERAL

On October 6, 1997, Environmental Technology & Engineering Corp. (ETE) personnel performed stack emissions testing at the Payne & Dolan, Inc. Control 27 portable plant located in Horicon, Wisconsin. The purpose of the testing was to determine the particulate emissions from the plant as a condition of Air Pollution Control Permit No. 87-LMW-407 issued by the State of Wisconsin Department of Natural Resources (WDNR). The facility Identification Number (FID) for this plant is 999516760. Formaldehyde testing was also performed as a condition of a BACT requirement for the plant. Sulfur dioxide testing was also performed at this time in order to determine a plant specific emission factor.

Pete Tolsma and Rick Hintz of Payne & Dolan was responsible for assuring proper operating conditions throughout the testing. During the test the plant production rate was approximately 300 tons per hour and included approximately 20 % recycled asphalt. The plant was fired with drain oil. A log of plant activity throughout the test was kept and is included in the APPENDIX. All testing was coordinated with the plant operator. Jerry Waters of the DNR was notified of the tests and witnessed a portion of the field testing, plant operation, and stack opacity. The field tests, corresponding laboratory analysis, and report preparation were performed by ETE personnel; Bill Dick was the test team leader.

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

2.0 RESULTS

Isokinetic sampling for particulate matter was performed in accordance with the procedures outlined in EPA Method 17. Formaldehyde testing was performed using non-isokinetic method 0011. Sulfur dioxide samples were collected and analyzed in accordance with EPA Method 6. A brief summary of the methods 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. Detailed results of the testing to determine particulate matter emissions are shown in Tables 2-1 through 2-3. All results were well below the permit limits. The results are summarized below:

TEST NO.	PARTICULATE	FORMALDEHYDE	SULFUR DIOXIDE
1	0.010 gr/dscf	0.64 lb/hr	15.31 lb/hr
2	0.010	0.86	15.57
3	0.007	0.57	16.62
AVERAGE	0.009 gr/dscf	0.69 lb/hr	15.73 lb/hr
DNR LIMIT	0.039	NA	NA
% OF LIMIT	23.1 %	NA	NA

PAYNE & DOLAN
CONTROL 27 PLANT

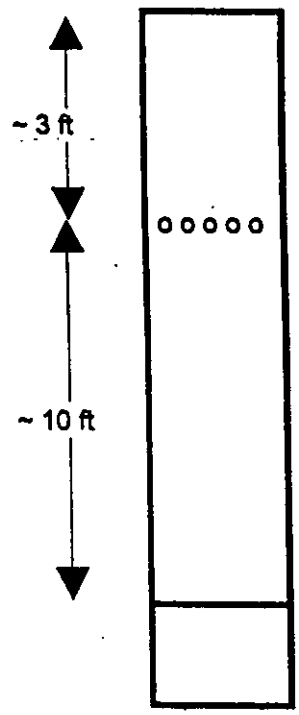
L x W
58" x 42"

SAMPLE POINT LOCATION

POINT	DISTANCE
1	4.2"
2	12.6
3	21.0
4	29.4
5	37.8

FIGURE 2-1

SAMPLE PORT LOCATION



PAYNE & DOLAN 6-Oct-97 CONTROL 27 TABLE 2-1

TEST NO.	1			
BAROMETRIC PRESSURE	29.40	IN HG		
TIP DIAMETER	0.245	IN		
STACK DIMENSIONS	42	IN	58	IN
STACK AREA	16.917	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	25			
METER VOLUME	43.51	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.008			
PARTICULATE COLLECTED	0.0286	GRAMS		
WATER COLLECTED	269	ML		
STATIC PRESSURE	-0.65	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
4.80%	13.20%	0.00%	82.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	282	1.40	2.55	67	82.61
2	282	1.25	2.15	68	78.06
3	285	1.15	2.10	68	75.03
4	285	0.80	1.45	69	62.58
5	282	0.70	1.25	69	58.42
6	287	1.15	2.10	71	75.13
7	285	1.00	1.80	72	69.96
8	287	0.70	1.25	73	58.61
9	288	0.55	1.00	73	51.99
10	285	0.55	1.00	73	51.89
11	282	1.00	1.80	75	69.82
12	285	0.75	1.35	75	60.59
13	287	0.55	1.00	76	51.96
14	287	0.55	1.00	77	51.96
15	285	0.80	1.45	78	62.58
16	280	0.85	1.55	80	64.29
17	282	0.50	0.90	81	49.37
18	285	0.50	0.90	82	49.47
19	285	0.75	1.35	83	60.59
20	282	1.50	2.70	83	85.51
21	285	1.35	2.50	85	81.29
22	287	1.10	2.00	86	73.48
23	287	1.00	1.80	87	70.06
24	285	1.15	2.10	90	75.03
25	285	1.50	2.70	91	85.69
AVERAGE	285		1.67	77	66.24

DRY STANDARD VOLUME	43.31	SCF
PERCENT WATER VAPOR	22.62	% VOL
FLOW RATE	67231	ACFM
	36186	DSCFM
	61487	M3/HR
PARTICULATE CONCENTRATION	0.010	GR/DSCF
PARTICULATE EMISSION RATE	3.14	LB/HR
LB PART PER 1000 LB GAS	0.016	
ISOKINETIC PERCENT	99.0	

PAYNE & DOLAN 6-Oct-97 CONTROL 27 TABLE 2-2

TEST NO.	2			
BAROMETRIC PRESSURE	29.40	IN HG		
TIP DIAMETER	0.245	IN		
STACK DIMENSIONS	42	IN	58	IN
STACK AREA	16.917	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	25			
METER VOLUME	41.48	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.008			
PARTICULATE COLLECTED	0.0259	GRAMS		
WATER COLLECTED	261	ML		
STATIC PRESSURE	-0.64	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
4.80%	13.20%	0.00%	82.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	288	1.35	2.50	99	81.50
2	290	1.00	1.80	99	70.20
3	290	1.10	2.00	98	73.62
4	287	1.25	2.10	98	78.33
5	285	1.50	2.70	99	85.69
6	286	0.75	1.40	99	60.63
7	287	0.50	0.90	100	49.54
8	287	0.50	0.90	101	49.54
9	287	0.75	1.40	101	60.67
10	290	1.50	2.70	101	85.97
11	290	0.85	1.55	102	64.72
12	290	0.75	1.40	102	60.79
13	287	0.50	0.90	102	49.54
14	285	0.55	1.00	103	51.89
15	285	0.90	1.65	104	66.37
16	290	1.10	2.00	105	73.62
17	290	1.00	1.80	105	70.20
18	287	0.75	1.40	105	60.67
19	287	0.50	0.90	105	49.54
20	285	0.55	1.00	105	51.89
21	287	1.30	2.35	106	79.88
22	287	1.05	1.90	107	71.79
23	285	0.80	1.45	107	62.58
24	285	0.75	1.40	108	60.59
25	282	0.55	1.00	109	51.78
AVERAGE	287		1.60	103	64.86

DRY STANDARD VOLUME	41.41	SCF
PERCENT WATER VAPOR	22.88	% VOL
FLOW RATE	65833	ACFM
	35199	DSCFM
	59810	M3/HR
PARTICULATE CONCENTRATION	0.010	GR/DSCF
PARTICULATE EMISSION RATE	2.87	LB/HR
LB PART PER 1000 LB GAS	0.015	
ISOKINETIC PERCENT	97.3	

PAYNE & DOLAN 6-Oct-97 CONTROL 27 TABLE 2-3

TEST NO.	3			
BAROMETRIC PRESSURE	29.40	IN HG		
TIP DIAMETER	0.245	IN		
STACK DIMENSIONS	42	IN	58	IN
STACK AREA	16.917	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	25			
METER VOLUME	42.67	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.008			
PARTICULATE COLLECTED	0.0193	GRAMS		
WATER COLLECTED	279	ML		
STATIC PRESSURE	-0.66	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
4.50%	14.00%	0.00%	81.50%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	285	1.40	2.55	110	82.96
2	286	1.20	2.20	109	76.69
3	287	1.10	2.00	109	73.48
4	290	0.85	1.50	109	64.72
5	285	0.75	1.40	110	60.59
6	282	1.15	2.10	110	74.88
7	282	1.10	2.00	110	73.23
8	285	0.80	1.45	110	62.58
9	285	0.55	1.00	110	51.89
10	280	0.60	1.10	110	54.01
11	282	0.95	1.70	111	68.05
12	285	0.70	1.30	111	58.53
13	286	0.55	1.00	111	51.92
14	286	0.55	1.00	112	51.92
15	285	0.90	1.65	112	66.37
16	286	0.75	1.40	112	60.63
17	287	0.55	1.00	112	51.96
18	287	0.55	1.00	112	51.96
19	286	0.70	1.30	112	58.57
20	280	1.50	2.70	113	85.40
21	285	1.40	2.55	113	82.78
22	285	1.00	1.80	113	69.96
23	282	1.00	1.80	113	69.82
24	282	1.30	2.35	114	79.61
25	280	1.50	2.70	114	85.40
AVERAGE	284		1.70	111	66.72

DRY STANDARD VOLUME	42.65	SCF
PERCENT WATER VAPOR	23.54	% VOL
FLOW RATE	67717	ACFM
	36024	DSCFM
	61212	M3/HR
PARTICULATE CONCENTRATION	0.007	GR/DSCF
PARTICULATE EMISSION RATE	2.13	LB/HR
LB PART PER 1000 LB GAS	0.011	
ISOKINETIC PERCENT	97.9	

PAYNE & DOLAN
CONTROL 27 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	Production Rate TPH	Emission Factor lb/ton
C27-1	2.00	82	55.74	263.36	4.73	61487	0.64	300	0.0021
C27-2	2.00	84	55.53	361.64	6.51	59810	0.86	300	0.0029
C27-3	2.05	88	56.50	237.78	4.21	61212	0.57	300	0.0019
		AVERAGE			5.15		0.69		0.0023

Meter Gama 1.028
Bar.Pressure 29.40

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

SO2 EMISSIONS CALCULATIONS

P&D Control 27

Sulfur in Burner Fuel

S = 0.39% by weight

Mass of Oil

Mass of one gallon oil = mass of water x specific gravity of oil
Mass = 8.34 lb/gallon x 0..8916 = 7.4359 lb/gallon

Mass Flow of Sulfur Dioxide from the Burner

566 gallons/hour x 7.4359lbs/gallon x .39/100 sulfur/oil x 2 SO2/S =
32.83 lbs SO2/hour

Mass Flow of Sulfur Dioxide from the Plant Stack

15.73 lbs/hour

Sulfur Dioxide Capture Efficiency

EF = 100 x (Burner SO2 - Stack SO2) / Burner SO2

EF = **52.09** %

comp\plt\so2test.wk1

3.0 METHODS

3.1 Particulate

The equipment used to sample was the Western Precipitation Division of the Joy Manufacturing Company Emission Parameter Analyzer. Samples were collected in accordance with EPA Method 17.

The sampling train consisted of a probe tip, an in-stack thimble holder with tared thimble, and a tared 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 of the same solution; the third was a modified Greenburg Smith impinger dry; and 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.

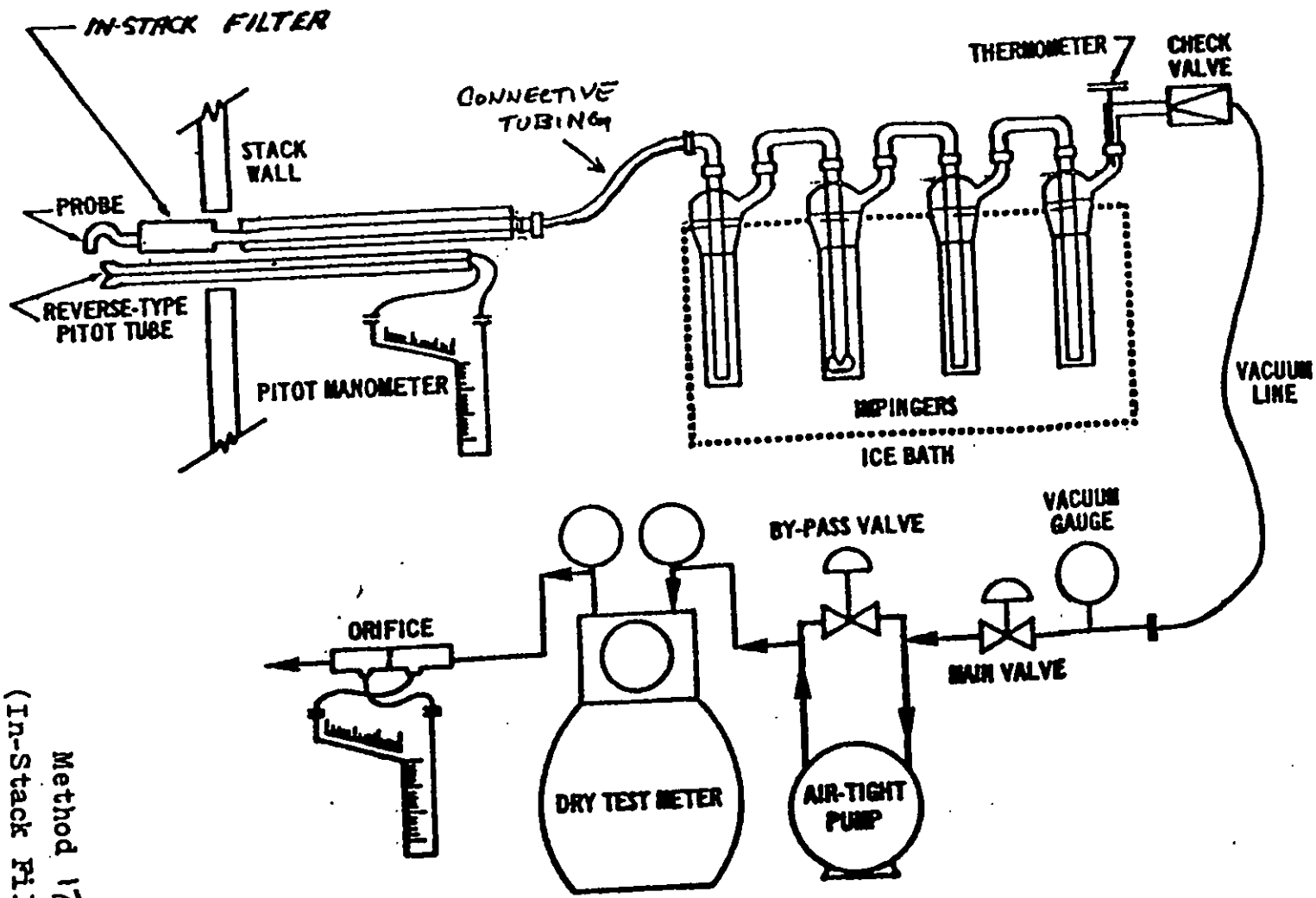
The temperatures of the stack gas stream, as well as strategic locations within the sampling devices, were monitored by RTDs and read directly from a gauge on the control unit.

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.

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

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



Particulate sampling train.

Method 17
(In-Stack Filter)

3.2 Sulfur Dioxide

Samples were collected and analyzed in accordance with the procedures outlined in EPA Method 6 (40 FR, Part 60, Appendix A). The sampling train consisted of a stainless steel probe with a glass wool plug serving as a filter. A series of four midget impingers followed in an ice bath. The first impinger contained 10 milliliters (ml) of 80% isopropyl alcohol, the second and third each contained 10 ml of 3% hydrogen peroxide, and the fourth was dry to serve as a trap for carry-over of any liquid. This train separates out sulfuric acid and sulfur trioxide in the first impinger and sulfur dioxide is collected in the second and third impingers. The gas then passed through a water trap and silica gel tube to trap all water vapor prior to the sampling pump and dry gas meter. A schematic of the sampling train is included as Figure 3-2.

The principle of the method was to collect a representative sample of the exhaust gas stream by placing the probe at a single point in the duct and sampling for a 20 minute period at a nominal sampling rate of 1 liter per minute. At the completion of each test, a leak check was performed and ambient air was purged through the sampling train for approximately 15 minutes.

The first impinger contents were then discarded while the second and third impinger contents were combined along with the washings from the connected tubing. Aliquots of this solution were diluted with known quantities of isopropyl alcohol and titrated with barium perchlorate using thorin indicator. From the quantity of titrant required, the weight of sulfur dioxide was calculated. This information was combined with the volume of gas sampled to determine the sulfur dioxide concentration. The emission rates were then calculated using these concentrations and the volumetric flow rate.

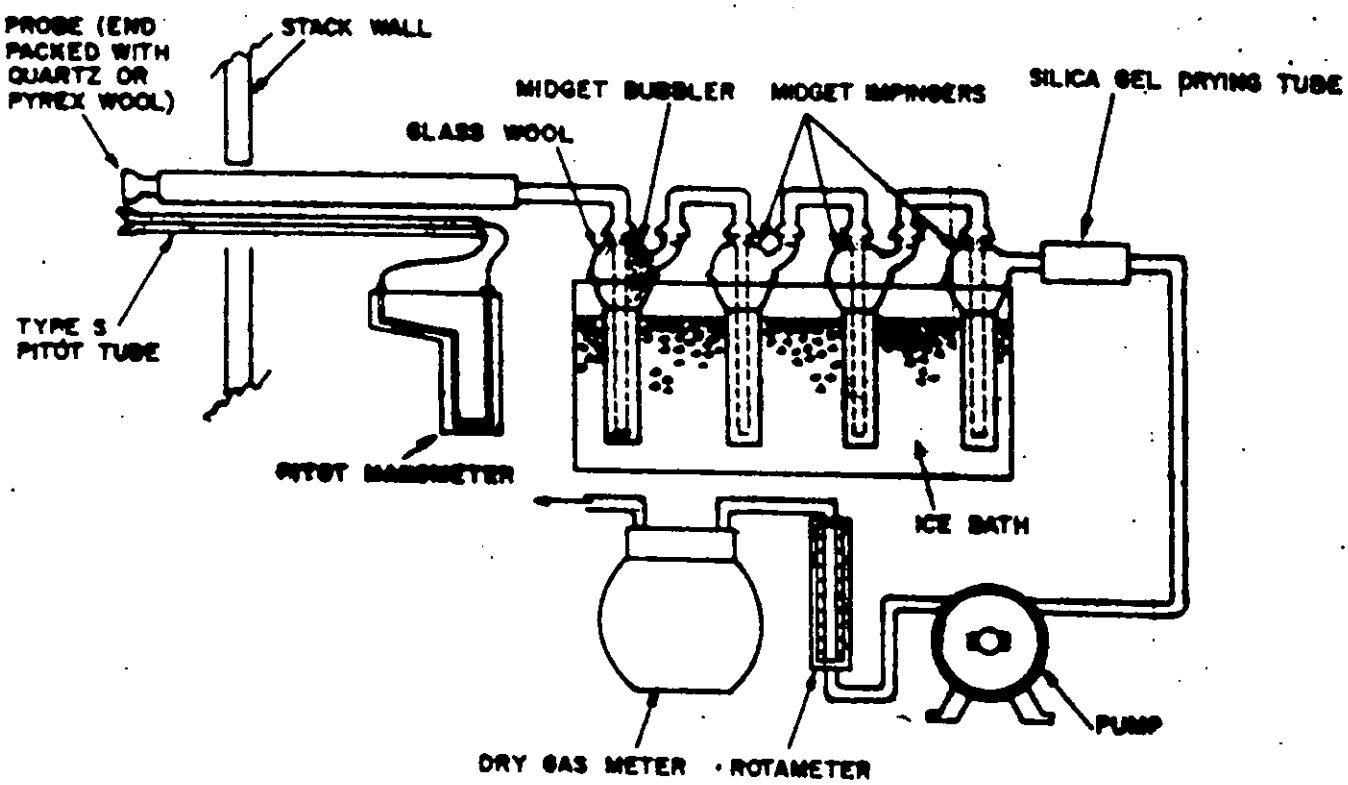


FIGURE - 1 SO_2 SAMPLING TRAIN

3.3 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.

4.0 CALIBRATIONS

4.1 Particulate

The probe tips, pitot tubes, dry gas meters, and orifices were calibrated prior to the test according to standard procedures as to procedures published by the EPA. The values obtained were:

Probe tip diameter	0.245"
Pitot tube coeff.	0.84
Orifice coeff.	1.832
Dry Gas Meter	1.008

4.2 Other Parameters

A dry gas meter was used to determine the sample volume obtained in the SO2 and formaldehyde tests. These dry gas meters were calibrated with a wet test meter. The values obtained were:

Sulfur Dioxide Meter	1.065
Formaldehyde Meter	1.028

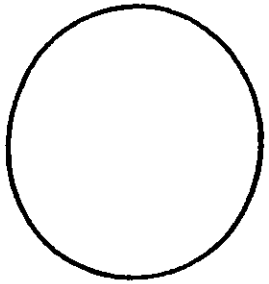
APPENDIX A

Field and Laboratory Data

Environmental Technology Engineering Corp.

PARTICULATE FIELD DATA

Cp: 0.87 γ: 1.008 9-30-8



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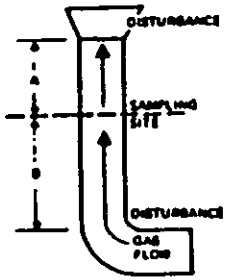


PLANT Payne & Dolan
DATE 10-6-97
LOCATION Horicon
OPERATOR WJD
STACK NO. Control 27
RUN NO. 1
SAMPLE BOX NO. 1
METER BOX NO. 1

AMBIENT TEMPERATURE 65
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 25
PROBE LENGTH, in. 4'+
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 58x42
PROBE HEATER SETTING –
HEATER BOX SETTING –

METER ΔH, 1.832
C FACTOR
PROCESS WEIGHT RATE ~300 TPH

ORSAT RESULTS
CO2
O2
CO
N2

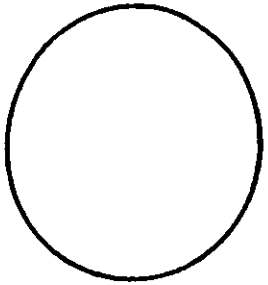
877

LEAK CHECKS
ok Pre <.01 22"
ok Pitot 4"
ok Post <.01 22"
ok Pitot 3"

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	SO_2 γ: 1.065 SAMPLE BOX TEMPERATURE °F	HCOH γ: 1.028 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A1	08/23		282	1.40	2.55		066.00		67	321.86/86	147.36/86	3	
2	55		282	1.25	2.15		68.2		68	22.66/78	149.36/78		
3	57½	-0.7	285	1.15	2.10		70.2		68	0.80/87	2.00/82		
4	00		285	0.80	1.45		72.2		69	(1A)		2	
5	02+		282	0.70	1.25		73.9		69				
B 6	05/05+		287	1.15	2.10		75.5		71				
7	08		285	1.00	1.80		77.5		72	323.06/76		4	
8	10+	-0.6	287	0.70	1.25		79.3		73	23.86/78			
9	13		288	0.55	1.00		80.9		73	0.80/77			
10	15+		285	0.55	1.00		82.2		73	(1B)		2	
C 11	18/18+		282	1.05	1.80		83.6		75				
12	21		285	0.75	1.35		85.5		75				
13	23+	-0.5	287	0.55	1.00		87.1		76				
14	26		287	0.55	1.00		88.5		77				
15	28+		285	0.80	1.45		89.9		78				
D 16	31/31+		280	0.85	1.55		91.5		80				
17	34	-0.6	282	0.50	.90		93.2		81				
18	36+		285	0.50	.90		94.5		82				
19	39		285	0.75	1.35		95.8		83				
20	41+		282	1.50	2.70		97.4	(45.51)	83			4	
E 21	44/44+		285	1.35	2.50		99.6		85			4	
22	47	-0.7	287	1.10	2.00		01.7		86				
23	49+		287	1.00	1.80		03.6	109.51	87				
24	52		285	1.15	2.10		05.4		90				
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		07.3		91				

Environmental Technology & Engineering Corp.

PARTICULATE FIELD DATA



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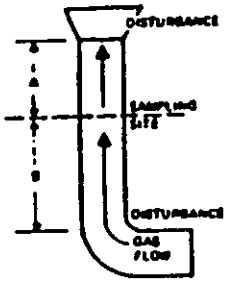


PLANT Payne & Dolan
DATE 10-6-97
LOCATION Horicon
OPERATOR WJD
STACK NO. Control 27
RUN NO. 2
SAMPLE BOX NO. 2
METER BOX NO. 1

AMBIENT TEMPERATURE _____
BAROMETRIC PRESSURE _____
ASSUMED MOISTURE, % 25
PROBE LENGTH, in. 4'+
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 58 x 42
PROBE HEATER SETTING -
HEATER BOX SETTING -

METER ΔH, _____
C FACTOR _____
PROCESS WEIGHT RATE _____

ORSAT RESULTS
CO2 _____
O2 _____
CO _____
N2 _____

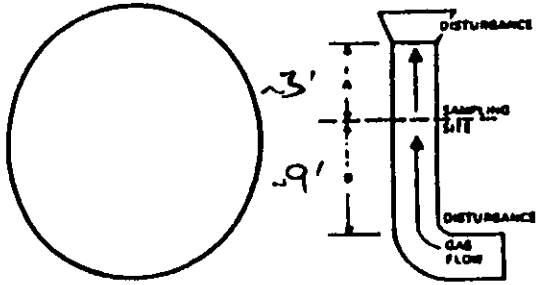
LEAK CHECKS
ok Pre 5.01 22"
ok Pitot 4"
ok Post .007 22"
ok Pitot 4"+

87 2

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	SO2 SAMPLE BOX TEMPERATURE °F	HCOH TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
E 1	1015		288	1.35	2.50		111.00		99	325.06/80	149.55/80	3	
2	17+		290	1.00	1.80		13.1		99	25.88/82	151.55/88		
3	20	-0.7	290	1.10	2.00		15.0		98	0.80/81	2.00/84		
4	22+		287	1.25	2.10		16.8		98	2A			
5	25		285	1.50	2.70		18.8		99			4	
D 6	27+/28		286	.75	1.40		21.0		99				
7	30+	-0.7	287	.50	.90		22.6		100	326.23/80			
8	33		287	.50	.90		24.0		101	27.23/88		2	
9	35+		287	.75	1.40		25.2		101	1.00/85			
10	38		290	1.50	2.70		26.8		101	2B			
C 11	40+/41		290	.85	1.55		29.0		102				
12	43+	-0.6	290	.75	1.40		30.7		102				
13	46		287	.50	.90		32.3		102				
14	48+		285	.55	1.00		33.6		103				
15	51		285	.90	1.65		34.9		104			3	
B 16	53+/54		290	1.10	2.00		36.6		105				
17	56+		290	1.00	1.80		38.4		105				
18	59	-0.6	287	.75	1.40		40.2		105				
19	04		287	.50	.90		41.7	41.58	105				
20	04		285	.55	1.00		43.0		105				
A 21	06+/07		287	1.35	2.35		44.3		106			4	
22	09+	-0.6	287	1.05	1.90		46.4	152.58	107				
23	12		285	.80	1.45		48.1		107				
24	14		285	.75	1.40		49.7		108				

Environmental Technology Engineering Corp.

PARTICULATE FIELD DATA



CROSS SECTION

PLANT Payne + Dolan
DATE 10-6-97
LOCATION Ibricon
OPERATOR WJD
STACK NO. Control 27
RUN NO. 3
SAMPLE BOX NO. 3
METER BOX NO. 1

AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 25
PROBE LENGTH, in. 4'+
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 58 x 90
PROBE HEATER SETTING –
HEATER BOX SETTING –

METER ΔH@
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO2 12.5
O2 12.0
CO
N2
879

LEAK CHECKS
Pre c.01 22
Pitot 4"+
Post
Pitot

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_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	SO2 SAMPLE BOX TEMPERATURE °F	HCOH TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	1130		285	1.60	2.55		154.00		110	328.12/86	151.55/86	4	
2	32+		286	1.20	2.20		56.2		109	28.96/90	153.60/90		
3	35	-0.7	287	1.10	2.00		58.1		109	0.84/88	2.03/88		
4	37+		290	.85	1.50		60.0		109	3A			
5	40		285	.75	1.40		61.7		110			3	
B 6	4 21/43		287	1.15	2.10		63.2		110				
7	45+		282	1.10	2.00		65.1		110	529.60/90			
8	48	-0.7	285	.80	1.45		67.0		110	530.40/90			
9	50+		285	.55	1.60		68.5		110	0.20/90		2	
10	53		280	.60	1.10		69.9		110	3B			
C 11	55/56		282	.95	1.70		71.3		111				
12	58+		285	.70	1.50		73.0		111				
13	61	-0.6	286	.55	1.00		74.5		111			2	
14	03+		286	.55	1.00		75.9		112				
15	06		285	.90	1.65		77.2		112				
D 16	03/09		286	.75	1.40		78.9		112			3	
17	11+		287	.55	1.00		80.5		112				
18	14	-0.6	287	.55	1.00		81.8		112				
19	16+		286	.70	1.30		83.1	42.67	112				
20	19		290	1.50	2.70		84.7		113				
21	21/22		285	1.90	2.55		86.9		113				
22	25+	-0.7	285	1.00	1.80		89.0	196.67	113			4	
23	28		282	1.01	1.80		90.8		113				
24	31+		282	1.30	2.35		92.6		114				
25	35		285	1.50	2.75		94.6		114				

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Payne + Dolan - Control #27 DATE OF TEST 10/6/97

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 1 STACK Asphalt Plant Exhaust

Sample Box 1 Filter T-877 Wash Bottle. —

Beaker No. 7

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	299	100	199
2	156	100	56
3	3	0	3
Sil Gel	696	685	11
		TOTAL	269

PARTICULATE COLLECTED

	Blank	Final Wt. g	Tare Wt. g	Collected grams
Filter		1.0440	1.0163	0.0277
Washings	0.0004	115.4385	115.4372	0.0009
			TOTAL	0.0286

WATER COLLECTED 269 GRAMS

PARTICULATE COLLECTED 0.0286 GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Payne + Dolan - Center #27 DATE OF TEST 10/6/77

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 2 STACK Asphalt Plant Exhaust

Sample Box 2 Filter T-878 Wash Bottle —

Beaker No. 8

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	244	100	144
2	165	100	65
3	50	0	50
Sil Gel	635	633	2
		TOTAL	261

PARTICULATE COLLECTED

	BLANK	Final Wt. g	Tare Wt. g	Collected grams
Filter		0.9947	0.9690	0.0257
Washings	0.0004	103.1757	103.1751	0.0002
			TOTAL	0.0259

WATER COLLECTED 261 GRAMS

PARTICULATE COLLECTED 0.0259 GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Payne & Dolan - Contract #27 DATE OF TEST 10/6/97

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 3 STACK Asphalt Plant Exhaust

Sample Box 3 Filter T-879 Wash Bottle -

Beaker No. 9

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	269	100	169
2	198	100	98
3	3	0	3
Sil Gel	653	644	9
		TOTAL	279

PARTICULATE COLLECTED

	BLANK	Final Wt. g	Tare Wt. g	Collected grams
Filter		1.0219	1.0030	0.0189
Washings	0.0004	102.1679	102.1671	0.0004
			TOTAL	0.0193

WATER COLLECTED 279 GRAMS

PARTICULATE COLLECTED 0.0193 GRAMS

NOTES:

PAYNE & DOLAN
CONTROL 27 PLANT
SO2 LAB RESULTS

Sample no.	Vol.Solution ml	Vol. Aliq. ml	Vol.Titrant ml	Vol.Tit. BL ml	N. Titrant	mg. SO2	mg/m3	Meter Vol. ft3	Meter GAMA	Meter T deg F	Pb in Hg	Meter Std. scf	Std m3	Flow Rate m3/hr	Emission Rate lb/hr
1A	19.0	3.0	1.25	0.02	0.010	2.495	108.03	0.80	1.065	82	29.4	0.816	0.023	61487	14.64
1B	18.0	3.0	1.45	0.02	0.010	2.748	117.89	0.80	1.065	77	29.4	0.823	0.023	61487	15.96
AVG							112.96								15.31
2A	19.2	3.0	1.40	0.02	0.010	2.829	122.25	0.80	1.065	81	29.4	0.817	0.023	59810	16.12
2B	18.8	3.0	1.65	0.02	0.010	3.272	113.95	1.00	1.065	85	29.4	1.014	0.029	59810	15.03
AVG							118.10								15.57
3A	18.7	3.0	1.50	0.02	0.010	2.955	123.19	0.84	1.065	88	29.4	0.847	0.024	61212	16.62
3B	20.5	3.0	1.30	0.02	0.010	2.802	123.09	0.80	1.065	90	29.4	0.804	0.023	61212	16.61
AVG							123.14								16.62

Data Analysis Technologies, Inc.
6385 Shier Rings Rd.
Dublin, OH 43016

Sample Analysis Certificate

Environmental Technology and Engineering, Inc.
13000 West Bluemound Rd.
Elm Grove, WI 53122

Date:	10/22/97
Project ID:	1097019
Sample Date:	10/10/97
Sample Time:	NA
Date Received:	10/14/97

Attn: Bill Dick
Project #: 2180
Sampled by: NA

FORMALDEHYDE ANALYSIS BY METHOD TO-5

Project: 1097019

Lab Id:	Client Id:	Analyte	Total ug Q
1097019-1	C27-1 HCOH	Formaldehyde	265.07 D
1097019-2	C27-2 HCOH	Formaldehyde	363.35 D
1097019-3	C27-3 HCOH	Formaldehyde	239.49
1097019-4	C27 Blank	Formaldehyde	1.71
1097019-MB	Method Blank	Formaldehyde	0.07 ND

ND: Analyte not detected.
Minimum detection reported.
D: Dilution result

Reviewed and approved for release by: _____ President Date: 10/22/97

Oil Services, Inc.

Quality Used Oil Recyclers

C27
Oct 5

As a used oil marketer, Oil Services, Inc. is subject to EPA regulations 40 CFR Part 266 and Vo. 50, No. 230. In this respect, I am pleased to submit the following data regarding the used oil fuel that you are receiving: Milwaukee, WI Group 7

Constituent/ Property	EPA Specification Used Oil	Your Requirements	Oil Services Used Oil Analysis Report #9721
Arsenic	5 ppm Max.	5 ppm Max.	0 ppm
Cadmium	2 ppm Max.	2 ppm Max.	1.6 ppm
Chromium	10 ppm Max.	10 ppm Max.	1.5 ppm
Lead	100 ppm Max.	400 ppm Max.	113 ppm
Flashpoint	100°F. Min. #1	140 °F. Min.	>210 °F.
Total Halogens	4,000 ppm Max. #2	1,000 #2 ppm Max.	585 ppm
Sulphur % by Wt.	N/A	.9 Specified	.38 .39
Ash % by Wt.	N/A	1.0 Specified	.73
B.T.U./gal.	N/A	>130 Specified	143,000
Acidity	N/A	Neutral Specified	Neutral
Specific Gravity	N/A	.8-.9 Specified	.8916/API 27.2
PCB's	Varied	0 ppm	0 ppm

#1 - Individual states may require a higher flashpoint, further reducing the possibility of solvent and/or cleaning solution contamination.

#2 - Used oil containing more than 1,000 ppm of total Halogens is presumed hazardous, unless a rebuttle analysis is performed to prove there are no hazardous constituents per EPA regulation 40 CFR Part 266.40 (c), and Subpart D.

Finally, this letter is to assure you that Oil Services, Inc. will be complying with all EPA and individual state requirements, and if I can be of any further assistance, please feel free to contact me at (414) 548-1482.

Sincerely,

David E. Jensen
Quality/Compliance Control Manager
Oil Services, Inc.

2020 Springdale Road • P.O. Box 582 • Waukesha, WI 53187 • (414) 548-1482

ASPHALT PLANT STACK TEST DATA

Date 10-6-97
FID # 999 516 760

Control # 27

Time*	Burner %	PSI Fuel Pressure	Production TPH	Aggregate TPH	A/C TPH	RAP TPH	Mix Temp	Stack Temp	Photo-helic	Magne-helic	Fuel Flow Rate	CO ppm	CO2 ppm	O2 %
9:00	80	100	300	237	13.1	60	290	300	.08	5	8.5			
9:15	70	100	300	237	13.2	60	295	304	.07	5	9.5			
9:30	65	100	300	237	13.1	60	295	304	.08	5	9.5			
9:45	65	100	300	237	13.2	60	290	305	.08	5	9.5			
10:00	65	100	300	237	13.1	60	290	306	.08	4.5	9.5			
10:15	6	100	300	237	13.1	6.0	295	305	.07	5	9.5			
10:30	6.5	100	300	237	13.1	58	295	305	.07	5	9.5			
10:45	6.5	100	300	238	13.2	58	295	304	.08	5	9.5			
11:00	6.5	100	300	235	13.2	58	300	303	.08	5	9.5			
11:15	6.5	100	300	238	13.1	59	295	304	.08	5	9.5			
11:30	6	100	300	240	13.1	58	300	303	.07	5	9.5			
11:45	6	100	300	240	13.0	58	300	302	.08	5	9.5			
12:00	6	100	300	238	13.1	59	300	303	.08	5	9.5			
12:15	6	100	300	238	13.1	59	300	301	.08	6	9.5			
12:30	6	100	300	235	13.1	57	300	302	.08	6	9.5			

SOG [illegible]

Fuel Type Waste Oil

Sulfur in Fuel 0.39 %

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

COMP\PLT\TESTDATA.WK1

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