AP42 Section: 11.1

Reference Number: 380

Title: Stack Emission Test, Payne And Dolan, Inc., Control 53 Plant, Newberry, MI,

Environmental Technology and Engineering Corporation, Elm Grove, WI,

September 1-2, 1998.

Sec. 11.1
Ref. 380

SO_2 HCl

Report to

PAYNE & DOLAN, INC.
Waukesha, Wisconsin

for

STACK EMISSION TEST
CONTROL 53 PLANT
FID NO. 999418640
Newberry, Michigan

September 1&2, 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 September 1&2, 1998, Environmental Technology & Engineering Corp. personnel performed stack emissions testing at the Payne & Dolan, Inc. Control 53 portable plant located in Newberry, Michigan. The tests were performed as a provision of an Air Pollution Control Permit 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	0.027 gr/dscf	0.07 lb/hr	13.65 lb/hr
2	0.036	0.03	16.37
3	0.023	0.02	16.40
AVERAGE	0.029 gr/dscf	0.04 lb/hr	15.47 lb/hr
DNR LIMIT	0.039	NA	NA
% OF LIMIT	73.5 %	NA	NA

1.0 GENERAL

On September 1&2, 1998, Environmental Technology & Engineering Corp. (ETE) personnel performed stack emissions testing at the Payne & Dolan, Inc. Control 53 portable plant located in Newberry, Michigan. The purpose of the testing was to determine the particulate emissions from the plant as a condition of an Air Pollution Control Permit issued by the State of Wisconsin Department of Natural Resources (WDNR). The Facility Identification Number (FID) for this plant is 999418640. Sulfur dioxide and hydrogen chloride testing were also performed at this time in order to determine plant specific emission factors.

Pete Tolsma and Dennis Linsmaier of Payne & Dolan was responsible for assuring proper operating conditions throughout the testing. During the test the plant production rate was approximately 227 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	0.027 gr/dscf	0.07 lb/hr	13.65 lb/hr
2	0.036	0.03	16.37
3	0.023	0.02	16.40
AVERAGE	0.029 gr/dscf	0.04 lb/hr	15.47 lb/hr
DNR LIMIT	0.039	NA	NA
% OF LIMIT	73.5 %	NA	NA

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

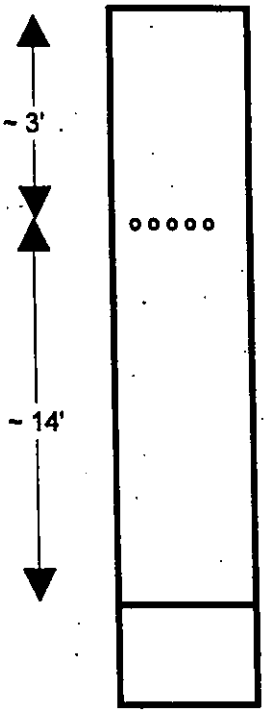
PAYNE & DOLAN CONTROL 53
FIGURE 2-1

SAMPLE POINT LOCATION

Point	Distance in
1	3.7
2	11.1
3	18.5
4	25.9
5	33.3

TEST PORT LOCATION

L 54
W 37



PAYNE & DOLAN	1-Sep-98	CONTROL 53	TABLE 2-1

TEST NO.	1			
BAROMETRIC PRESSURE	29.10	IN HG		
TIP DIAMETER	0.250	IN		
STACK DIMENSIONS	37	IN	54	IN
STACK AREA	13.875	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	25			
METER VOLUME	43.76	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	0.993			
PARTICULATE COLLECTED	0.0748	GRAMS		
WATER COLLECTED	418	ML		
STATIC PRESSURE	-0.70	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
4.50%	12.50%	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	220	0.20	0.37	74	30.67
2	222	0.20	0.37	75	30.71
3	222	0.10	0.19	75	21.72
4	227	0.10	0.19	75	21.80
5	225	0.10	0.19	76	21.76
6	228	0.60	1.10	80	53.43
7	237	0.40	0.74	81	43.91
8	235	0.20	0.37	81	31.00
9	238	0.20	0.37	81	31.07
10	235	0.40	0.74	82	43.84
11	248	0.70	1.30	84	58.54
12	248	0.70	1.30	86	58.54
13	245	0.30	0.56	87	38.24
14	242	0.30	0.56	88	38.16
15	242	0.80	1.45	88	62.32
16	250	2.00	3.70	90	99.09
17	247	1.80	3.30	90	93.81
18	245	1.20	2.20	91	76.49
19	245	1.10	2.00	92	73.23
20	242	1.50	2.75	92	85.33
21	250	3.20	5.90	92	125.34
22	252	3.00	5.50	93	121.53
23	250	2.80	5.30	94	117.25
24	248	3.00	5.50	96	121.19
25	245	3.20	5.90	96	124.90
AVERAGE	240		2.07	86	64.95

DRY STANDARD VOLUME	42.58	SCF
PERCENT WATER VAPOR	31.61	% VOL
FLOW RATE	54075	ACFM
	27100	DSCFM
	46048	M3/HR
PARTICULATE CONCENTRATION	0.027	GR/DSCF
PARTICULATE EMISSION RATE	6.37	LB/HR
LB PART PER 1000 LB GAS	0.040	
ISOKINETIC PERCENT	102.3	

PAYNE & DOLAN | 2-Sep-98 | CONTROL 53 | TABLE 2-2

TEST NO.	2			
BAROMETRIC PRESSURE	29.25	IN HG		
TIP DIAMETER	0.250	IN		
STACK DIMENSIONS	37	IN	54	IN
STACK AREA	13.875	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	25			
METER VOLUME	43.41	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	0.993			
PARTICULATE COLLECTED	0.0980	GRAMS		
WATER COLLECTED	419	ML		
STATIC PRESSURE	-0.70	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
4.50%	12.50%	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	240	3.20	5.60	50	124.18
2	242	3.20	5.60	53	124.36
3	245	2.60	4.80	56	112.34
4	243	2.80	5.20	57	116.41
5	243	2.20	4.00	57	103.19
6	236	2.00	3.70	58	97.89
7	238	1.60	2.90	59	87.68
8	235	1.00	1.85	60	69.17
9	236	1.00	1.85	60	69.22
10	235	1.40	2.60	61	81.85
11	232	0.80	1.45	63	61.74
12	232	0.70	1.30	65	57.75
13	234	0.50	0.92	67	48.88
14	235	0.40	0.76	69	43.75
15	236	0.70	1.30	70	57.91
16	222	0.50	0.92	72	48.45
17	225	0.30	0.56	74	37.61
18	225	0.20	0.37	75	30.71
19	224	0.20	0.37	75	30.69
20	225	0.30	0.56	77	37.61
21	220	0.20	0.37	78	30.60
22	222	0.20	0.37	80	30.64
23	222	0.10	0.18	81	21.67
24	220	0.10	0.18	81	21.64
25	220	0.20	0.37	81	30.60
AVERAGE	231		1.92	67	63.06

DRY STANDARD VOLUME	42.33	SCF
PERCENT WATER VAPOR	31.78	% VOL
FLOW RATE	52499	ACFM
	26687	DSCFM
	45346	M3/HR
PARTICULATE CONCENTRATION	0.036	GR/DSCF
PARTICULATE EMISSION RATE	8.31	LB/HR
LB PART PER 1000 LB GAS	0.053	
ISOKINETIC PERCENT	103.3	

PAYNE & DOLAN | 2-Sep-98 | CONTROL 53 | TABLE 2-3

TEST NO.	3			
BAROMETRIC PRESSURE	29.25	IN HG		
TIP DIAMETER	0.245	IN		
STACK DIMENSIONS	37	IN	54	IN
STACK AREA	13.875	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	25			
METER VOLUME	44.68	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	0.993			
PARTICULATE COLLECTED	0.0657	GRAMS		
WATER COLLECTED	392	ML		
STATIC PRESSURE	-0.70	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
4.60%	12.40%	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	240	3.40	5.80	72	127.41
2	242	3.00	5.50	73	119.85
3	242	2.20	4.00	73	102.63
4	240	2.80	5.20	74	115.62
5	240	3.00	5.50	75	119.68
6	235	2.40	4.40	77	106.66
7	234	1.80	3.30	78	92.30
8	235	1.20	2.20	79	75.42
9	234	1.20	2.20	80	75.37
10	232	1.80	3.30	81	92.17
11	230	1.20	2.20	80	75.15
12	230	0.70	1.30	80	57.40
13	229	0.50	0.94	80	48.47
14	228	0.50	0.94	80	48.44
15	230	0.70	1.30	80	57.40
16	228	0.50	0.94	79	48.44
17	225	0.40	0.74	79	43.23
18	225	0.30	0.56	80	37.44
19	225	0.20	0.37	80	30.57
20	222	0.40	0.74	80	43.14
21	218	0.20	0.37	81	30.41
22	220	0.10	0.18	81	21.54
23	218	0.10	0.18	81	21.50
24	218	0.10	0.18	82	21.50
25	215	0.10	0.18	82	21.46
AVERAGE	229		2.10	79	65.33

DRY STANDARD VOLUME	43.65	SCF
PERCENT WATER VAPOR	29.71	% VOL
FLOW RATE	54385	ACFM
	28571	DSCFM
	48547	M3/HR
PARTICULATE CONCENTRATION	0.023	GR/DSCF
PARTICULATE EMISSION RATE	5.79	LB/HR
LB PART PER 1000 LB GAS	0.035	
ISOKINETIC PERCENT	103.6	

TABLE 2-4

PAYNE & DOLAN CONTROL 53
DRUM MIX PLANT
SULFUR DIOXIDE RESULTS

Test No.	SO2 Conc mg/m3	Flow Rate m3/hr	SO2 ER lb/hr	Production Rate TPH	SO2 Factor lb/ton
C53-1	134.51	46048	13.66	228	0.060
C53-2	163.76	45346	16.37	227	0.072
C53-3	153.25	48547	16.40	226	0.073
AVERAGE	150.51		15.48		0.068

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

Table 2-4

SO2 EMISSIONS CALCULATIONS

F[illegible]D Control 53 FID 999418640

Sulfur in Burner Fuel

S = 0.66% 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

1.8 gallons/ton x 227 tons/hour x 7.45 lbs/gallon x 0.66/100 sulfur/oil x 2 SO2/S =
40.18 lbs SO2/hour

Mass Flow of Sulfur Dioxide from the Plant Stack

15.47 lbs/hour

Sulfur Dioxide Capture Efficiency

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

EF = **61.50 %**

comp\plt\so2test.wk1

Table 2-5

HCL EMISSIONS CALCULATIONS

P&D Control 53 FID 999418640

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 = 578.7 parts per million, by weight.
HCl concentration in the burner fuel = 36/35 x 578.7 =
595.2 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

1.80 gallons/ton hot mix produced x 227 tons hot mix/hour x 7.45 lbs/gallon x 595.2/1000000 HCl/oil =

1.81 lbs HCl/hour from the dryer drum

Mass Flow of Hydrogen Chloride from the Plant Stack

0.04 lbs/hour

Hydrogen Chloride Capture Efficiency

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

EF = **97.79** %

comp\plt\HCltest.wk1

PAYNE & DOLAN CONTROL 53
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
C53-1	2.67	82	73.65	51	0.69	46048	0.07	228	0.00031
C53-2	2.46	61	70.59	18	0.25	45346	0.03	227	0.00011
C53-3	2.41	64	68.76	16	0.23	48547	0.02	226	0.00011
		AVERAGE			0.39		0.04		0.00018

Meter Gama 1.028
Bar.Pressure 29.10

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.

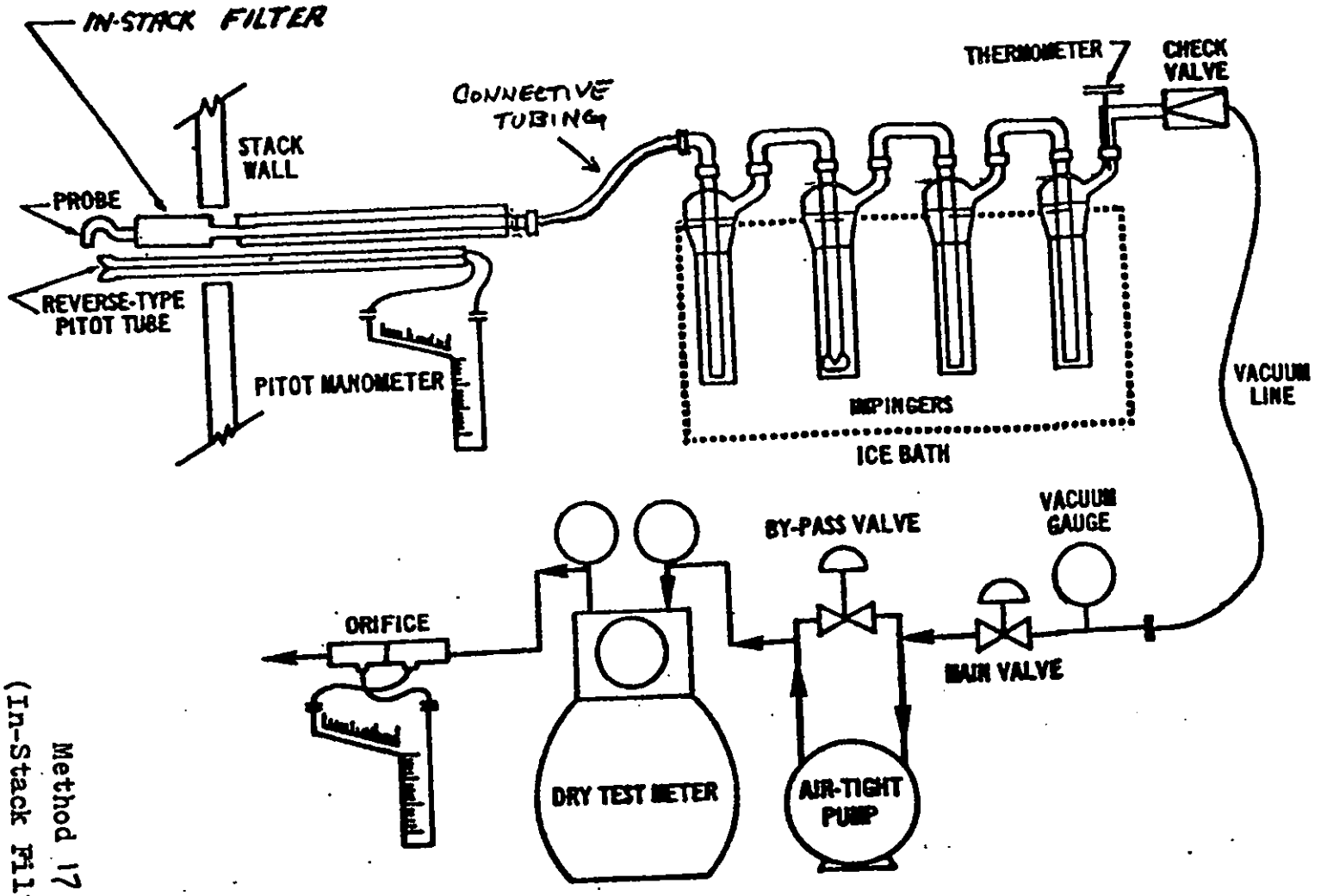
The temperatures of the stack gas stream, as well as strategic locations within the sampling devices, were monitored by RTDs and read directly from a gauge on the control unit.

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.

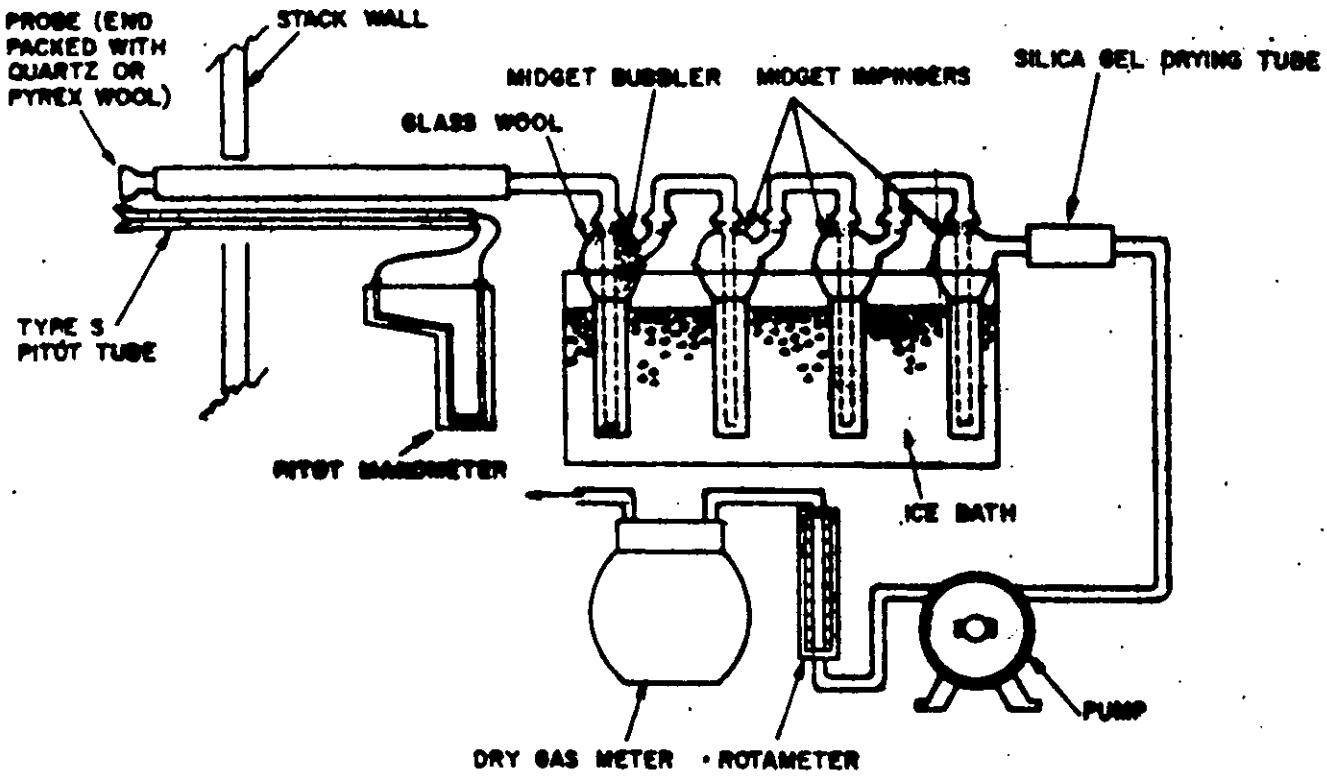


FIGURE - 1 SO_2 SAMPLING TRAIN

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.

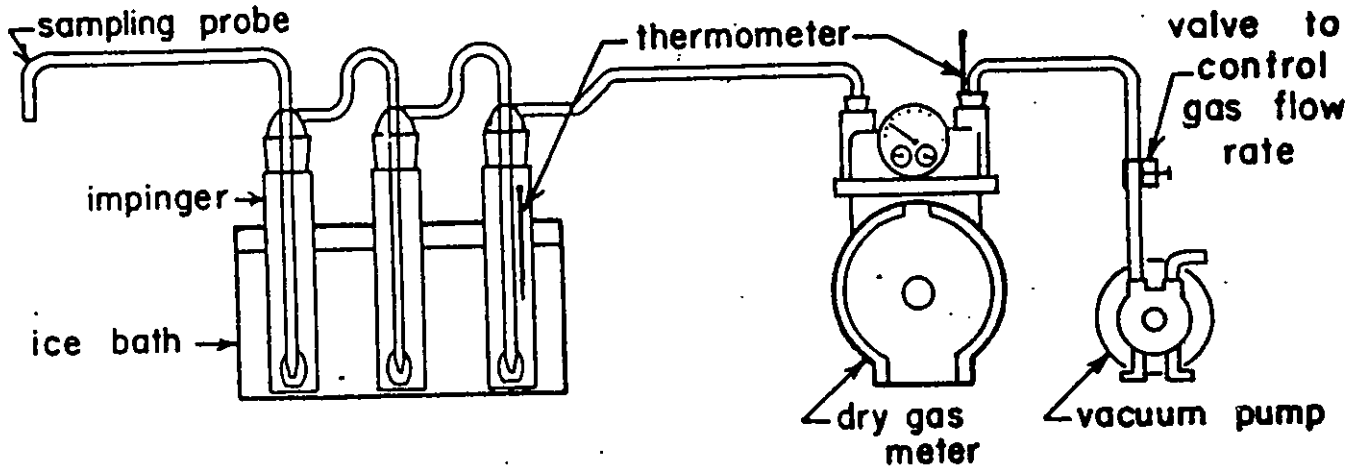
The first two impinger contents were then analyzed for hydrogen chloride content by ion chromatography. The analysis was performed at DAT, Inc. The laboratory information was combined with the volume of gas sampled to determine the HCl concentration. The emission rates were then calculated using these 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	1.065
Hydrogen Chloride Meter	1.028

(1)

Department of Natural Resources

SMOKE FORM
Form 4500-29 Rev. 6-85

Name of Company: Payne & Dolan, Inc #53	Date: September 1, 1998
Location: Newberry, Michigan	FID Number: 999 418 640
City, State, Zip Code	Observer Certification Date: April 7, 1998
Discharge Location: Stack Tip	Control Device: Baghouse
Height of Discharge Above Ground: 28'	Steam Plume? Attached Yes / Detached (No)

	Initial		Final
Time of Observation	11:50 AM		11:55.45
Observer Location: Distance to Discharge	80'		80'
Direction from Discharge	SSE		SSE
Height of Observation Point in Relation to Discharge	23' below		23' below
Plume Description (Color, Length, etc.)	~~no plume~~ Grey, 50'		Grey, 50'
Plume Background Description	sky		sky
Weather Conditions: Wind Direction	WSW		WSW
Wind Speed	10~15		15~20
Ambient Temperature	75°F		70°F
Sky Conditions (clear, overcast, % clouds, etc.)	75% overcast		100% overcast

Describe Point in Plume at Which Opacity was Determined: at point of maximum opacity

Remarks:

- waste oil
- 240 tons/hr production
- starting to rain at the end of this test run

SEC MIN	0	15	30	45	SEC MIN	0	15	30	45
0	0	0	0	0	30				
1	0	0	5	0	31				
2	0	5	0	0	32				
3	0	0	0	0	33				
4	0	5	0	0	34				
5	0	5	0	0	35				
6					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				

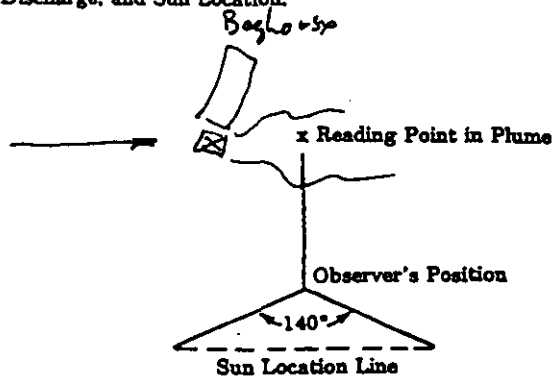
Summary of Average Opacity
(From Computer Program)

Set Number	Time: Start — End	Opacity: Sum	Opacity: Average

Signature of Observer: Peter Tolsma

Name of Observer (Please print): Peter Tolsma

Sketch of Observer, Discharge, and Sun Location.



(N)

Allowable Source Opacity: 20%

Department of Natural Resources

(2)

SMOKE FORM
Form 4500-29 Rev. 6-85

Name of Company: Payne & Dolan - #53	Date: September 2, 1998
Location: Newberry, Michigan	FID Number: 999 418 640
City, State, Zip Code	Observer Certification Date: April 4, 1998
Discharge Location: Stack Tip	Control Device: Baghouse
Height of Discharge Above Ground: 28'	Steam Plume? Attached (Yes) Detached (No)

	Initial		Final
Time of Observation	07:35.00		07:40.45
Observer Location			
Distance to Discharge	100'		
Direction from Discharge	S		
Height of Observation Point in Relation to Discharge	23' below		
Plume Description (Color, Length, etc.)	Grey		
Plume Background Description	Sky		
Weather Conditions			
Wind Direction	W		
Wind Speed	5-10		
Ambient Temperature	60°, F		
Sky Conditions (clear, overcast, % clouds, etc.)	overcast, No Sun		

Describe Point in Plume at Which Opacity was Determined
at point of maximum opacity

Remarks:

230 tons/hr

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					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				

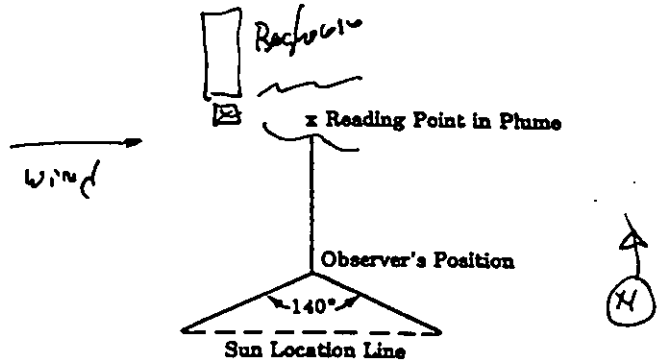
Summary of Average Opacity
(From Computer Program)

Set Number	Time Start — End	Opacity Sum	Opacity Average

Signature of Observer: Peter Tolsma

Name of Observer (Please print): Peter Tolsma

Sketch of Observer, Discharge, and Sun Location.



Allowable Source Opacity 20 %

Department of Natural Resources

(3)

SMOKE FORM
Form 4500-29 Rev. 6-85

Name of Company: Payne & DeLong - #53	Date: September 2, 1998
Location: Newberry, Michigan	FID Number: 999 418 640
City, State, Zip Code	Observer Certification Date: April 7, 1998
Discharge Location: Stack Tip	Control Device: Boghouse
Height of Discharge Above Ground: 28'	Steam Plume? Attached (Yes) / Detached (No)

	Initial		Final
Time of Observation	09:53.00		09:58.45
Observer Location: Distance to Discharge	80'		80'
Direction from Discharge	S		S
Height of Observation Point in Relation to Discharge	23' below		23' below
Plume Description (Color, Length, etc.)	40', grey		40', grey
Plume Background Description	Sky		Sky
Weather Conditions: Wind Direction	W		W
Wind Speed	5-10 mph		5-10
Ambient Temperature	65°, F		65°, F
Sky Conditions (clear, overcast, % clouds, etc.)	90% overcast		90% overcast

Describe Point in Plume at Which Opacity was Determined: at point of maximum opacity

Remarks:

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					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				

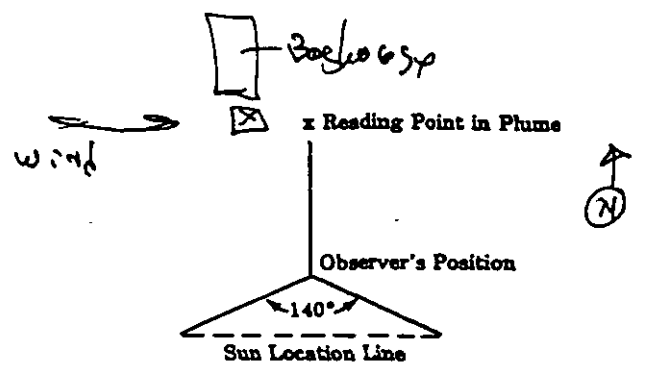
Summary of Average Opacity
(From Computer Program)

Set Number	Time: Start — End	Opacity: Sum	Opacity: Average

Signature of Observer: Peter Tolsma

Name of Observer (Please print): Peter Tolsma

Sketch of Observer, Discharge, and Sun Location.



Allowable Source Opacity 20%

APPENDIX A

Field and Laboratory Data

9-1-98 &
9-2-98

ASPHALT PLANT PM & FORMALDEHYDE TEST

Time[1]	Burner Setting	Fuel Pressure[2]	[illegible]	[illegible]	Liquid Asphalt	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11:4?	6	70	225	213	12.0		304	280	25%	.05	5			
12:00	6	70	230	220	12.5		305	280	25%	.04	5			
12:15	6½	70	230	217	12.6		304	270	22%	.04	5			
12:30	7	70	225	211	12.0		300	270	25%	.05	5			
12:45	7	70	229	220	12.0		294	265	25%	.04	5			
13:00	7	70	225	213	12.1		303	275	25%	.04	5			
8:30	7	70	228	216	12.2		306	275	25%	.04	5			
8:45	6½	70	227	216	12.3		304	275	25%	.04	5			
9:00	6	70	225	213	12.2		303	275	25%	.035	5			
9:15	6½	70	226	213	12.1		306	280	25%	.04	5			
10:45	6½	70	222	211	12.0		305	280	25%	.04	5			
11:00														
11:30	6	70	225	212	12.2		317	290	25%	.04	5			
11:45	5.5	70	228	213	12.3		308	290	25%	.04	5			
12:00	5½	70	229	217	12.4		312	285	25%	.04	5			

[1] Record the time and conditions at 15 minute intervals. Typically record 3 runs of one hour each, i.e. at 0, 15, 30, 45 & 60 minutes.

[2] Indicate units.

[3] Percent open unless noted otherwise.

[4] Pollution control equipment, e.g. baghouse.

1.8 gal oil/ton

S-F ANALYTICAL LABORATORIES, INC
A Subsidiary of Sommer-Frey Laboratories, Inc.

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

Attn: Peter Tolsma

Received: 09/04/1998
Reported: 09/15/1998
Project#: 98005530

Analytical Results

Parameter	Result		MDL	Analyzed	By	Method
98A12794 : #1 Collected: 09/01/1998						
Flash Point	>210	F		09/08/98	GGG	D3828
Arsenic	<0.5	ppm	0.5	09/09/98	GGG	6010
Cadmium	<0.1	ppm	0.1	09/09/98	GGG	6010
Chromium	0.3	ppm	0.1	09/09/98	GGG	6010
Lead	19.0	ppm	0.1	09/09/98	GGG	6010
Acidity	Neutral	-		09/08/98	RAB	D1093
API Gravity @ 60F	26.9	-		09/08/98	RAB	D1298
Specific Gravity	0.8935	-		09/08/98	RAB	D1298
Ash	0.42	%	0.01	09/08/98	GGG	D482
BTU/Gallon	141500	BTU/gal	100	09/08/98	RAB	D240
Halogens as Cl	676	mg/kg	100	09/08/98	RAB	D808
Sulfur	0.67	%	0.04	09/08/98	RAB	D129
98A12795 : #2 Collected: 09/02/1998						
Flash Point	>210	F		09/08/98	GGG	D3828
Arsenic	<0.5	ppm	0.5	09/09/98	GGG	6010
Cadmium	<0.1	ppm	0.1	09/09/98	GGG	6010
Chromium	0.3	ppm	0.1	09/09/98	GGG	6010
Lead	19.0	ppm	0.1	09/09/98	GGG	6010
Acidity	Neutral	-		09/08/98	RAB	D1093
API Gravity @ 60F	26.3	-		09/08/98	RAB	D1298
Specific Gravity	0.8965	-		09/08/98	RAB	D1298
Ash	0.40	%	0.01	09/08/98	GGG	D482
BTU/Gallon	141800	BTU/gal	100	09/08/98	RAB	D240
Halogens as Cl	520	mg/kg	100	09/08/98	RAB	D808
Sulfur	0.64	%	0.04	09/08/98	RAB	D129

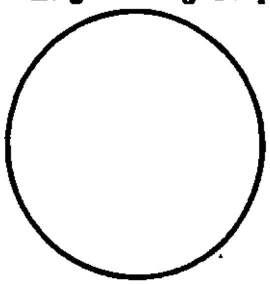
6125 West National Avenue, P.O. Box 14513, Milwaukee, Wisconsin 53214
(414) 475-6700 FAX: (414) 475-7216
Toll-Free: 800-300-6700

S-F ANALYTICAL LABORATORIES, INC
A Subsidiary of Sommer-Frey Laboratories, Inc.

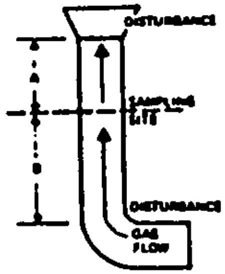
Parameter	Result	MDL	Analyzed	By	Method
98A12796 : #3 Collected: 09/02/1998					
Flash Point	>210 F		09/08/98	GGG	D3828
Arsenic	<0.5 ppm	0.5	09/09/98	GGG	6010
Cadmium	<0.1 ppm	0.1	09/09/98	GGG	6010
Chromium	0.3 ppm	0.1	09/09/98	GGG	6010
Lead	22.4 ppm	0.1	09/09/98	GGG	6010
Acidity	Neutral -		09/08/98	RAB	D1093
API Gravity @ 60F	26.9 -		09/08/98	RAB	D1298
Specific Gravity	0.8935 -		09/08/98	RAB	D1298
Ash	0.45 %	0.01	09/08/98	GGG	D482
BTU/Gallon	140000 BTU/gal	100	09/08/98	RAB	D240
Halogens as Cl	540 mg/kg	100	09/08/98	RAB	D808
Sulfur	0.66 %	0.04	09/08/98	RAB	D129

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

Environmental Technology Engineering Corp.



CROSS SECTION



PARTICULATE FIELD DATA

PLANT Payne & Dolan

DATE 9-1-98

LOCATION Newberry

OPERATOR WJO

STACK NO. Control S3

RUN NO. 1

SAMPLE BOX NO. 4

METER BOX NO. 1

AMBIENT TEMPERATURE 70

BAROMETRIC PRESSURE [illegible]

ASSUMED MOISTURE, % 25

PROBE LENGTH, in. 5'+

NOZZLE DIAMETER, in. 1/2

STACK DIAMETER, in. 54 x 37

PROBE HEATER SETTING –

HEATER BOX SETTING –

[illegible] 0.84 {8-10-98

METER ΔH@ 1.832

C FACTOR

PROCESS WEIGHT RATE

ORSAT RESULTS

CO_2 4.5

O_2 12.5

CO

N_2

LEAK CHECKS

ok Pre <.01 22

ok Pitot 6"+

ok Post <.01 21

ok Pitot 5"+

T. 970

γ = 1065 SO_2

HCl 1.078

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	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	1145		220	.2	.37		315.00		74	660.62/74	489.08/80	2	
2	[illegible]		222	.2	.37		16.0		75	661.42/70	11.75/83		
3	[illegible]	-0.6	222	.1	.19		16.9		75	0.80/76	2.67/82		
4	[illegible]		207	.1	.19		17.6		75	(1A)			
5	[illegible]		225	.1	.19		18.2		76				
B 6	57+/52		229	.6	1.1		18.9		80				
7	out		237	.4	.74		20.4		81				
8	03		235	.2	.37		21.6		81				
9	05+	-0.6	233	.2	.37		22.5		81				
10	[illegible]		235	.4	.74		23.3		82				
C 11	[illegible]		248	.7	1.30		24.6		84			4	
12	[illegible]		248	.7	1.30		26.2		86	661.50/74			
13	[illegible]		245	.3	.56		27.8		87	62.30/76			
14	[illegible]	-0.7	242	.3	.56		28.9		88	0.80/75			
15	21		242	.8	1.45		30.0		88	(1B)		5	
D 16	[illegible]		250	2.0	3.70		31.7		90				
17	[illegible]		247	1.8	3.30		34.4		90				
18	2[illegible]	-0.8	245	1.2	2.20		36.9		91				
19	21+		245	1.1	2.00		38.8		92				
20	31		242	1.5	2.75		40.7		92				
E 21	96+/31+		250	3.2	5.90		43.0		92			8	
22	40	-0.8	252	3.0	5.50		46.2	(43.76)	93				
23	42+		250	2.8	5.30		49.4		94				
24	4[illegible]		248	3.0	5.50		52.3		95				
25	47+		245	3.2	5.90		55.4		96				
	1230						358.78						

Environmental Technology Engineering Corp.

PARTICULATE FIELD DATA

γ = .993

PLANT PAYNE & POLA
DATE 9-7-98
LOCATION NEWBERRY
OPERATOR WJD
STACK NO. CONTROL 53
RUN NO. 2
SAMPLE BOX NO. 5
METER BOX NO. 1

AMBIENT TEMPERATURE 65F
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 25
PROBE LENGTH, in. 5 FT.
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 37x54
PROBE HEATER SETTING -
HEATER BOX SETTING -

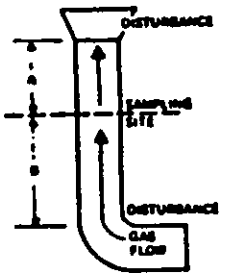
METER ΔH 1.832
C FACTOR
PROCESS WEIGHT RATE ~250 TPH

ORSAT RESULTS
CO2 [illegible]
O2 12.5
CO
N2

T-971

LEAK CHECKS
OM Pre C.01 22"
OM Pitot 5"+
OM Post <<.02 21"
SM Pitot 5"+

CROSS SECTION

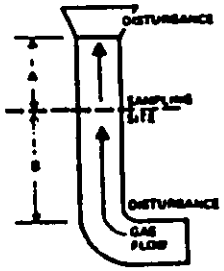


TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{IN}}$), °F	GAS SAMPLE TEMPERATURE AT DRY GAS METER OUTLET ($T_{m_{OUT}}$), °F	SAMPLE BOX TEMPERATURE °F (γ = 1.065, SO_2)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F (γ = 1.028, HCl)	PUMP VACUUM in. Hg gauge	VELOCITY fps
1	0937		240	3.2	5.60		380.00		50	663.00/56F	491.88/60F	7	
2	20		242	3.2	5.60		83.3		53	63.80/56	91.34/62		
3	33+	-1.0	245	2.6	4.80		86.5		56	0.80/56	2.46/61		
4	35		243	2.8	5.70		89.6		57	(2A)		8	
5	37		243	2.2	4.00		92.7		57				
P6	3:1/40L		234	2.0	3.70		95.5		57				
7	43		238	1.6	2.90		98.2		59				
8	45+	-0.8	235	1.0	1.95		00.6		60				
9	47		236	1.0	1.85		02.5		60				
10	50+		235	1.4	2.60		04.4		61	64.05/56			
C 11	52/53+		232	.8	1.45		06.7		63	64.80/60			
12	54		232	.7	1.30		08.4		65	0.80/56		5	
13	55+		234	.5	.92		10.0		67	(2A)			
14	57	-0.6	235	.4	.76		11.3		69				
15	59		236	.7	1.30		12.5		70				
16	59/1:04+		232	.5	.92		14.1		72				
17	06		225	.3	.56		15.5		74				
18	08		225	.2	.37		16.6		75				
19	10	-0.6	224	.2	.37		17.5		75				
20	12+		225	.3	.56		18.3		77				
A 21	10/22		220	.2	.37		19.4		78				
22	22		222	.2	.37		20.3	(43.41)	80				
23	24	-0.5	222	.1	.18		21.2		81				
24	27		220	.1	.18		21.9		81				
25	30		220	.2	.37		22.5		81				

933.91

Environment Technolo[illegible] Engineering Corp.

PARTICULATE FI[illegible]D DATA



CROSS SECTION

PLANT Payne & Dolan
DATE 9-2-98
LOCATION Newbern
OPERATOR WJD
STACK NO. Control 53
RUN NO. 3
SAMPLE BOX NO. 6
METER BOX NO. 1

AMBIENT TEMPERATURE ______
BAROMETRIC PRESSURE ______
ASSUMED MOISTURE, % 25
PROBE LENGTH, in. 5' +
NOZZLE DIAMETER, in. 1/2
STACK DIAMETER, in. 37x54
PROBE HEATER SETTING -
HEATER BOX SETTING -

METER ΔH ______
C FACTOR ______
PROCESS WEIGHT RATE ______

ORSAT RESULTS
CO2 4.6
O2 12.4
CO ______
N2 ______

LEAK CHECKS
ok Pre <.01 22"
ok Pitot 5"+
ok Post <.01 21"
ok Pitot 5"+

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
										72	66.50/62	49.4 34/60	8	
E 1	10:15		240	3.4		5.80		425.40		73	65.80/58	6.75/66		
2	61+		242	3.0		5.30		28.2		73	0.80/60	2.41/64		
3	50	-1.0	242	2.2		4.00		31.4		74	(3A)			
4	57+		240	2.8		5.20		34.3		75				
5	55		240	3.0		5.50		37.4		77				
D 6	57.58		235	2.6		4.90		40.6		78				
7	00+		234	1.8		3.30		43.5		79				
8	03	-0.8	235	1.2		2.20		46.0		80				
9	05+		234	1.2		2.20		48.0		81				
10	08		232	1.8		3.30		50.0		80	66.40/58			
C 11	12+/22+		230	1.2		2.20		52.6		80	66.90/66			
12	25		230	0.7		1.30		54.6		80	6.80/62			
13	27+	-0.7	229	0.5		.96		56.3		80	(3B)			
14	30		229	0.5		.94		57.7		80				
15	32+		230	0.7		1.30		59.0		79				
B 16	33/35+		228	.5		.94		60.7		79				
17	38		225	.4		.74		62.0		80				
18	40+	-0.6	225	.3		.56		63.2		80				
19	43		225	.2		.37		64.3		80				
20	45+		222	.4		.74		65.2		81				
A 21	42/48-		218	.2		.37		66.3		81				
22	51	-0.6	220	.1		.18		67.2		81				
23	53		218	.1		.18		67.8	41.18	82				
24	56		218	.1		.10		68.2		82				
25	58+		215	.1		.18		69.1						
	120							464.48						

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME P&D #53 DATE OF TEST 9-2-98

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 1 STACK Baghouse

Sample Box 4 Filter T-970 Wash Bottle —

Beaker No. 4

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	311	100	211
2	278	100	178
3	14	0	14
SILICA	624	609	15
		TOTAL	418

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.0952	1.0734	0.0218
Washings (0.0003)	95.3894	95.3861	0.0030
		TOTAL	0.0248

WATER COLLECTED [ ] GRAMS

PARTICULATE COLLECTED [ ] GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME P&D #53 DATE OF TEST 9-2-98

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 2 STACK Baghouse

Sample Box 5 Filter T-971 Wash Bottle —

Beaker No. 5

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	355	100	255
2	242	100	142
3	8	0	8
SIL GEL	683	669	14
		TOTAL	419

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.1634	1.0686	0.0948
Washings (0.0003)	110.4562	110.4527	0.0032
		TOTAL	0.0980

WATER COLLECTED [ ] GRAMS

PARTICULATE COLLECTED [ ] GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME P+D #53 DATE OF TEST 9-2-98

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 3 STACK Baghouse

Sample Box 6 Filter T-972 Wash Bottle —

Beaker No. 6

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	318	100	218
2	238	100	138
3	23	0	23
SILICA	689	676	13
		TOTAL	392

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.0983	1.0391	0.0592
Washings (0.0003)	108.6582	108.6514	0.0065
		TOTAL	0.0657

WATER COLLECTED [ ] GRAMS

PARTICULATE COLLECTED [ ] GRAMS

NOTES:

PAYNE & DOLAN
CONTROL 53 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	10.2	3.0	0.10	0.02	0.010	0.133	5.75	0.80	1.065	74	29.1	0.819	0.023	46048	0.58
1B	10.0	3.0	0.10	0.02	0.010	0.131	5.65	0.80	1.065	75	29.1	0.818	0.023	46048	0.57
AVG							5.70								0.58
2A	10.5	3.0	0.10	0.02	0.010	0.137	5.89	0.80	1.065	56	29.25	0.852	0.024	45346	0.57
2B	10.0	3.0	0.10	0.02	0.010	0.131	5.44	0.80	1.065	58	29.25	0.849	0.024	45346	0.54
AVG							5.56								0.56
3A	10.0	3.0	0.10	0.02	0.010	0.131	5.46	0.80	1.065	60	29.25	0.846	0.024	46547	0.58
3B	10.2	3.0	0.10	0.02	0.010	0.133	5.59	0.80	1.065	62	29.25	0.842	0.024	46547	0.60
AVG							5.53								0.59

PAYNE & DOLAN
CONTROL 53 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	1.55	0.02	0.010	3.104	133.76	0.80	1.065	74	29.1	0.819	0.023	48048	13.56
1B	18.0	3.0	1.65	0.02	0.010	3.133	135.25	0.80	1.065	75	29.1	0.818	0.023	48048	13.73
AVG							134.51								13.65
2A	19.0	3.0	2.00	0.02	0.010	4.017	166.41	0.80	1.065	56	29.25	0.852	0.024	45346	16.64
2B	18.8	3.0	1.95	0.02	0.010	3.874	161.12	0.80	1.065	58	29.25	0.849	0.024	45346	16.11
AVG							163.76								16.37
3A	18.5	3.0	1.85	0.02	0.010	3.615	150.91	0.80	1.065	60	29.25	0.846	0.024	48547	16.15
3B	19.0	3.0	1.85	0.02	0.010	3.712	155.59	0.80	1.065	62	29.25	0.842	0.024	48547	16.65
AVG							153.25								16.40

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