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: 374

Title: Stack Emission Test, Payne And Dolan, Inc., Control 25 Plant, Markesan, WI,

Environmental Technology and Engineering Corporation, Elm Grove, WI,

October 7, 1998.

Sec. 11.1
Ref. 374

SO2

HCl

Report to

PAYNE & DOLAN, INC.

Waukesha, Wisconsin

for

STACK EMISSION TEST
CONTROL 25 PLANT
WDNR AIR POLLUTION CONTROL PERMIT NO. 89-IRS-072
FID NO. 999010760

October 7, 1998

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 7, 1998, Environmental Technology & Engineering Corp. personnel performed stack emissions testing at the Payne & Dolan, Inc. Control 25 portable plant located in Markesan, Wisconsin. The tests were performed as a provision of Air Pollution Control Permit No. 89-IRS-072 issued by the State of Wisconsin Department of Natural Resources. Tests were performed in order to determine compliance with the applicable particulate emission limitation. Additional tests were performed to determine plant specific emission factors for sulfur dioxide and hydrogen chloride. All measured particulate emissions were well below the limits shown in the following table:

TEST NO.	PARTICULATE	HYDROGEN CHLORIDE	SULFUR DIOXIDE
1	0.017 gr/dscf	0.08 lb/hr	6.86 lb/hr
2	0.021	0.10	7.46
3	0.020	0.06	6.78
AVERAGE	0.019 gr/dscf	0.08 lb/hr	7.03 lb/hr
DNR LIMIT	0.039	NA	NA
% OF LIMIT	49.6 %	NA	NA

1.0 GENERAL

On October 7, 1998, Environmental Technology & Engineering Corp. (ETE) personnel performed stack emissions testing at the Payne & Dolan, Inc. Control 25 portable plant located in Markesan, Wisconsin. The purpose of the testing was to determine the particulate emissions from the plant as a condition of Air Pollution Control Permit No. 89-IRS-072 issued by the State of Wisconsin Department of Natural Resources (WDNR). The Facility Identification Number (FID) for this plant is 999010760. Sulfur dioxide and hydrogen chloride testing were also performed at this time in order to determine plant specific emission factors.

Ron Kilby and Brent Zelachowski of Payne & Dolan was responsible for assuring proper operating conditions throughout the testing. During the test the plant production rate was approximately 250 tons per hour. 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. 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. Hydrogen chloride 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	HYDROGEN CHLORIDE	SULFUR DIOXIDE
1	0.017 gr/dscf	0.08 lb/hr	6.86 lb/hr
2	0.021	0.10	7.46
3	0.020	0.06	6.78
AVERAGE	0.019 gr/dscf	0.08 lb/hr	7.03 lb/hr
DNR LIMIT	0.039	NA	NA
% OF LIMIT	49.6 %	NA	NA

Tables with detailed results of the SO2 and HCl testing are included as Tables 2-4 and 2-5.

EMISSIONS CALCULATIONS

P&D Control 25 FID 999010760

Hydogen Chloride in the Burner Fuel: Burner fuel was analyzed for total halogens, which were expressed as chlorine. Since air toxics considerations are related to hydrogen chloride emissions, chlorine masses and concentrations were corrected to hydrogen chloride.

Cl concentration in the burner fuel = 587.3 parts per million, by weight.
HCl concentration in the burner fuel = 36/35 x 587.3 =
604.1 parts per million, by weight

Mass of Oil

Mass of one gallon oil = mass of water x specific gravity of oil
Mass = 8.34 lb/gallon x 0.8933 = 7.45 lb/gallon

Mass Flow of Hydrogen Chloride from the Dryer Drum Burner

6 gallons per minute x 60 minutes per hour x 7.45 lb/gallon x 604.1/1000000 =

1.62 lbs HCl/hour from the dryer drum

Mass Flow of Hydrogen Chloride from the Plant Stack

0.08 lbs/hour

Hydrogen Chloride Capture Efficiency

EF = 100 x (Burner HCl - Stack HCl) / Burner HCL

EF = **95.06 %**

comp\plt\HCltest.wk1

SO2 EMISSIONS CALCULATIONS

Control 25 FID 999010760

Sulfur in Burner Fuel

S = 0.437% by weight

Mass of Oil

Mass of one gallon oil = mass of water x specific gravity of oil
Mass = 8.34 lb/gallon x 0.8933 = 7.45 lb/gallon

Mass Flow of Sulfur Dioxide from the Burner

8 gallons per minute x 60 minutes per hour x 7.45 lbs/gallon x 0.437/100 sulfur/oil x 2 SO2/S = **31.25** lbs SO2/hour

Mass Flow of Sulfur Dioxide from the Plant Stack

7.03 lbs/hour

Sulfur Dioxide Capture Efficiency

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

EF = **77.50 %**

comp\plt\so2test.wk1

Department of Natural Resources

SMOKE FORM
Form 4500-29 Rev. 6-85

Name of Company: P&D #25 Payne & Dolan	Date: 10.7.98
Location:	FID Number: 999010760
City, State, Zip Code: Markesan, WI	Observer Certification Date: 4.7.98
Discharge Location: Stack	Control Device: Bag house
Height of Discharge Above Ground: 35'	Steam Plume? Attached (Yes) Detached No

	Initial		Final
Time of Observation	12:04		12:10
Observer Location: Distance to Discharge	100'		
Direction from Discharge	SE		
Height of Observation Point in Relation to Discharge	-29		
Plume Description (Color, Length, etc.)	white		
Plume Background Description	sky		
Weather Conditions: Wind Direction	SW		
Wind Speed	0-20		
Ambient Temperature	60°		
Sky Conditions (clear, overcast, % clouds, etc.)	overcast 100%		

Describe Point in Plume at Which Opacity was Determined

Remarks: Point of max density

TPH 254

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

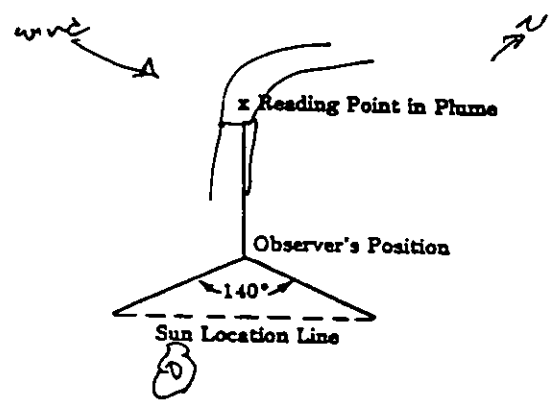
Summary of Average Opacity
(From Computer Program)

Set Number	Time Start — End	Opacity Sum	Opacity Average

Signature of Observer: [signature]

Name of Observer (Please print): Ron Kirby

Sketch of Observer, Discharge, and Sun Location.



Allowable Source Opacity 20%

Department of Natural Resources

SMOKE FORM
Form 4500-29 Rev. 6-85

Name of Company: PSD #25 Payne Dolan	Date: 10.7.98
Location:	FID Number: 999010760
City, State, Zip Code: Markham	Observer Certification Date: 4.7.98
Discharge Location: Stack	Control Device: Baghouse
Height of Discharge Above Ground: 25'	Steam Plume? Attached (Yes) Detached No

	Initial		Final
Time of Observation	9:00	—	9:06
Observer Location			
Distance to Discharge	100'		
Direction from Discharge	4/E		
Height of Observation Point in Relation to Discharge	-29 ft		
Plume Description (Color, Length, etc.)	white		
Plume Background Description	sky		
Weather Conditions			
Wind Direction	NE		
Wind Speed	0-15		
Ambient Temperature	60°		
Sky Conditions (clear, overcast, % clouds, etc.)	overcast 95%		

Describe Point in Plume at Which Opacity was Determined

point of max density

Remarks:

TPH 254

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

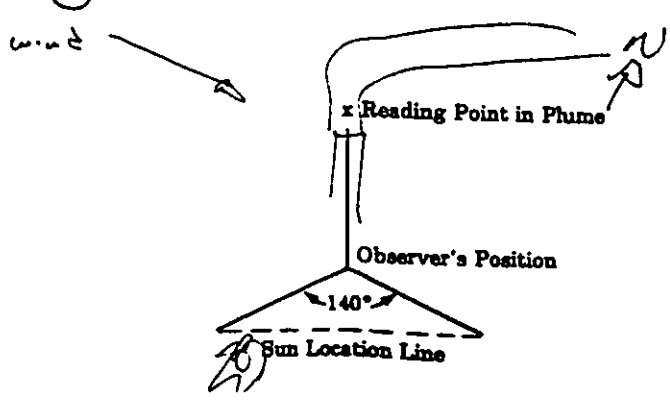
Summary of Average Opacity
(From Computer Program)

Set Number	Time Start — End	Opacity Sum	Opacity Averag

Signature of Observer: [signature]

Name of Observer (Please print): Ron Kilby

Sketch of Observer, Discharge, and Sun Location.



Allowable Source Opacity 20%

Department of Natural Resources

SMOKE FORM
Form 4500-29 Rev. 6-85

Name of Company: P&D N25 Rayne's Dolan	Date: 10.7.98
Location:	FID Number: 999010760
City, State, Zip Code: Martesan	Observer Certification Date: 4.7.98
Discharge Location: Stack	Control Device: Baghouse
Height of Discharge Above Ground: ~~Stack~~ 35'	Steam Plume? Attached / Yes / Detached / No

	Initial		Final
Time of Observation	10:15		10:21
Observer Location			
Distance to Discharge	100'		
Direction from Discharge	SSE		
Height of Observation Point in Relation to Discharge	-29ft		
Plume Description (Color, Length, etc.)	white		
Plume Background Description	sky		
Weather Conditions			
Wind Direction	SW		
Wind Speed	0-15		
Ambient Temperature	60°		
Sky Conditions (clear, overcast, % clouds, etc.)	overcast 100%		

Describe Point in Plume at Which Opacity was Determined: Point of max density

Remarks:

TPH254

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

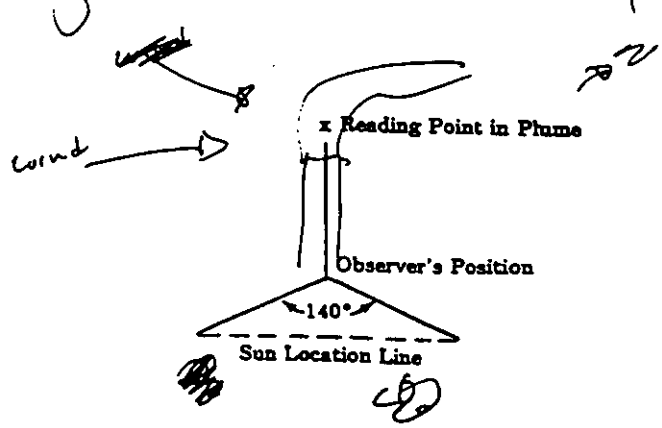
Summary of Average Opacity
(From Computer Program)

Set Number	Time Start — End	Opacity Sum	Opacity Average

Signature of Observer: RKilby

Name of Observer (Please print): Ron Kilby

Sketch of Observer, Discharge, and Sun Location.



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PAYNE & DOLAN
CONTROL 25 PLANT

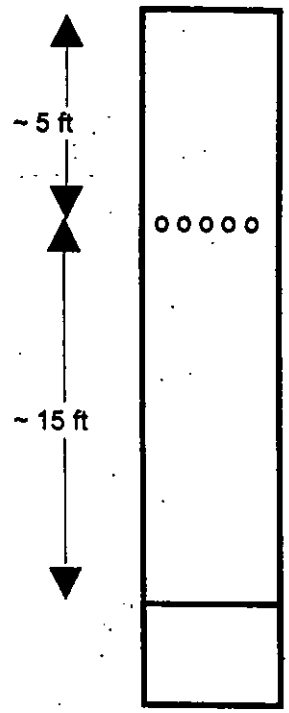
FIGURE 2-1

SAMPLE PORT LOCATION

L x W
50" x 48"

SAMPLE POINT LOCATION

POINT	DISTANCE
1	5.0
2	15.0
3	25.0
4	35.0
5	45.0



PAYNE & DOLAN 7-Oct-98 CONTROL 25 TABLE 2-1

TEST NO.	1			
BAROMETRIC PRESSURE	29.35	IN HG		
TIP DIAMETER	0.250	IN		
STACK DIMENSIONS	50	IN	48	IN
STACK AREA	16.667	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	25			
METER VOLUME	39.13	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	0.993			
PARTICULATE COLLECTED	0.0424	GRAMS		
WATER COLLECTED	401	ML		
STATIC PRESSURE	-0.50	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
6.80%	12.20%	0.00%	81.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	260	1.60	2.70	50	88.72
2	261	1.00	1.70	50	70.19
3	262	1.50	2.50	51	86.02
4	260	2.40	4.00	51	108.66
5	260	3.60	6.00	52	133.08
6	260	0.80	1.35	53	62.73
7	262	0.60	1.00	53	54.40
8	265	0.60	1.00	54	54.52
9	260	1.20	2.00	55	76.83
10	260	2.00	3.30	56	99.19
11	258	0.60	1.00	59	54.25
12	258	0.60	1.00	60	54.25
13	260	0.20	0.34	60	31.37
14	260	0.50	0.85	61	49.60
15	260	1.00	1.70	62	70.14
16	260	0.20	0.34	62	31.37
17	260	0.30	0.51	63	38.42
18	260	0.30	0.51	63	38.42
19	262	0.20	0.34	64	31.41
20	260	0.60	1.00	64	54.33
21	254	0.30	0.51	65	38.26
22	255	0.30	0.51	65	38.28
23	255	0.20	0.34	65	31.26
24	255	0.20	0.34	66	31.26
25	254	0.60	1.00	67	54.10
AVERAGE	259		1.43	59	59.24

DRY STANDARD VOLUME	38.20	SCF
PERCENT WATER VAPOR	33.07	% VOL
FLOW RATE	59242	ACFM
	28518	DSCFM
	48457	M3/HR
PARTICULATE CONCENTRATION	0.017	GR/DSCF
PARTICULATE EMISSION RATE	4.29	LB/HR
LB PART PER 1000 LB GAS	0.025	
ISOKINETIC PERCENT	104.8	

PAYNE & DOLAN 7-Oct-98 CONTROL 26 TABLE 2-2

TEST NO.	2			
BAROMETRIC PRESSURE	29.35	IN HG		
TIP DIAMETER	0.250	IN		
STACK DIMENSIONS	50	IN	48	IN
STACK AREA	16.667	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	25			
METER VOLUME	40.5	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	0.993			
PARTICULATE COLLECTED	0.0531	GRAMS		
WATER COLLECTED	354	ML		
STATIC PRESSURE	-0.50	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
7.00%	11.80%	0.00%	81.20%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	260	1.60	2.70	75	88.01
2	258	1.00	1.70	76	69.48
3	255	1.60	2.70	77	87.71
4	257	2.50	4.20	79	109.79
5	260	3.50	5.80	80	130.17
6	260	1.00	1.70	81	69.58
7	260	0.80	1.35	81	62.23
8	258	0.60	1.00	82	53.82
9	258	0.80	1.35	83	62.15
10	260	2.40	4.00	83	107.79
11	255	0.60	1.00	84	53.71
12	255	0.60	1.00	85	53.71
13	260	0.40	0.68	85	44.01
14	262	0.60	1.00	86	53.97
15	256	1.40	2.50	87	82.10
16	256	0.60	1.00	87	53.75
17	256	0.40	0.68	87	43.88
18	256	0.20	0.34	88	31.03
19	258	0.30	0.51	88	38.06
20	255	0.80	1.35	88	62.02
21	255	0.30	0.51	90	37.98
22	254	0.30	0.51	90	37.95
23	254	0.20	0.34	90	30.99
24	255	0.20	0.34	89	31.01
25	252	0.50	0.85	88	48.93
AVERAGE	257		1.56	84	61.75

DRY STANDARD VOLUME	39.67	SCF
PERCENT WATER VAPOR	29.58	% VOL
FLOW RATE	61752	ACFM
	31375	DSCFM
	53312	M3/HR
PARTICULATE CONCENTRATION	0.021	GR/DSCF
PARTICULATE EMISSION RATE	5.52	LB/HR
LB PART PER 1000 LB GAS	0.031	
ISOKINETIC PERCENT	98.9	

PAYNE & DOLAN 7-Oct-98 CONTROL 25 TABLE 2-3

TEST NO.	3			
BAROMETRIC PRESSURE	29.35	IN HG		
TIP DIAMETER	0.250	IN		
STACK DIMENSIONS	50	IN	48	IN
STACK AREA	16.667	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	25			
METER VOLUME	40.74	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	0.993			
PARTICULATE COLLECTED	0.0508	GRAMS		
WATER COLLECTED	327	ML		
STATIC PRESSURE	-0.50	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
6.80%	12.00%	0.00%	81.20%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	235	1.50	2.50	70	83.43
2	242	1.10	1.85	72	71.81
3	245	1.60	2.70	73	86.79
4	248	2.40	4.00	74	106.52
5	250	3.60	6.00	75	130.64
6	252	1.00	1.70	75	68.95
7	250	0.80	1.35	75	61.59
8	250	0.60	1.00	75	53.33
9	252	1.00	1.70	75	68.95
10	252	2.20	3.70	75	102.27
11	255	0.60	1.00	75	53.52
12	255	0.60	1.00	75	53.52
13	252	0.60	1.00	76	53.41
14	255	0.60	1.00	76	53.52
15	256	1.20	2.00	77	75.74
16	256	0.50	0.85	77	48.89
17	260	0.40	0.68	78	43.85
18	260	0.40	0.68	78	43.85
19	258	0.30	0.51	78	37.93
20	256	1.00	1.70	78	69.15
21	255	0.30	0.51	79	37.85
22	256	0.20	0.34	79	30.92
23	256	0.20	0.34	80	30.92
24	255	0.20	0.34	80	30.90
25	254	0.40	0.68	80	43.67
AVERAGE	253		1.57	76	61.68

DRY STANDARD VOLUME	39.87	SCF
PERCENT WATER VAPOR	27.85	% VOL
FLOW RATE	61678	ACFM
	32303	DSCFM
	54889	M3/HR
PARTICULATE CONCENTRATION	0.020	GR/DSCF
PARTICULATE EMISSION RATE	5.35	LB/HR
LB PART PER 1000 LB GAS	0.029	
ISOKINETIC PERCENT	96.6	

PAYNE & DOLAN CONTROL 25
DRUM MIX PLANT
SULFUR DIOXIDE RESULTS

TABLE 2-4

Test No.	SO2 Conc mg/m3	Flow Rate m3/hr	SO2 ER lb/hr	Production Rate TPH	SO2 Factor lb/ton
C25-1	64.19	48457	6.86	250	0.027
C25-2	63.46	53312	7.46	246	0.030
C25-3	56.04	54889	6.78	246	0.028
AVERAGE	61.23		7.03		0.028

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

PAYNE & DOLAN CONTROL 25
DRUM MIX PLANT
HYDROGEN CHLORIDE RESULTS

TABLE 2-5

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	Production Rate TPH	Emission Factor lb/ton
C25-1	2.08	82	59.95	46	0.77	48457	0.08	250	0.00033
C25-2	2.20	87	62.83	51	0.81	53312	0.10	246	0.00039
C25-3	1.50	82	43.23	21	0.49	54889	0.06	246	0.00024
		AVERAGE			0.69		0.08		0.00032

Meter Gama 1.065
Bar.Pressure 29.35

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

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.

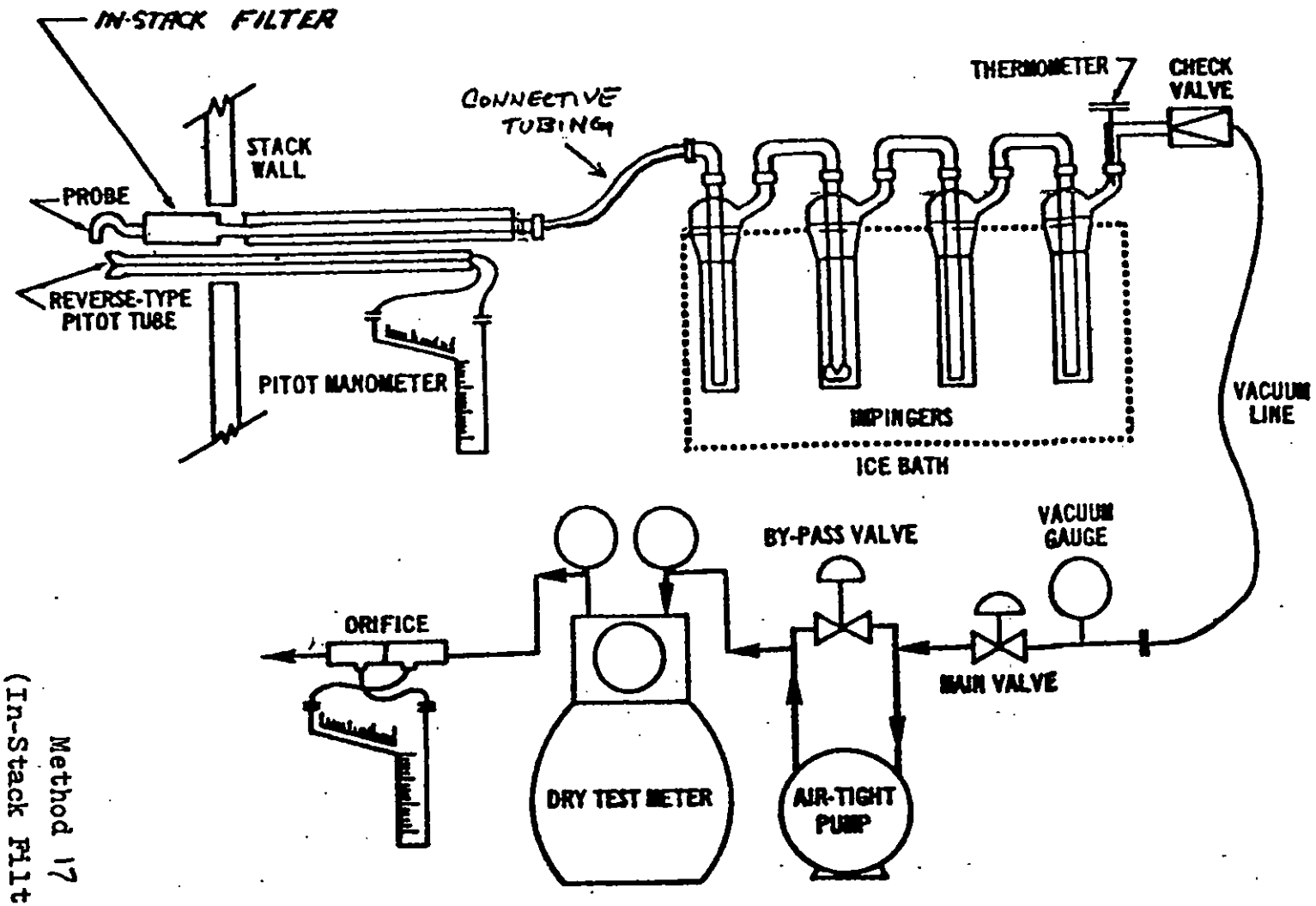
The temperatures of the stack gas stream, as well as strategic locations within the sampling devices, were monitored by RTDs and read directly from a gauge on the control unit.

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.

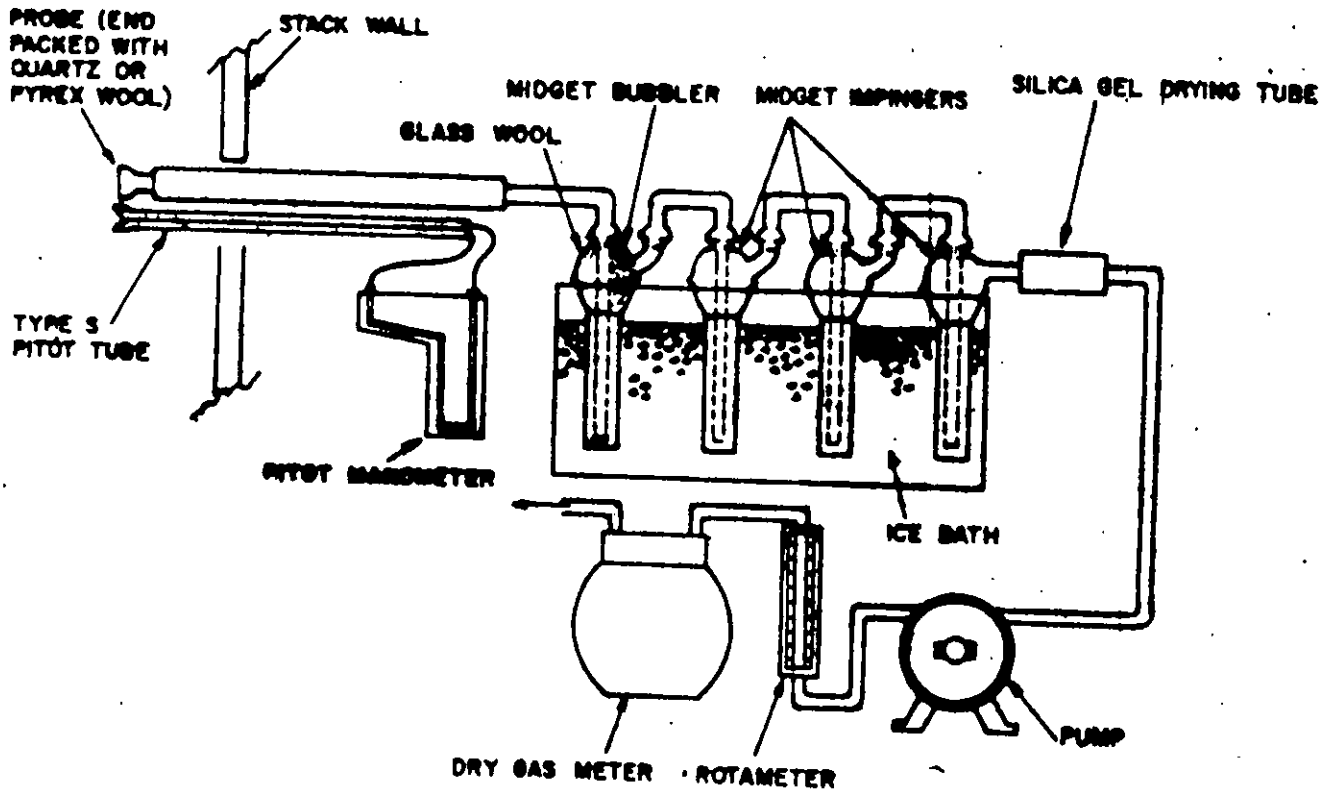


FIGURE - 1 SO_2 SAMPLING TRAIN

3.3 Hydrogen Chloride

Samples were collected and analyzed in accordance with the procedures outlined in EPA Method 26 (40 FR, Part 60, Appendix A). The sampling train consisted of a heated glass probe followed by a heated filter. A series of five midget impingers followed in an ice bath. The first two impingers contained 15 milliliters (ml) of 0.1 N sulfuric acid, the third and fourth each contained 15 ml of 0.1 N sodium hydroxide, and the fifth contained silica gel to remove moisture. The gas then passed through a sampling pump and dry gas meter. A schematic of the sampling train is included as Figure 3-3.

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 60 minute period at a nominal sampling rate of about 2 liters 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.

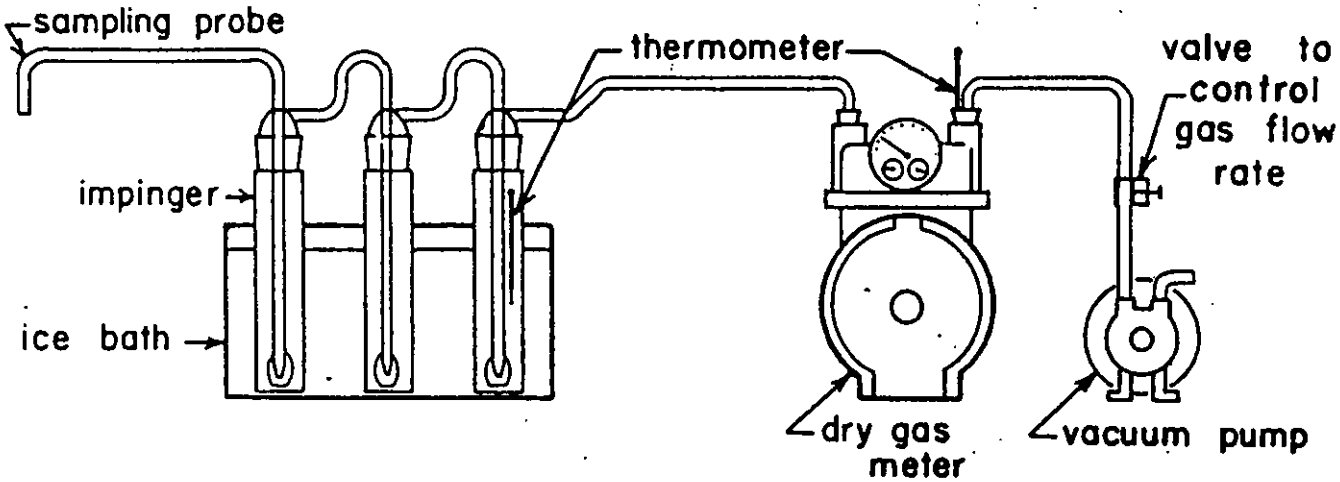
The first two impinger contents were then analyzed for hydrogen chloride content by ion chromatography. The analysis was performed at DAT, Inc. The laboratory information was combined with the volume of gas sampled to determine the HCl concentration. The emission rates were then calculated using these concentrations and the volumetric flowrate.

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	0.250"
Pitot tube coeff.	0.84
Orifice coeff.	1.832
Dry Gas Meter	0.993



IMPINGER SAMPLING TRAIN

4.2 Other Parameters

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

Sulfur Dioxide Meter	1.028
Hydrogen Chloride Meter	1.065

Plant Name: #25010

ASPHALT PLANT STACK TEST DATA

Date: 10-7-98
FID # 999010760

Time*	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 %
9:00	42	150	252	241	5.1	0	306	250	.14	.34	gpm 30-8			
9:15	39	150	250	237	5.1	0	308	250	.14	.30	30-8			
9:30	42	150	250	241	5.1	0	305	250	.10	.40	30-8			
9:45	49	150	253	242	5.3	0	300	250	.10	.40	30-8			
10:00	39	150	247	234	5.3	0	316	250	.14	.30	30.8			
10:15	40	150	248	233	5.3	0	304	250	.14	.30	30.8			
10:30	39	150	244	234	5.3	0	311	250	.13	.30	30-8			
10:45	40	150	246	238	5.3	0	307	250	.13	.30	30.8			
11:00	35	150	246	231	5.3	0	313	250	.15	.41	30.8			
12:00	50	150	247	237	5.1	0	300	230	.14	.47	30-8			
12:15	45	150	250	234	5.1	0	305	250	.14	.50	30.8			
12:30	41	150	245	236	5.1	0	305	250	.15	.40	30.8			
12:45	43	150	247	237	5.1	0	302	250	.14	.41	30-8			
1:00	42	150	249	237	5.1	0	308	250	.14	.41	30.8			

Fuel Type WASTE OIL Sulfur in Fuel _____ %
Plant Drum Type Parallel flow

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

fuel flow rate: 30 liters/minute

COMPLETE TEST DATA WKI

S-F ANALYTICAL LABORATORIES, INC

A Subsidiary of Sommer-Frey Laboratories, Inc.

Project: 98006296 Page - 2 - 10/12/1998

Parameter	Result		MDL	Analyzed	By	Method
98A14688						
Collected: 10/07/1998						
Flash Point	>210	F		10/12/98	RAB	D3828
Arsenic	1.4	ppm	0.5	10/12/98	GGG	6010
Cadmium	0.5	ppm	0.1	10/12/98	GGG	6010
Chromium	1.6	ppm	0.1	10/12/98	GGG	6010
Lead	30.7	ppm	0.1	10/12/98	GGG	6010
Antimony	1.40	mg/Kg	0.01	10/12/98	GGG	6010
Sulfur	0.44	%	0.04	10/12/98	RAB	D129
Halogens as Cl	510	mg/kg	100	10/12/98	RAB	**
Specific Gravity	0.8937	-		10/12/98	RAB	D1298
API Gravity @ 60F	26.8	-		10/12/98	RAB	D1298
Acidity	Neutral	-		10/12/98	RAB	D1093
BTU/Gallon	137300	BTU/gal	100	10/12/98	RAB	D240
Ash	0.69	%	0.01	10/12/98	RAB	D482

** EPA SW846 methods 5050 and 9252

Gary G. Geipel
Senior Analyst

6125 West National Avenue, P.O. Box 14513, Milwaukee, Wisconsin 53214
(414) 475-6700 FAX: (414) 475-7216
Toll-Free: 800-300-6700

• Dept. of Health State Certified Laboratory #168 • Dept. of Natural Resources State Certified Laboratory #241249360 •
• USDA Accredited Laboratory #5581 • NIOSH Proficiency Analytical Testing Program •

S-F ANALYTICAL LABORATORIES, INC

A Subsidiary of Sommer-Frey Laboratories, Inc.

Payne & Dolan of Wisc.,Inc.
P.O. Box 781
Waukesha, WI 53186

Received: 10/08/1998
Reported: 10/12/1998
Project#: 98006296

Attn: Peter Tolsma

Analytical Results

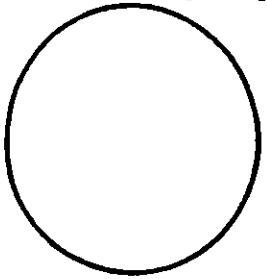
Parameter	Result		MDL	Analyzed	By	Method
98A14685 Collected: 10/07/1998						
Flash Point	>210	F		10/12/98	RAB	D3828
Arsenic	1.0	ppm	0.5	10/12/98	GGG	6010
Cadmium	0.5	ppm	0.1	10/12/98	GGG	6010
Chromium	1.9	ppm	0.1	10/12/98	GGG	6010
Lead	31.8	ppm	0.1	10/12/98	GGG	6010
Antimony	1.40	mg/Kg	0.01	10/12/98	GGG	6010
Sulfur	0.44	%	0.04	10/12/98	RAB	D129
Halogens as Cl	727	mg/kg	100	10/12/98	RAB	**
Specific Gravity	0.8938	-		10/12/98	RAB	D1298
API Gravity @ 60F	26.8	-		10/12/98	RAB	D1298
Acidity	Neutral	-		10/12/98	RAB	D1093
BTU/Gallon	132500	BTU/gal	100	10/12/98	RAB	D240
Ash	0.69	%	0.01	10/12/98	RAB	D482
98A14687 Collected: 10/07/1998						
Flash Point	>210	F		10/12/98	RAB	D3828
Arsenic	1.1	ppm	0.5	10/12/98	GGG	6010
Cadmium	0.6	ppm	0.1	10/12/98	GGG	6010
Chromium	1.8	ppm	0.1	10/12/98	GGG	6010
Lead	31.7	ppm	0.1	10/12/98	GGG	6010
Antimony	1.10	mg/Kg	0.01	10/12/98	GGG	6010
Sulfur	0.43	%	0.04	10/12/98	RAB	D129
Halogens as Cl	525	mg/kg	100	10/12/98	RAB	**
Specific Gravity	0.8957	-		10/12/98	RAB	D1298
API Gravity @ 60F	26.5	-		10/12/98	RAB	D1298
Acidity	Neutral	-		10/12/98	RAB	D1093
BTU/Gallon	133900	BTU/gal	100	10/12/98	RAB	D240
Ash	0.69	%	0.01	10/12/98	RAB	D482

6125 West National Avenue, P.O. Box 14513, Milwaukee, Wisconsin 53214
(414) 475-6700 FAX: (414) 475-7216
Toll-Free: 800-300-6700

• Dept. of Health State Certified Laboratory #168 • Dept. of Natural Resources State Certified Laboratory #241249360 •
• USDA Accredited Laboratory #5581 • NIOSH Proficiency Analytical Testing Program •

Environmental
Technol[illegible]
Engineering Corp.

PARTICULATE FIELD DATA



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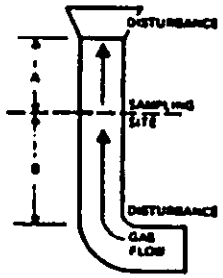

PLANT Payne & Pola[illegible]
DATE 10-7-98
LOCATION Markesan
OPERATOR WJD
STACK NO. Control 25
RUN NO. 1
SAMPLE BOX NO. 1
METER BOX NO. 1

AMBIENT TEMPERATURE 50
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 30
PROBE LENGTH, in. 5'
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 50 x 48
PROBE HEATER SETTING —
HEATER BOX SETTING

γ: 0.993
Cp: 0.84
0-98

METER ΔH 1.832
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO2 6.8
O2 12.2
CO
N2

963

LEAK CHECKS
ok Pre <.01 22"
on Pitot 3"+
ok Post <.01 21"
on 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 1.028 SAMPLE BOX TEMPERATURE °F	HCl 1.065 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
1	0850		260	1.6	2.70		070.00		50	541.80/82	710.36/74	5	
2	52+		261	1.0	1.70		72.3		50	42.64/86	712.44/90		
3	55	-1.0	262	1.5	2.50		74.1		51	0.85/84	2.08/82		
4	5[illegible]		260	2.4	4.00		76.5		51	1A		7	
5	00		260	3.6	6.00		79.3		52			10	
6	02/03		260	.8	1.35		82.7		53				
7	05+	-0.7	262	.6	1.00		84.3		53				
8	08		265	.6	1.00		85.7		54				
9	10+		260	1.2	2.00		87.2		55			4	
10	13		260	2.0	3.30		89.3		56				
11	13+/16		258	.6	1.00		91.7		59				
12	18+	-0.4	258	.6	1.00		93.1		60	543.08/90			
13	21		260	.2	.34		94.5		60	43.88/94			
14	23+		260	.5	.85		95.3		61	0.80/92			
15	26		260	1.0	1.70		96.7		62	1B			
16	28+/29		260	.2	.34		98.5		62				
17	31+	-0.4	260	.3	.51		99.5		63				
18	33		260	.3	.51		00.5		63				
19	36+		262	.2	.34		01.6		64				
20	39		260	.6	1.00		02.5		64				
21	41+/42		254	.3	.51		03.9	39.13	65				
22	46+	-0.3	255	.3	.51		04.9		65				
23	47		255	.2	.34		06.0		65				
24	49+		255	.2	.34		06.8		66				
25	52		254	.6	1.00		07.7		67				
	095450						109.13						

Environmental
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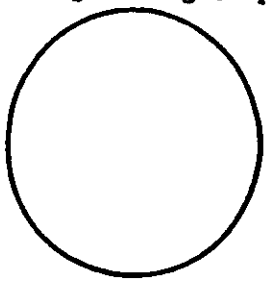
Engineering Corp.

PARTICULATE FIELD DATA



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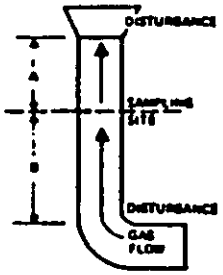


PLANT Payne #2
DATE 10-7-98
LOCATION Markesan
OPERATOR WJD
STACK NO. Control 25
RUN NO. 2
SAMPLE BOX NO. 2
METER BOX NO. 1

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 30
PROBE LENGTH, in.
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 50x48
PROBE HEATER SETTING -
HEATER BOX SETTING

METER ΔH
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO2 7.0
O2 11.8
CO
N2

964

LEAK CHECKS
ok Pre <.01 20"
ok Pitot 3"
ok Post <.01 21"
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	SO2 21.1.008 SAMPLE BOX TEMPERATURE °F	HCl TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A1	100.5		260	1.6	2.70		110.00		75	544.28/90	712.44/86	5	
2	07+		253	1.0	1.70		12.3		76	45.08/88	714.64/88		
3	10	-1.0	255	1.6	2.70		14.1		77	0.80/89	2.20/87		
4	12+		257	2.5	4.20		16.4		79	(2A)		7	
5	15		260	2.5	5.80		19.3		80			10	
B6	17/18		260	1.0	1.70		22.5		81				
7	23+		260	.8	1.35		24.3		81				
8	23	-0.7	258	.6	1.00		26.0		82				
9	25+		258	.8	1.35		27.4		83				
10	28		260	2.4	4.00		29.0		83				
C11	30+/31		255	.4	1.00		31.7		84				
12	32		255	.6	1.00		33.2		85				
13	36	-0.7	260	.4	.68		34.6		85	545.55/88			
14	38+		262	.6	1.00		35.7		86	46.45/88			
15	41		256	1.4	2.50		37.1		87	0.85/88			
D16	43+/44		256	.6	1.00		39.3		87	(2B)			
17	46+		256	.4	.68		40.7		87				
18	49	-0.5	256	.2	.34		41.3		88				
19	51+		258	.3	.51		42.7		88				
20	54		255	.8	1.35		43.7		88				
E21	56+/57+		255	.3	.51		45.4		90				
22	00	-0.4	254	.3	.51		46.4	(40.50)	90				
23	02+		254	.2	.34		47.4		90				
24	05		255	.2	.34		48.3		89				
25	07+		252	.5	.85		49.2		89				
	1110						150.50						

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

Sample Analysis Certificate

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

Date:	10/28/98
Project ID:	1098016
Sample Date:	10/9/98
Sample Time:	NA
Date Received:	10/13/98

Attn: Bill Dick
Project #: 2342
Sampled by: NA

HYDROGEN CHLORIDE ANALYSIS BY METHOD 26

Project: 1098016

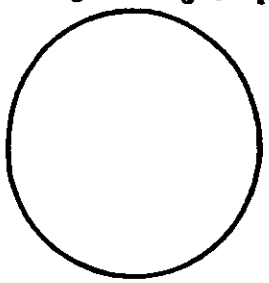
DAT ID:	Client ID:	Analyte	Total ug	
1098016-1	C25-HCl-4	Hydrogen Chloride	51.1	
1098016-2	C25-HCl-2	Hydrogen Chloride	56.0	
1098016-3	C25-HCl-3	Hydrogen Chloride	26.0	
1098016-4	C25-HCl-Blank	Hydrogen Chloride	4.6	J

J: Analyte detected below the lowest calibrator.

Reviewed and approved for release by: _____ President Date: 10/28/98

Environmental
Technol[illegible]
Engineering Corp.

PARTICULATE FIELD DATA



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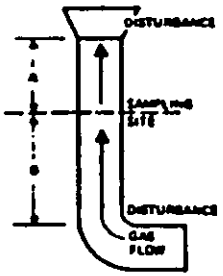

PLANT Payne & Pola[illegible]
DATE 10-7-98
LOCATION Markesan
OPERATOR WJD
STACK NO. Control 25
RUN NO. 3
SAMPLE BOX NO. 3
METER BOX NO. 1

AMBIENT TEMPERATURE 55
BAROMETRIC PRESSURE 29.35
ASSUMED MOISTURE, % 30
PROBE LENGTH, in.
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 50 x 48
PROBE HEATER SETTING -
HEATER BOX SETTING -

METER ΔH
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO2 6.8
O2 12.0
CO
N2

965

LEAK CHECKS
on Pre 4.01 7.0"
on Pitot 3"
on Post 4.01 8"
on 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 SAMPLE BOX TEMPERATURE °F	HCl TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A1	1200		235	1.5		2.50		152.00		70	546.84/84	715.54/77	3	
2	02+		242	1.1		1.85		54.2		72	47.68/80	17.04/87		
3	05	-1.1	245	1.6		2.70		56.2		73	0.84/82	1.50/82		
4	07+		248	2.4		4.00		58.5		74	3A		7	
5	10		250	3.6		6.00		61.3		75			10	
B 6	12+/13		252	1.0		1.70		64.5		75				
7	15+	-0.7	250	.8		1.35		66.4		75				
8	18		250	.6		1.00		68.1		75		718.54		
9	20+		252	1.0		1.70		69.5		75				
10	23		252	2.2		3.70		71.3		75			7	
C 11	25+/26		255	.6		1.00		74.0		75				
12	28+		255	.6		1.00		75.5		75	548.00/82			
13	31	-0.7	252	.6		1.00		76.8		76	48.80/86			
14	34		255	.6		1.00		78.2		76	0.80/84			
15	36		256	1.2		2.00		79.6		77	3B		4	
D 16	38+/39		256	.5		.85		81.6		77				
17	41+		260	.4		.68		82.9		78				
18	44	-0.5	260	.4		.68		84.0		78				
19	46+		258	.3		.51		85.2		78				
20	49		256	1.0		1.70		86.2		78				
U 21	51+/52+		255	.3		.51		88.0		79				
22	55	-0.4	256	.2		.34		89.0	40.74	79				
23	57+		256	.2		.34		90.0		80				
24	00		255	.2		.34		90.8		80				
25	02+		254	.4		.60		91.6		80				
	1305							192.74						

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Payne & Dolan C25 DATE OF TEST 10-7-98

JOB NO. _____ TEST ENGINEER WJO

RUN NO. 1 STACK Baghouse

Sample Box 1 Filter T-962 Wash Bottle —

Beaker No. 4

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	251	100	151
2	242	100	142
3	99	0	99
SIL GEL	713	704	9
		TOTAL	401

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.1083	1.0569	0.0414
Washings (0.0003)	95.3876	95.3863	0.0010
		TOTAL	0.0424

WATER COLLECTED [ ] GRAMS

PARTICULATE COLLECTED [ ] GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Payne & Dolan C25 DATE OF TEST 10-7-98

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 2 STACK Baghouse

Sample Box 2 Filter T-964 Wash Bottle —

Beaker No. 5

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	248	100	148
2	212	100	112
3	88	0	88
SIL GEL	686	680	6
		TOTAL	354

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.1460	1.0937	0.0523
Washings (0.0003)	110.4543	110.4532	0.0008
		TOTAL	0.0531

WATER COLLECTED [ ] GRAMS

PARTICULATE COLLECTED [ ] GRAMS

1460
.0937
.0523

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Payne + Dolan DATE OF TEST 10-7-98

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 3 STACK Baghouse

Sample Box 3 Filter T-965 Wash Bottle —

Beaker No. 6

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	249	100	149
2	207	100	107
3	65	0	65
SILGEL	637	631	6
		TOTAL	327

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.0582	1.0077	0.0505
Washings (0.0003)	108.6523	108.6517	0.0003
		TOTAL	0.0508

WATER COLLECTED [ ] GRAMS

PARTICULATE COLLECTED [ ] GRAMS

NOTES:

PAYNE & DOLAN
CONTROL 25 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	0.70	0.02	0.010	1.379	62.21	0.80	1.028	84	29.35	0.783	0.022	48457	6.65
1B	21.5	3.0	0.65	0.02	0.010	1.446	66.18	0.80	1.028	92	29.35	0.772	0.022	48457	7.07
AVG							64.19								6.86
2A	21.0	3.0	0.65	0.02	0.010	1.413	64.29	0.80	1.028	89	29.35	0.776	0.022	53312	7.56
2B	20.5	3.0	0.65	0.02	0.010	1.379	62.64	0.80	1.028	88	29.35	0.777	0.022	53312	7.36
AVG							63.46								7.46
3A	19.0	3.0	0.70	0.02	0.010	1.379	59.03	0.84	1.028	82	29.35	0.825	0.023	54889	7.14
3B	19.0	3.0	0.60	0.02	0.010	1.177	53.06	0.80	1.028	84	29.35	0.783	0.022	54889	6.42
AVG							56.04								6.78

PAYNE & DOLAN
CONTROL 25 PLANT
H2SO4 LAB RESULTS

Sample no.	Vol.Solution ml	Vol. Aliq. ml	Vol.Titrant ml	Vol.Tit. Bl. ml	N. Titrant	mg. H2SO4	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	12.5	3.0	0.05	0.02	0.010	0.061	2.76	0.80	1.028	84	29.35	0.783	0.022	48457	0.30
1B	12.0	3.0	0.05	0.02	0.010	0.059	2.69	0.80	1.028	92	29.35	0.772	0.022	48457	0.29
AVG							2.73								0.29
2A	10.5	3.0	0.05	0.02	0.010	0.051	2.34	0.80	1.028	89	29.35	0.776	0.022	53312	0.28
2B	11.5	3.0	0.05	0.02	0.010	0.056	2.56	0.80	1.028	88	29.35	0.777	0.022	53312	0.30
AVG							2.45								0.29
3A	12.0	3.0	0.05	0.02	0.010	0.059	2.52	0.84	1.028	82	29.35	0.825	0.023	54889	0.30
3B	12.0	3.0	0.05	0.02	0.010	0.059	2.65	0.80	1.028	84	29.35	0.783	0.022	54889	0.32
AVG							2.59								0.31

Plant Name: #25010

ASPHALT PLANT STACK TEST DATA

Date: 10-7-98
FID # 999010760

Time*	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 %
9:00	42	150	252	241	5.1	0	306	250	.14	.34	gpm 30-8 gpm			
9:15	39	150	250	237	5.1	0	308	250	.14	.30	30-8			
9:30	42	150	250	241	5.1	0	305	250	.10	.40	30-8			
9:45	49	150	253	242	5.3	0	300	250	.10	.40	30-8			
10:00	39	150	247	234	5.3	0	310	250	.14	.30	30.8			
10:15	40	150	248	233	5.3	0	304	250	.14	.30	30.8			
10:30	39	150	244	234	5.3	0	311	250	.13	.30	30-8			
10:45	40	150	246	238	5.3	0	307	250	.13	.30	30.8			
11:00	35	150	246	231	5.3	0	313	250	.15	.41	30.8			
11:00	50	150	247	237	5.1	0	300	230	.14	.47	30-8			
12:15	45	150	250	234	5.1	0	305	250	.14	.50	30.8			
12:30	41	150	245	236	5.1	0	305	250	.15	.40	30.8			
12:45	43	150	247	237	5.1	0	302	250	.14	.41	30-8			
1:00	42	150	249	237	5.1	0	308	250	.14	.41	30-8			

Fuel Type WASTE OIL Sulfur in Fuel _____ %
Plant Drum Type Parallel flow

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

COMPLIANCE DATA WK1

APPENDIX B

Sample Calculations

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

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