AP42 Section: 11.1

Reference Number: 385

Title: Results Of The September 23, 1999 Air Emission Compliance Test On The Monarch Paving No. 10 Asphalt Plant Near Hager City, Wisconsin,

Interpoll Laboratories, Circle Pines, MN,

November 11, 1999.

Sec. 11.1
Ref. 385

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RESULTS OF THE SEPTEMBER 23, 1999 AIR EMISSION COMPLIANCE TEST ON THE MONARCH PAVING NO. 10 ASPHALT PLANT NEAR HAGER CITY, WISCONSIN

Submitted to:

Mathy Construction Company
920 10th Ave. N.
Onalaska, Wisconsin 54650

Attention:

Tara Wetzel

Approved by:

Kathleen Eickstadt

Kathleen Eickstadt
Department Coordinator
Field Services Department

Report Number 9-13517
November 11, 1999
KE/mn

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ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	dry standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (°F)	degrees Fahrenheit
DIA.	diameter
FP	finished product for plant
FT/SEC	feet per second
g	gram
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g/dscm	grams per dry standard cubic meter
HP	horsepower
HRS	hours
IN.	inches
IN.HG.	inches of mercury
IN.WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/10^6BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
LTPD	long tons per day
MW	megawatt
mg/Nm^3	milligrams per dry standard cubic meter
ug/Nm^3	micrograms per dry standard cubic meter
microns (um)	micrometer
MIN.	minutes
ng	nanograms
ohm-cm	ohm-centimeter
PM	particulate matter
PPH	pounds per hour
PPM	parts per million
ppmC	parts per million carbon
ppm,d	parts per million, dry
ppm,w	parts per million, wet
ppt	parts per trillion
PSI	pounds per square inch
SQ.FT.	square feet
TPD	tons per day
ug	micrograms
v/v	percent by volume
w/w	percent by weight
<	≤ (when following a number)

Standard conditions are defined as 68°F (20°C) and 29.92 IN. of mercury pressure.

g:\stack\wp\misc\abbrev.frm

INTRODUCTION

On September 23, 1999 Interpoll Laboratories personnel conducted an air emission compliance test on the Monarch Paving Plant No. 10 located in Hager City, Wisconsin. The plant was tested while fired with waste oil. On-site testing was performed by Ed Juers, Scott Fjelsta and Doug Peterson. Coordination between testing activities and plant operation was provided by Tara Wetzel of Mathy Construction.

Particulate determinations were performed in accordance with EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1999). A preliminary determination of the gas linear velocity profile was made before the first particulate determination to select the appropriate nozzle diameter for isokinetic sample withdrawal. An Interpoll Labs sampling train which meet or exceed specifications in the above-cited reference was used to extract particulate samples by means of heated glass-lined probes. A one hour opacity determination was run simultaneously with Run 1 in accordance with EPA Method 9.

The O_2, CO_2, SO_2 determinations were performed in accordance with CFR Title 40, Part 60 Appendix B (revised July 1, 1999). Evaluations were performed in accordance with EPA Methods 3A and 6C . For oxygen analysis, a slip stream of sample gas was withdrawn from the exhaust gas stream using test ports (provided by the plant) on the stack using a heat-traced probe and filter assembly. After passing through the filter, the gas passed through two condenser-type moisture removal systems operating in series. The particulate-free dry gas was then transported to the oxygen analyzer with the excess exhausted to the atmosphere through a calibrated orifice which was used to ensure that the flow from the stack exceeds the requirements of the analyzer. For SO_2 and CO_2 analysis, a dilution probe based system was used. In this system, a slip stream of exhaust gas is drawn from the exhaust gas stream using an EPM dilution probe. The sample stream is filtered and diluted (dilution during this test was 100:1) before delivery to the SO_2 and CO_2 analyzers. The analog response of the analyzers in both systems was recorded using a computer data logger and backed up with a strip chart recorder.

The O_2, SO_2, and CO_2 analyzers were calibrated with National Specialty Gases and Air Products and Chemicals standard gases. The instruments were calibrated before and after each run as per EPA Method 3A and 6C. The sample probe was moved through a three-point traverse to measure sulfur dioxide concentrations.

Testing on the No. 10 Asphalt Plant Stack was conducted from eight test ports evenly spaced across the face of the stack. The ports are located 5.9 diameter equivalents downstream of the nearest flow disturbance and .96 diameter equivalents upstream of the stack exit. A 24-point traverse was used to collect representative particulate samples. Each traverse point was sampled 3.0 minutes to give a total sampling time of 72 minutes per run.

The important results of the test are summarized in Section 2. Detailed results are presented in Section 3. Field data and all other supporting information are presented in the appendices.

2 SUMMARY AND DISCUSSION

The important results of the air emission compliance tests are summarized in Tables 1-2. An overview of the results is presented below:

PARAMETER	LIMIT	MEASURED
NO.10 ASPHALT PLANT STACK		
PM		
DRY CATCH ONLY (GR/DSCF)	N/A	0.1777
(LB/HR)	N/A	32.27
DRY + METHOD 202 (GR/DSCF)	N/A	0.1813
(LB/HR)	N/A	32.89
Emission Rate (LB/KLB)	0.30	0.30
Sulfur Dioxide		
(ppm,w)	N/A	1.87
(LB/HR)	N/A	0.49
Opacity		
(%)	20%	5.00

No difficulties were encountered in the field by Interpoll Labs or in the laboratory evaluation of the samples which were conducted by Interpoll Labs. On the basis of these facts and a complete review of the data and results, it is our opinion that the results reported herein are accurate and closely reflect the actual values which existed at the time the test was performed.

SO2 EMISSIONS CALCULATIONS

Monarch Paving Plant #10

Sulfur in Burner Fuel

S = 0.36% by weight

Mass of Oil = 7.43 lb/gallon

Mass Flow of Sulfur Dioxide from the Burner

Average burner fuel flow = (288 + 324 + 324)gallons/hour / 3 = 312 gallons/hour.
312 gallons/hour x 7.43 lbs/gallon x .36/100 sulfur/oil x 2 SO2/S =
16.69 lbs SO2/hour generated in the plant drum by combustion.

Mass Flow of Sulfur Dioxide from the Plant Stack

0.49 lbs/hour

Sulfur Dioxide Capture Efficiency

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

EF = **97.06** %

comp\plt\so2test

Table 1a Summary of the Results of the September 23, 1999 Particulate Emission Compliance Test on the Mathy/Monarch Paving No. 10 Asphalt Plant Located Near Hager City, Wisconsin.

ITEM	Run 1	Run 2	Run 3
Date of test	09-23-99	09-23-99	09-23-99
Time runs were done (HRS)	755/ 912	1130/1233	1255/1359
Volumetric flow			
actual (ACFM)	33783	36617	37291
standard (DSCFM)	20666	20879	21766
Gas temperature (DEG-F)	227	258	245
Moisture content (%V/V)	17.77	19.96	19.48
Gas composition (%V/V,dry)			
carbon dioxide	3.97	4.54	4.54
oxygen	15.12	14.51	14.63
nitrogen	80.91	80.95	80.83
Isokinetic variation (%)	96.0	102.6	101.4
Particulate concentration			
actual (GR/ACF)	.0803	0.113	0.125
standard (GR/DSCF)	0.131	0.198	0.215
Part. emission rate (LB/HR)	23.26	35.37	40.05
(LB/KLB Flue Gas)	0.218	0.328	0.356

Note: Dry + Method 202 Condensible Particulate Material

Table 1b. Summary of the Results of the September 23, 1999 Particulate Emission Compliance Test on the Mathy/Monarch Paving No. 10 Asphalt Plant Located Near Hager City, Wisconsin.

ITEM	Run 1	Run 2	Run 3
Date of test	09-23-99	09-23-99	09-23-99
Time runs were done (HRS)	755/ 912	1130/1233	1255/1359
Volumetric flow			
actual (ACFM)	33783	36617	37291
standard (DSCFM)	20666	20879	21766
Gas temperature (DEG-F)	227	258	245
Moisture content (%V/V)	17.77	19.96	19.48
Gas composition (%V/V,dry)			
carbon dioxide	3.97	4.54	4.54
oxygen	15.12	14.51	14.63
nitrogen	80.91	80.95	80.83
Isokinetic variation (%)	96.0	102.6	101.4
Particulate concentration			
actual (GR/ACF)	.0778	0.111	0.123
standard (GR/DSCF)	0.127	0.195	0.211
Part. emission rate (LB/HR)	22.53	34.94	39.34

Note: Dry Catch Only

Table 2. Summary of the Results of the **Sulfur Dioxide** Emission Compliance Tests on the No. 10 Asphalt Plant Stack.

Date	Time (HRS)	Concentration (ppm,w)	Emission Rate (LB/HR)
No. 10 Asphalt Plant			
9-23-99	0755-0857	2.07	0.52
9-23-99	1130-1233	2.07	0.54
9-23-99	1255-1358	1.47	0.40
Avg		1.87	0.49

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Orsat (gas composition) and moisture is presented first followed by the computer printout of the particulate, sulfur dioxide and opacity results. Preliminary measurements including test port locations are given in the appendices.

The results have been calculated on a personal computer using programs written in Extended BASIC specifically for source testing calculations. EPA-published equations have been used as the basis of the calculation techniques in these programs. The emission rates have been calculated using the product of the concentration times flow method.

APPENDIX A

PRELIMINARY VOLUMETRIC FLOW DETERMINATION

Test No. 1
No. 10 Asphalt Plant Stack

Results of Volumetric Flow Rate Determination-------Method 2

Date of Determination...........	09-23-99
Time of Determination.......(HRS)	709
Barometric pressure.......(IN.HG)	28.99
Pitot tube coefficient..........	.84
Number of sampling ports.........	8
Total number of points..........	24
Shape of duct....................	Rectangular
Duct width..................(IN)	23.75
Duct length.................(IN)	63.5
Duct area................(SQ.FT)	10.47
Direction of flow...............	UP
Static pressure..........(IN.WC)	-.32
Avg. gas temp............(DEG-F)	212
Moisture content..........(% V/V)	17.77
Avg. linear velocity.....(FT/SEC)	55.1
Gas density.............(LB/ACF)	.05381
Molecular weight......(LB/LBMOLE)	29.24
Mass flow of gas.........(LB/HR)	111795
Volumetric flow rate............	
actual....................(ACFM)	34623
dry standard............(DSCFM)	21657

APPENDIX B

LOCATION OF TEST PORTS

SAMPLING SITE DETAIL

Plant # 10

stack Dimensions :

Width = 65 inches

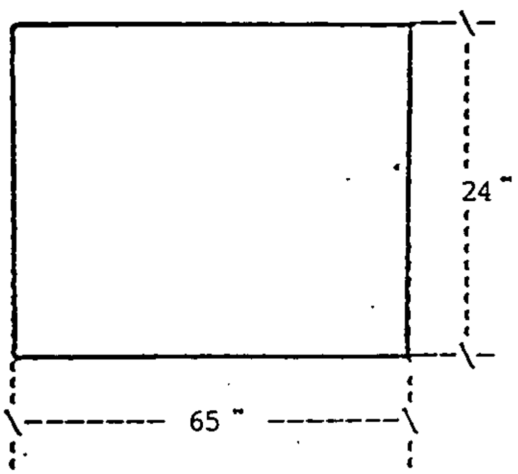
Length = 24 inches

Equiv.Diameter = $\frac{2\ L\ W}{(L + W)}$ = 35.06 inches

o. of Ports = 8 No. of Traverse Points = 24

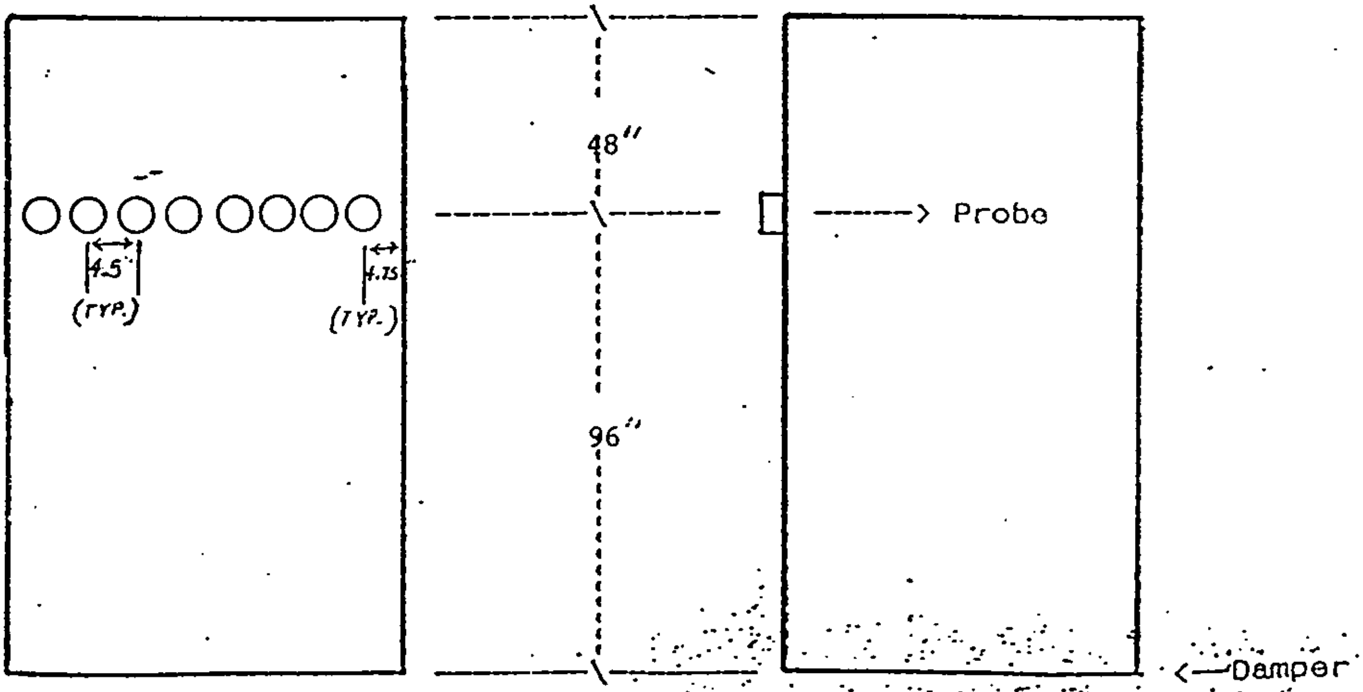
utside Port Spacing = 4.75 inches

nside Port Spacing = 4.5 inches



Point	Probe Mark
1	4" **
2	12"
3	20"

** from stack wall



APPENDIX C

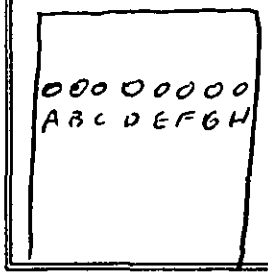
FIELD DATA SHEETS

INTERPOLL LABORATORIES, INC.
(612) 786-6020

EPA Method 2 Field Data Sheet

Job Mathy/Monarch Paving
Source Plant #10 Stack
Test 1 Run 0 Date 9-23-99
Stack Dimen. 23.75 ×63.5 IN.
Dry Bulb ______ °F Wet bulb ______ °F
Manometer ☒ Reg. ☐ Exp ☐ Elec.
Barometric Pressure 28.99 IN.HG
Static Pressure -.32 IN.WC
Operators E. Jvers, Scott Fjelsta, Doug Peterson
Pitot No. 40v-2½ C_p .840

Drawing of Test Site

Cross-section View	Elevation View
	

Traverse Point No.	Fraction of Diameter	Distance From Stack Wall (IN.)	Distance From End of Port (IN.)	140 TPH Velocity	Temp. of Gas
		Port Length: 2.75 IN.		Time Start: 0709 HRS	
A 1	~~1/8~~ 1/6	~~2.97~~ 3.96	~~5.72~~ 6.71	1.20	
2	~~3/8~~ 3/6	11.88	14.63	1.2	
3	~~5/8~~ 5/6	19.80	22.55	1.1	
B 1 ~~4~~	~~7/8~~			1.1	
2				1.15	
3				1.1	
C 1				.90	
2				.97	
3				.98	
D 1				.71	
2				.83	
3				.89	212
E 1				.56	
2				.65	
3				.79	
F 1				.38	
2				.49	
3				.62	
G 1				.31	
2				.36	
3				.44	
H 1				.24	
2				.27	
3				.30	
			Avg	.73	
Temp. Meas. Device & S/N: PDT				Time End: HRS	

R or nothing = reg. manometer; S = expanded; E = electronic

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Interpoll Laboratories EPA Method 5/202 Sample Log Sheet

Job Mathy/Monarch Paving
Source Plant #10 Stack
Method 5/202

Date 9-23-99 Test 1 Run 1
No. of traverse points 24
Filter holder Glass Filter Type 4"GF

Sample train Leak Check:
Pretest: ≤ 0.02 cfm @ 15 In. Hg (vac)
Post test 0 cfm @ 6 Hg (vac)

Particulate Catch Data
No. of filters used
1133

Recovery Solvents
Acetone ✓
Others MeCl2, H2O

No. of probe wash bottles: 1
Sample recovered by: ES

Condensate Data:

Item	Weight (g) Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	734	581	153
Impinger No. 3			
Condenser			
Desiccant	1490	1478	12
Total			165

EPA Method 202 Data:
pH of Impinger Catch: 5.5
Purge: NA Time: Date:
Tare weight of imp catch jar: g

Integrated Bag Sample: Ran Instrumental O_2 CO_2
Bag Pump No.
Box No. Bag No.
Bag Material 5-layer aluminized Tedlar
Size: 44L
Pretest Leak Check:
cc/min @ In.Hg
Time Start:
Time End

S/N of O2 Analyzer 11

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INTERPOLL LABORATORIES, INC.
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EPA Method 5 Field Data Sheet

Job Mathy/Monarch Paving
Source Plant #10 Stack
Date 9-23-99 Test 1 Run 1

Operators ES SF
Meter Box No. 14 ΔH@ 1.91 in.WC
Gasmeter Coeff. 1.0019

Nozzle No. 9-3
Nozzle Dia. .220 in.
Bar. Press. 28.99 in.Hg

Pitot No. sev-2½
C_p .840
H_2O 23 %

Traverse Point No.	Sampling Time (min)	Sample Vol. (cf)	Velocity Head (in.WC)	Orifice Meter (in.WC)	Des. Vol. (cf)	VAC. (in.Hg)	Temperatures (°F) Stack	Probe	Oven	Imp.	Gas/In	Gas/Out	Oxygen (% v/v)
	(0755)	(162.80)											
H 3	3	163.99	.30	.41	3.86	2	215	227	261	42	79	79	
2	6	164.95	.31	.42	4.95	2	217				78	79	16.3
1	9	166.16	.26	.35	5.94	2	217	233	271	45	78	79	15.8
G 3	12	167.57	.48	.65	7.29	2.5	217				79	79	15.8
2	15	168.93	.45	.60	8.59	2.5	222	237	270	49	79	78	15.8
1	18	170.13	.39	.52	9.79	2	225				80	79	15.5
F 3	21	171.96	.81	1.09	1.53	3.5	227	257	269	52	81	79	15.6
2	24	173.48	.63	.84	3.07	3	226				81	79	16.1
1	27	174.91	.47	.63	4.40	3	227	261	267	55	81	79	15.4
E 3	30	176.60	.81	1.08	6.13	3.5	228				81	79	15.4
2	33	178.31	.70	.94	7.75	3	228	260	269	56	82	79	15.8
1	36	179.76	.53	.71	9.16	3	228				82	79	15.7
D 3	39	181.46	.81	1.08	0.90	3.5	228	266	263	56	81	79	15.9
2	42	183.12	.84	1.12	2.66	3.5	232				82	79	15.5
1	45	184.76	.71	.95	4.29	4	230	263	267	54	82	79	15.6
C 3	48	186.58	.83	1.10	6.04	3.5	232				82	79	15.8
2	51	188.31	.89	1.11	7.80	3.5	230	261	266	55	83	79	15.6
1	54	189.96	.73	.97	9.45	3.5	231				83	79	15.6
B 3	57	191.23	.83	1.11	1.91	3.5	231	258	261	53	82	79	15.7
2	60	193.56	.89	1.18	3.03	3.5/4	233				82	79	15.7
1	63	195.20	.76	1.01	4.71	4	231	257	263	54	82	79	15.6
A 3	66	197.05	.82	1.09	6.46	4	231				82	79	15.9
2	69	198.90	.88	1.17	8.26	4	231	260	264	55	82	79	15.5
1	72	200.66	.73	.97	9.91		230				83	79	15.9
	(0912)												
	θ - 72	V_m - 37.86		ΔH - .88							Avg. - 80		

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Interpoll Laboratories EPA Method 5/202 Sample Log Sheet

Job Mathy / Monarch Paving
Source Plant #10 Stack
Method 5/202

Date 9-23-99 Test 1 Run 2
No. of traverse points 24
Filter holder Glass Filter Type 4" GF

Sample train Leak Check:
Pretest: ≤ 0.02 cfm @ 15 In. Hg (vac)
Post test 0 cfm @ 7.5 Hg (vac)

Particulate Catch Data

No. of filters used
1134

Recovery Solvents
Acetone ✓
Others MeCl$_2$, H$_2$O

No. of probe wash bottles:
Sample recovered by:

Condensate Data:

Item	Weight (g) Final	Tare	Difference
Impinger No. 1	E 688	582	106
Impinger No. 2	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
Impinger No. 3	404	295	109
Condenser	1445	1430	15
Desiccant	~~1490~~	~~1478~~	~~12~~
Total			~~[illegible]~~ 230

EPA Method 202 Data:
pH of Impinger Catch: 5.5
Purge: N/A Time: Date:
Tare weight of imp catch jar: g

Integrated Bag Sample: Simultaneous Instrument
Bag Pump No.
Box No. Bag No.
Bag Material 5-layer aluminized Tedlar
Size: 44L
Pretest Leak Check:
cc/min @ In.Hg
Time Start:
Time End

S/N of O2 Analyzer 11

INTERPOLL LABORATORIES, INC.
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EPA Method 5 Field Data Sheet

Job Mathy / Monarch Paving
Source Plant #10 Stack
Date 9-23-99 Test 1 Run 2

Operators EJ SF DP
Meter Box No. 14 ΔH@ 1.91 in.WC
Gasmeter Coeff. 1.0019

Nozzle No. 9-4
Nozzle Dia. .255 in.
Bar. Press. 28.99 in.Hg

Pitot No. 40v-2b
C_p .84
H_2O 20 %

Traverse Point No.	Sampling Time (min)	Sample Vol. (cf)	Velocity Head (in.WC)	Orifice Meter (in.WC)	Des. Vol. (cf)	VAC. (in.Hg)	Temperatures (°F)						Oxygen (% v/v)
							Stack	Probe	Oven	Imp.	Gas/In	Gas/Out	
▨	(1130)	(201.05)	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
A 3	2.5	202.85	.61	1.54	2.77	5	240	239	261	43	75	75	14.7
2	5	204.68	.65	1.62	4.53	5	245				78	75	14.6
1	7.5	206.37	.61	1.52	6.24	5	245	240	266	45	79	76	14.6
B 3	10	208.29	.70	1.75	8.07	5.5	245				79	75	15.5
2	12.5	210.24	.76	1.91	9.98	6	242	236	263	45	80	76	14.9
1	15	211.98	.61	1.53	1.70	5.5	242				81	76	15.6
C 3	17.5	214.03	.79	1.99	3.66	6	242	263	261	46	81	76	15.4
2	20	216.10	.84	2.11	5.67	7	243				81	76	14.6
1	22.5	217.90	.67	1.68	7.46	6	245	261	263	46	82	76	15.1
D 3	25	219.80	.84	2.10	9.48	7	245				82	76	14.8
2	27.5	221.91	.86	2.15	1.51	8	248	257	267	47	82	76	14.7
1	30	223.89	.69	1.72	3.73	6	248				82	76	14.8
E 3	32.5	225.79	.92	2.29	5.43	7	248	261	267	46	82	76	14.8
2	35	227.80	.78	1.96	7.37	7	244				83	76	15.8
1	37.5	229.82	.76	1.91	9.29	6.5	245	266	265	47	84	77	15.3
F 3	40	231.90	.95	2.39	1.43	7.5	245				83	77	15.3
2	42.5	234.01	.80	2.00	3.39	7	249	266	259	48	84	77	15.0
1	45	235.86	.61	1.53	5.11	6	245				84	77	14.9
G 3	47.5	237.80	.81	2.04	7.10	6.5	245	267	263	47	84	77	14.8
2	50	239.70	.73	1.83	8.98	6	249				84	78	14.9
1	52.5	240.41	.59	1.48	0.67	6	248	261	263	49	84	78	15.3
H 3	55	243.30	.64	1.60	2.43	5	248				84	79	14.9
2	57.5	245.01	.63	1.58	4.18	5	246	256	261	51	84	79	15.3
1	60	246.60	.51	1.29	5.76	4	243				84	79	14.6
	(1233)												
▨	0-60	V_m = 44.55	▨	ΔH = 1.81	▨	▨	▨	▨	▨	▨	Avg. = 79.2		▨

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EPA Method 5 Field Data Sheet

Job Mathy/Monarch Paving
Source Plant #10 Stack
Date 7-23-99 Test 1 Run 3

Operators EJ SF
Meter Box No. 14 ΔH@ 1.91 in.WC
Gasmeter Coeff. 1.0012

Nozzle No. 9-4
Nozzle Dia. .255 in.
Bar. Press. 28.99 in.Hg

Pitot No. 40v-3½
C_p .840
H_2O 20 %

Traverse Point No.	Sampling Time (min)	Sample Vol. (cf)	Velocity Head (in.WC)	Orifice Meter (in.WC)	Des. Vol. (cf)	VAC. (in.Hg)	Temperatures (°F) Stack	Probe	Oven	Imp.	Gas/In	Gas/Out	Oxygen (% v/v)
▨	(1255)	(246.85)	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
H 3	2.5	248.60	.63	1.58	8.59	4.5	245	256	261	48	80	79	14.8
2	5	250.31	.64	1.60	0.35	5	249				83	79	14.7
1	7.5	252.05	.55	1.38	1.98	4	248	257	263	50	83	79	15.1
G 3	10	254.07	.85	2.13	4.01	6	248				83	79	14.5
2	12.5	256.06	.74	1.85	5.90	6.	249	260	263	51	83	79	14.9
1	15	257.58	.39	.98	7.28	7	243				83	79	16.1
F 3	17.5	259.48	.76	1.91	9.20	6	245	263	265	51	83	79	14.5
2	20	261.37	.63	1.59	0.95	5.5	243				84	80	15.1
1	22.5	263.10	.49	1.24	2.51	5.0	241	261	266	52	83	80	15.1
E 3	25	264.98	.83	2.10	4.52	6.5	241				84	80	15.1
2	27.5	267.01	.75	1.90	6.44	6.5	243	257	269	52	84	80	15.1
1	30	268.88	.61	1.55	8.17	6	241				83	80	15.1
D 3	32.5	270.86	.88	2.23	0.24	7	241	259	268	50	83	79	14.7
2	35	272.97	.87	2.19	2.30	7	245				83	79	15.3
1	37.5	274.92	.71	1.79	4.15	6	244	260	263	53	83	80	14.9
C 3	40	276.95	.90	2.27	6.25	7	244				83	80	14.6
2	42.5	279.05	.94	2.36	8.38	7	247	257	267	54	83	80	14.8
1	45	281.04	.79	1.99	0.37	6.5	246				84	79	15.2
B 3	47.5	283.10	.89	2.24	2.42	7	246	261	267	54	84	79	15.2
2	50	285.30	.98	2.46	4.60	8	246				85	79	15.2
1	52.5	287.51	.86	2.16	6.64	7.5	247	259	265	53	84	80	14.8
A 3	55	289.61	.91	2.29	8.74	7.5	247				84	80	14.8
2	57.5	291.85	.97	2.43	0.91	8	249	259	265	55	85	80	15.3
1	60	293.98	.89	2.24	2.99	8	246				85	80	14.8
	(1359)												
▨	0 - 60	V_m - 47.13	▨	ΔH - 1.93	▨	▨	▨	▨	▨	▨	Avg. -	82.4	▨

688-593 = 95
417-294 = 123
1502-1490 = 12

Leak check EJ
Post Test < .02 at 13 in. Hg ✓

EPA

VISIBLE EMISSION OBSERVATION FORM 1

Method Used (Circle One): [✓ Method 9] 203A 203B Other: ______

Company Name: MATHY PLANT NO. 10

Facility Name:

Street Address:

City: HAGAR City State: WI Zip:

Process: ASPALT PLANT Unit #: Operating Mode:

Control Equipment: BAGHOUSE Operating Mode:

Describe Emission Point: rectangular ~~st~~ stack

Height of Emiss. Pt.: Start 35 Ft End 35 Ft

Height of Emiss. Pt. Rel. to Observer: Start 35 Ft End 35 Ft

Distance to Emiss. Pt.: Start 150 Ft End 150 Ft

Direction to Emiss. Pt. (Degrees): Start 0° N End 0° N

Vertical Angle to Obs. Pt.: Start 15° End 15°

Direction to Obs. Pt. (Degrees): Start 0° N End 0° N

Distance and Direction to Observation Point from Emission Point: Start 150 Ft 0° N End 150 Ft 0° N

Describe Emissions: Start high Velocity End

Emission Color: Start grey/yellow End

Water Droplet Plume: Attached ☐ Detached ☒ None ☐

Describe Plume Background: Start overcast sky End overcast sky

Background Color: Start Blue/GREY End

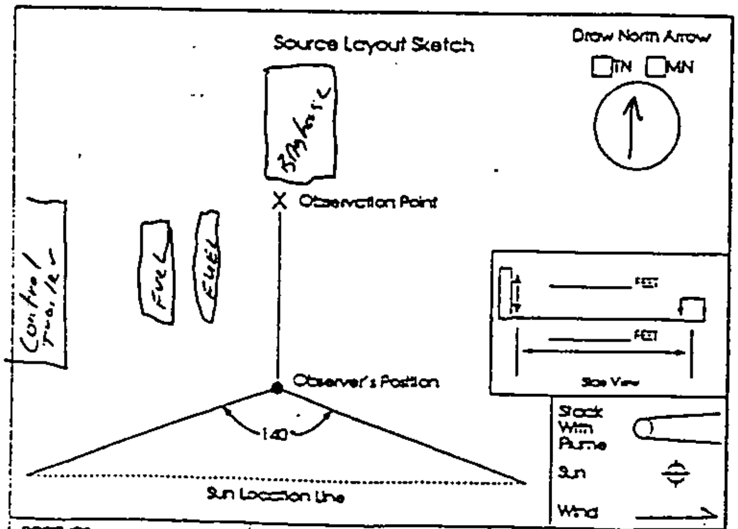
Sky Conditions: Start Grey End DARK Grey

Wind Speed: Start CALM End 0-5 mph

Wind Direction: Start End

Ambient Temp.: Start 58° F End 60°

Wet Bulb Temp.: RH Percent:



Longitude: Latitude: Declination:

Additional Information:

VEOF1.1

Form Number: Page of

Continued on VEO Form Number:

Observation Date: 9/23/99 Time Zone: Start Time: 0755 End Time:

Min \ Sec	0	15	30	45	Comments
1	0	5	0	5	
2	0	0	0	0	GREY SKY
3	0	10	0	5	
4	5	5	5	0	
5	0	5	5	5	
6	5	10	5	0	
7	0	0	5	0	
8	0	0	5	0	
9	0	5	0	5	
10	5	10	5	5	
11	0	10	0	5	
12	0	5	5	5	
13	0	5	0	0	
14	0	5	5	0	
15	5	0	5	0	
16	5	0	0	5	
17	0	10	5	5	
18	5	5	5	5	
19	0	5	0	0	DARKER GREY
20	0	0	0	0	SKY
21	0	10	0	0	
22	5	5	15	5	
23	5	5	0	5	
24	0	5	5	10	
25	5	5	5	0	
26	0	10	5	5	
27	10	5	0	5	
28	5	5	5	10	
29	5	0	10	5	
30	0	0	0	5	

Observer's Name (Print): Douglas J Peterson

Observer's Signature: Date: 9/23/99

Organization: Inter-poll Labs

Certified By: Easter tech Ass Date: 4/7/99

EPA

VISIBLE EMISSION OBSERVATION FORM 1

Method Used (Circle One)
Method 9 203A 203B Other: ______

Company Name		
Facility Name		
Street Address		
City	State	Zip

Process	Unit #	Operating Mode
Control Equipment		Operating Mode

Describe Emission Point

Height of Emiss. Pt. Start End	Height of Emiss. Pt. Rel. to Observer Start End
Distance to Emiss. Pt. Start End	Direction to Emiss. Pt. (Degrees) Start End
Vertical Angle to Obs. Pt. Start End	Direction to Obs. Pt. (Degrees) Start End

Distance and Direction to Observation Point from Emission Point
Start End

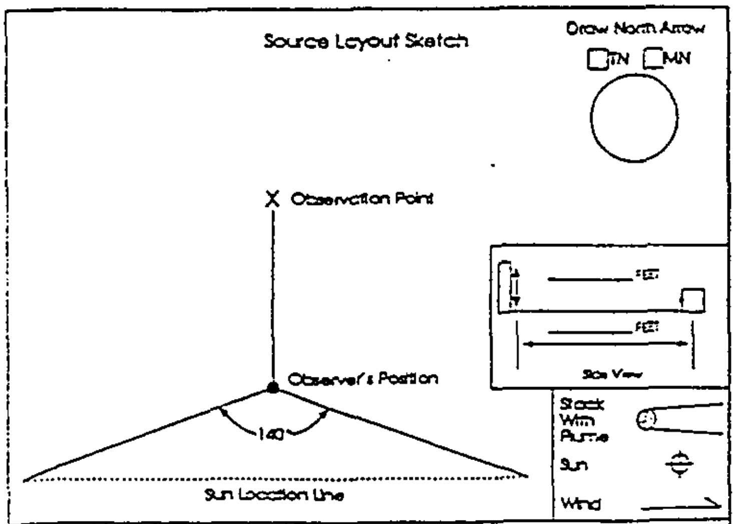
Describe Emissions
Start End

Emission Color Start End	Water Droplet Plume Attached ☐ Detached ☐ None ☐

Describe Plume Background
Start End

Background Color Start End	Sky Conditions Start End	
Wind Speed Start End	Wind Direction Start End	
Ambient Temp. Start End	Wet Bulb Temp.	RH Percent

Source Layout Sketch



Longitude	Latitude	Declination

Additional Information

VEOF1.1

Form Number				Page	Of
Continued on VEO Form Number					

Observation Date	Time Zone	Start Time	End Time

Min \ Sec	0	15	30	45	Comments
1	0	5	20	15	
2	5	0	5	0	
3	0	5	0	0	Difficult to distinguish
4	0	0	5	0	Steam VS Particulate
5	0	0	0	0	due to darker (grey)
6	5	5	5	10	sky color.
7	0	5	5	5	
8	0	5	0	0	
9	10	0	10	5	
10	0	5	5	5	
11	0	0	5	0	
12	15	0	5	0	
13	0	5	10	5	
14	5	5	10	5	
15	5	5	5	10	
16	0	5	0	0	
17	0	0	5	0	
18	5	5	0	5	
19	5	0	0	0	
20	0	0	0	0	
21	5	0	0	5	
22	0	0	5	0	
23	0	5	10	0	
24	0	0	5	0	
25	0	5	10	0	
26	5	5	0	5	
27	0	5	5	0	
28	0	5	0	0	
29	0	0	5	0	
30	5	0	5	0	

Observer's Name (Print)	
Observer's Signature	Date 9/23/99
Organization	
Certified By	Date

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Doug Peterson

met the specifications of Federal Reference Method 9 and qualified as a visible emissions evaluator. Maximum deviation on white and black smoke did not exceed 7.5% opacity and no single error exceeding 15% opacity was incurred during the certification test conducted by Eastern Technical Associates of Raleigh, North Carolina. This certificate is valid for six months from date of issue.

270123	*Minneapolis, Minnesota*	*April 7, 1999*
Certificate Number	Location	Date of Issue

President

Director of Training

APPENDIX D

INTERPOLL LABORATORIES ANALYTICAL DATA

9/27/99

INTERPOLL LABORATORIES, INC.
(612) 786-6020

Impinger Catch Data Reporting Sheet

Protocol: ☐Minnesota ☐Wisconsin ☐Iowa ☒EPA Method 202 ☐Other

Job: Mathy
Date Submitted: 9/24/99
Date of Analysis: 9/24/99
Source/Site: PLANT #10 / STACK
Test No.: 1
Technician: AKG / MKJ

	Solvent Phase	Aqueous Phase
Test: 1 Run: 0	Dish No: 029	Dish No: 100
Log No: 13517 . 09/13	Dish + Sample Wt: 52.5580 g	Dish + Sample Wt: 560668 g
Color & Appearance:	Dish Tare Wt: 52.5580 g	Dish Tare Wt: 56.0665 g
	Fraction Wt: 0.0000 g	Fraction Wt: 0.0003 g
Comments:	Smpl Vol: 300 ml, Alqt: 250 ml, Factor: 1200	Smpl Vol: 300 ml, Alqt: 250 ml, Factor: 1200
	Sample Wt: 0.0000 g	Sample Wt: 0.0004 g
Test: 1 Run: 1	Dish No: 060	Dish No: 757
Log No: 10/14	Dish + Sample Wt: 52.4156 g	Dish + Sample Wt: 50.8106 g
Color & Appearance:	Dish Tare Wt: 52.4105 g	Dish Tare Wt: 50.8067 g
	Fraction Wt: 0.0051 g	Fraction Wt: 0.0039 g
Comments:	Smpl Vol: 450 ml, Alqt: 400 ml, Factor 1.125	Smpl Vol: 450 ml, Alqt: 400 ml, Factor 1.125
	Sample Wt: 0.0057 g	Sample Wt: 0.0044 g
Test: 1 Run: 2	Dish No: 125	Dish No: 801
Log No: 11/15	Dish + Sample Wt: 52.2705 g	Dish + Sample Wt: 44.9883 g
Color & Appearance:	Dish Tare Wt: 52.2678 g	Dish Tare Wt: 44.9845 g
	Fraction Wt: 0.0027 g	Fraction Wt: 0.0038 g
Comments:	Smpl Vol: 500 ml, Alqt: 450 ml, Factor 1.111	Smpl Vol: 500 ml, Alqt: 450 ml, Factor 1.111
	Sample Wt: 0.0030 g	Sample Wt: 0.0042 g
Test: 1 Run: 3	Dish No: 135	Dish No: 938
Log No: 12/16	Dish + Sample Wt: 43.0145 g	Dish + Sample Wt: 43.6201 g
Color & Appearance:	Dish Tare Wt: 43.0132 g	Dish Tare Wt: 43.6110 g
	Fraction Wt: 0.0013 g	Fraction Wt: 0.0091 g
Comments:	Smpl Vol: 525 ml, Alqt: 475 ml, Factor 1.105	Smpl Vol: 525 ml, Alqt: 475 ml, Factor 1.105
	Sample Wt: 0.0014 g	Sample Wt: 0.0101 g

Note: Factor = Sample Volume/Aliquot Volume

Blank Solvent Wt.________g

	RUN 0	RUN 1	RUN 2	RUN 3
Results of Solvent Phase g	0.0000	0.0057	0.0030	0.0014
Results of Aqueous Phase D-1 g	0.0004	0.0040	0.0038	0.0097

INTERPOLL LABORATORIES, INC.
(612) 786-6020

GRAVIMETRICS DATA SHEET

Job Mathy Plant No. 10
Date Collected 9/23/99
Date of Analysis 9/27/99

Source No. 10 Stack
Test No. 1
Technician

Probe Wash Data
Solvent Used: Acetone

Filter Data
Filter Type: GF

Run 0			
Log # 13517-01	Dish # 41	Log # 13517-05	Filter # 1048
Volume 80 ml	Leakage X no, ___ yes	Color	
Tare + Sample (g)	45.3190	Tare + Sample (g)	0.8831
Tare (g)	45.3185	Tare (g)	0.8828
Sample (g)	0.0005	Sample (g)	0.0003
Run 1			
Log # -02	Dish # 45	Log # -06	Filter # 1133
Volume 70 ml	Leakage X no, ___ yes	Color	
Tare + Sample (g)	52.2542	Tare + Sample (g)	1.0844
Tare (g)	52.1398	Tare (g)	0.9017
Sample (g)	0.1144	Sample (g)	0.1827
Run 2			
Log # -03	Dish # 275	Log # -07	Filter # 1134
Volume 90 ml	Leakage X no, ___ yes	Color	
Tare + Sample (g)	52.5712	Tare + Sample (g)	1.3043
Tare (g)	52.4607	Tare (g)	0.8641
Sample (g)	0.1105	Sample (g)	0.4402
Run 3			
Log # -04	Dish # 501	Log # -08	Filter # 1047
Volume 80 ml	Leakage X no, ___ yes	Color	
Tare + Sample (g)	53.5254	Tare + Sample (g)	1.4112
Tare (g)	53.4169	Tare (g)	0.9067
Sample (g)	0.1085	Sample (g)	0.5045

Note: Solvent residue must be less than 0.0000078 g/ml

		0.1140	0.1099	0.1080
	Run 0	Run 1	Run 2	Run 3
Results of Filter + Probe Wash (g)		0.2967	0.5501	0.6125
Total Mass (g)				

Due 9-27-9

Interpoll Laboratories, Inc.
(612)786-6020

Ion Chromatography Laboratory

DIONEX MODEL 4000i WITH ANION MICRO MEMBRANE SUPRESSION

Analyst: KAB

Date of Analysis: 9/28/99

Job: Mathy

Source: Plant #10

Site: Stack

Chromatography Conditions

Column		Flow Rate	Eluent	Flow Rate		Suppressor Acid
	AS3	ml/min	2.4 mM Na_2CO_3 & 3.0 mM $NaHCO_3$	ml/min		12.5 mM Sulfuric Acid
X	AS4A	2 ml/min	1.8 mM Na_2CO_3 & 1.7 mM $NaHCO_3$	2 ml/min		SRS Setting 1
	AS5	ml/min	100 mM NaOH	X	Isocratic	
		ml/min			Gradient(List program below)	

Gradient Program	Time (Min)									
Eluent	0.0									
% A										
% B										

REVIEWED
SEP 29 1999

Results of Sulfate Determination

Sample Name	Interpoll Log Number	Tot. Sample Volume (ml)	Dilution	Solution Conc. (ug/ml)	Total ug Sulfate	meq of Sulfate
T1R0	13517-09	300	100X	<0.025	<750	<0.0156
↓ R1	↓ -10	456	↓	0.0433	1950	0.0406
R2	-11	500		0.0445	2220	0.0464
R3	-12	525		0.0318	1670	0.0348

Total ug = (Sample Vol.) x (Dilution) x (Solution Conc.)
meq = Total ug / 48000

INTERPOLL LABORATORIES, INC.
(612) 786-6020

Sample Chain of Custody

Job Mathy / Monarch Paving Source Plant #10 Site Stack Log No. B517
Field Engineer E. Juers Date of Test 9-23-99 Test No. 1 No. of Runs 3

No. Items	Sample Type		Analysis		Sequence No.	Comments
4	**Probe Wash:** ☒ Acetone ☐ $MeCl_2$	☐ DI Water ☐ ______	☒ EPA M-5 ☐ EPA M-29	☐ EPA M-201A ☐ ______	01-04	
4	**Filter:** ☒ 4" Glass ☐ SS Thimble	☐ Pallflex ☐ 2.5" Glass	☒ EPA M-5 ☐ EPA M-29 ☐ EPA M-201A	☐ EPA M-17	05-08	
6 4	**Impingers:** ☐ DI Water ☐ $3\% H_2O_2$ ☐ 1N NaOH ☐ 2,4-DNPH	☐ H_2SO_4 ☐ HNO_3/H_2O_2 ☐ $KMnO_4/H_2SO_4$ ☒ HPLC Grade H_2O	☐ MN Protocol ☐ WI Protocol ☒ EPA M-202 ☐ EPA M6,8 ☐ Acid Gases ~~☒ MeCl2~~	☐ IA Protocol ☐ Formaldehyde ☐ EPA M-29 ☐ EPA M-26 ☐ ______	09-12 ~~13-16~~	
—	**Integrated Gas:** ☐ Tedlar Bag	☐ ______	☐ EPA M-3 ☐ ______	☐ EPA M-10		
—	**Oxides of Nitrogen:**		☐ EPA M-7A ☐ ______			
1	**Fuel Lab:** ☒ Fuel Sample	☐ Aggregate	☐ Per S-0163 Waste		17	
	Particle Sizing:		☐ X-Ray Sdgraph ☐ ______	☐ Cascade Imp		
4	**Miscellaneous:**	☒ $MeCl_2/H_2O$	☒ M-202		13-16	

Fuel Type:

Coal:	☐ Bituminous ☐ Anthracite ☐ Lignite	Wood:	☐ Wood Waste ☐ Dust ☐ Bark	
Oil:	☒ Waste Oil ☐ No. 2 ☐ No. 6	Misc:	☐ Natural Gas ☐ RDF ☐ ______	

Relinquished by/Affiliation	Accepted by/Affiliation	Date
Interpoll	Bill Drake / ILI	9-24-99

033094-G:\STACK\WP\FORMS\S-278.2

APPENDIX E

COMPUTER DATALOGGER PRINTOUTS

Mathy Constuction **9/23/99**
Hager City, WI **Test 2** **Run 1**
Plant No. 10 Stack

VOLUMETRIC FLOW RATE
NUMBER OF SAMPLE POINTS 24

PT. NO.		DELTA P	SQ. RT P	TEMP	TIME
1	A-1	.82	.906	226.8	7:55 AM
2	-2	.88	.938	226.8	
3	-3	.73	.854	226.8	
4	B-1	.76	.872	226.8	
5	-2	.89	.943	226.8	
6	-3	.83	.911	226.8	
7	C-1	.73	.854	226.8	
8	-2	.89	.943	226.8	
9	-3	.83	.911	226.8	
10	D-1	.71	.843	226.8	
11	-2	.84	.917	226.8	
12	-3	.81	.9	226.8	
13	E-1	.53	.728	226.8	
14	-2	.7	.837	226.8	
15	-3	.81	.9	226.8	
16	F-1	.47	.686	226.8	
17	-2	.63	.794	226.8	
18	-3	.81	.9	226.8	
19	G-1	.39	.624	226.8	
20	-2	.45	.671	226.8	
21	-3	.48	.693	226.8	
22	H-1	.26	.51	226.8	
23	-2	.31	.557	226.8	
24	-3	.3	.548	226.8	
AVERAGE		.661	.802	226.8	8:58 AM

MOISTURE CONTENT	DATA	FLOW RATE	
METER VOLUME	37.86	STATIC PRESSURE	-.32
AVERAGE METER TEMP	80.	PITOT COEF.	0.84
GAS METER COEF. (Y)	1.0019		
GAS METER DELTA H@	1.91	DUCT WIDTH(IN)	23.75
GRAMS OF WATER	165.	DUCT LENTGH(IN)	63.5
BAROMETRIC PRESSURE	28.99	DUCT AREA (SQ.FT.)	10.473
		STACK DIA. (IN)	.
STANDARD METER VOLUME	36.096	STACK AREA (SQ.FT.)	.
MOISTURE CONTENT	17.716		
		MOLECULAR WEIGHT (DRY)	29.239
OXYGEN %	15.117	MOLECULAR WEIGHT (WET)	27.248
CO 2 %	3.967	STACK PRESSURE	28.966
		FEET PER SECOND	53.698
STANDARD CFH	1,506,861	ACTUAL CFM	33743.05
K STANDARD CFM	25.114	DRY STANDARD CFM	20665.11

Mathy Constuction
Hager City, WI
Plant No. 10 Stack

9/23/99
Test 2 Run 1

FIELD CALCULATIONS

RAW DATA TABLE

INSTRUMENT	PPM OR %	ZERO	SPAN	GAS	C GAS	
O2 (dry)	15.4	0.02	11.11	10.9	**15.12**	dry
CO2 (wet)	3.3	0.02	11.18	11.1	**3.26**	wet
SO2 (wet)	4.2	2.20	88.90	89.8	**2.07**	wet

MOISTURE	17.72	STANDARD CFH	1,506,861
FUEL FACTOR C	.	K STANDARD CFM	25.114
DSCFM	20665.1		

RESULTS

O2 % (dry)	15.12		
CO2 % (dry)	3.97		
SO2 (dry)	**2.52**	**SO2 LBS/HR**	**.518**
		Fo	1.458

Mathy Constuction
Hager City, WI
Plant No. 10 Stack
9/23/99
Run 1

Time	SO2 ppm, w	O2 %, d	CO2 %, w
7:55 AM	5.4	15.6	3.2
7:56 AM	4.9	15.6	3.2
7:57 AM	5.2	15.5	3.2
7:58 AM	5.0	15.5	3.2
7:59 AM	5.2	15.6	3.2
8:00 AM	5.5	15.6	3.2
8:01 AM	5.3	15.6	3.2
8:02 AM	5.0	15.7	3.1
8:03 AM	4.6	15.7	3.1
8:04 AM	4.4	15.6	3.2
8:05 AM	4.3	15.6	3.2
8:06 AM	4.6	15.5	3.2
8:07 AM	5.5	15.5	3.2
8:08 AM	4.9	15.5	3.3
8:09 AM	4.3	15.2	3.4
8:10 AM	4.2	15.2	3.4
8:11 AM	4.1	15.2	3.4
8:12 AM	4.4	15.2	3.4
8:13 AM	4.8	15.2	3.4
8:14 AM	4.6	15.3	3.3
8:15 AM	4.0	15.6	3.1
8:16 AM	3.8	15.8	3.1
8:17 AM	4.0	15.8	3.1
8:18 AM	3.8	15.5	3.2
8:19 AM	5.2	15.3	3.4
8:20 AM	4.5	15.1	3.5
8:21 AM	4.4	15.2	3.4
8:22 AM	3.8	15.3	3.4
8:23 AM	4.0	15.5	3.2
8:24 AM	3.5	15.5	3.2
8:25 AM	3.8	15.5	3.2
8:26 AM	4.9	15.5	3.2
8:27 AM	4.7	15.5	3.2
8:28 AM	4.3	15.5	3.3
8:29 AM	3.9	15.5	3.3
8:30 AM	4.1	15.5	3.3
8:31 AM	4.0	15.5	3.2
8:32 AM	3.7	15.4	3.3
8:33 AM	4.3	15.4	3.3
8:37 AM	4.0	15.4	3.4

8:38 AM	3.8	15.2	3.4
8:39 AM	3.5	15.2	3.4
8:40 AM	3.8	15.2	3.4
8:41 AM	3.4	15.4	3.3
8:42 AM	3.2	15.6	3.2
8:43 AM	3.5	15.6	3.2
8:44 AM	3.8	15.5	3.2
8:45 AM	3.9	15.4	3.3
8:46 AM	4.4	15.2	3.4
8:47 AM	4.5	15.2	3.4
8:48 AM	4.1	15.2	3.4
8:49 AM	3.9	15.2	3.4
8:50 AM	3.5	15.2	3.4
8:51 AM	3.2	15.2	3.4
8:52 AM	3.5	15.3	3.4
8:53 AM	3.7	15.3	3.4
8:54 AM	3.6	15.2	3.4
8:55 AM	3.4	15.3	3.4
8:56 AM	3.4	15.3	3.4
8:57 AM	3.5	15.2	3.4
Average	**4.2**	**15.4**	**3.3**

Mathy Constuction
Hager City, WI
Plant No. 10 Stack

9/23/99
Test 2 Run 2

VOLUMETRIC FLOW RATE
NUMBER OF SAMPLE POINTS 24

PT. NO.		DELTA P	SQ. RT P	TEMP	TIME
1	A-1	.61	.781	245.	11:30 AM
2	-2	.65	.806	245	
3	-3	.61	.781	245	
4	B-1	.61	.781	245	
5	-2	.76	.872	245	
6	-3	.7	.837	245	
7	C-1	.67	.819	245	
8	-2	.84	.917	245	
9	-3	.79	.889	245	
10	D-1	.69	.831	245	
11	-2	.86	.927	245	
12	-3	.84	.917	245	
13	E-1	.76	.872	245	
14	-2	.78	.883	245	
15	-3	.92	.959	245	
16	F-1	.61	.781	245	
17	-2	.8	.894	245	
18	-3	.95	.975	245	
19	G-1	.59	.768	245	
20	-2	.73	.854	245	
21	-3	.81	.9	245	
22	H-1	.51	.714	245	
23	-2	.63	.794	245	
24	-3	.64	.8	245	12:34 PM
AVERAGE		.723	.848	245.0	

MOISTURE CONTENT	DATA	FLOW RATE	
METER VOLUME	45.55	STATIC PRESSURE	-0.32
AVERAGE METER TEMP	79.2	PITOT COEF.	0.84
GAS METER COEF. (Y)	1.0019		
GAS METER DELTA H AT	1.91	DUCT WIDTH(IN)	23.75
GRAMS OF WATER	230.	DUCT LENTGH(IN)	63.5
BAROMETRIC PRESSURE	28.99	DUCT AREA (SQ.FT.)	10.4731
		STACK DIA. (IN)	0
STANDARD METER VOLUME	43.492	STACK AREA (SQ.FT.)	0.0000
MOISTURE CONTENT	19.941		
		MOLECULAR WEIGHT (DRY)	29.307
OXYGEN %	14.509	MOLECULAR WEIGHT (WET)	27.052
CO 2 %	4.543	STACK PRESSURE	28.966
		FEET PER SECOND	57.757
STANDARD CFH	1,578,934	ACTUAL CFM	36293.92
K STANDARD CFM	26.316	DRY STANDARD CFM	21067.94

Mathy Constuction
Hager City, WI
Plant No. 10 Stack

9/23/99
Test 2 Run 2

FIELD CALCULATIONS

RAW DATA TABLE

INSTRUMENT	PPM OR %	ZERO	SPAN	GAS	C GAS	
O2 (dry)	14.8	0.01	11.12	10.9	**14.51**	dry
CO2 (wet)	3.7	0.12	11.05	11.1	**3.64**	wet
SO2 (wet)	3.7	1.70	88.44	89.8	**2.07**	wet

MOISTURE	19.94	STANDARD CFH	1,578,934
FUEL FACTOR C	0	K STANDARD CFM	26.316
DSCFM	21067.9		

RESULTS

O2 % (dry)	14.51		
CO2 % (dry)	4.54		
SO2 ppm (dry)	**2.59**	**SO2 LBS/HR**	**.543**
		Fo	1.407

Mathy Constuction
Hager City, WI
Plant No. 10 Stack
9/23/99
Run 2

Time	SO2 ppm, w	O2 %, d	CO2 %, w
11:30 AM	6.0	14.3	3.9
11:31 AM	4.8	14.3	4.0
11:32 AM	4.4	14.3	4.0
11:33 AM	4.2	14.3	4.0
11:34 AM	3.4	14.4	4.0
11:35 AM	4.6	14.4	4.0
11:36 AM	4.0	14.4	4.0
11:37 AM	3.9	14.6	3.8
11:38 AM	4.5	15.2	3.5
11:39 AM	3.8	15.2	3.4
11:40 AM	4.5	14.8	3.8
11:41 AM	4.0	14.5	3.9
11:42 AM	3.6	14.9	3.8
11:43 AM	3.8	15.5	3.3
11:44 AM	4.2	15.7	3.2
11:45 AM	3.6	15.6	3.2
11:46 AM	4.2	15.1	3.5
11:47 AM	5.1	14.6	3.8
11:48 AM	4.1	14.4	4.0
11:49 AM	3.8	14.5	3.9
11:50 AM	3.9	14.8	3.7
11:51 AM	4.3	14.9	3.6
11:52 AM	3.7	14.9	3.6
11:53 AM	3.4	14.7	3.7
11:54 AM	3.7	14.5	3.9
11:55 AM	3.8	14.4	3.9
11:56 AM	3.1	14.5	3.9
11:57 AM	3.2	14.4	3.9
11:58 AM	3.6	14.4	3.9
11:59 AM	2.9	14.5	3.9
12:00 PM	3.6	14.6	3.9
12:01 PM	3.4	14.9	3.7
12:02 PM	3.2	15.4	3.4
12:07 PM	4.1	15.0	3.5
12:08 PM	3.2	14.9	3.6
12:09 PM	4.1	14.9	3.6
12:10 PM	3.5	14.9	3.6
12:11 PM	3.6	14.7	3.8
12:12 PM	3.4	14.6	3.8
12:13 PM	3.4	14.6	3.7

12:14 PM	3.4	14.6	3.7
12:15 PM	3.3	14.6	3.8
12:16 PM	2.9	14.6	3.8
12:17 PM	3.4	14.6	3.8
12:18 PM	3.3	14.6	3.8
12:19 PM	2.9	14.7	3.7
12:20 PM	3.2	14.8	3.7
12:21 PM	3.2	15.1	3.5
12:22 PM	2.9	15.2	3.4
12:23 PM	3.3	15.1	3.5
12:24 PM	3.1	14.8	3.7
12:25 PM	3.1	14.8	3.7
12:26 PM	3.5	15.0	3.5
12:27 PM	3.4	15.3	3.4
12:28 PM	3.6	15.3	3.4
12:29 PM	3.1	15.1	3.5
12:30 PM	3.3	14.6	3.8
12:31 PM	2.8	14.3	3.9
12:32 PM	3.0	14.4	3.9
12:33 PM	3.3	15.3	3.4
Averages	**3.7**	**14.8**	**3.7**

Mathy Constuction
Hager City, WI
Plant No. 10 Stack

9/23/99
Test 2 Run 3

VOLUMETRIC FLOW RATE
NUMBER OF SAMPLE POINTS 24

PT. NO.		DELTA P	SQ. RT P	TEMP	TIME
1	A-1	.89	.943	243.	12:55 PM
2	-2	.97	.985	243	
3	-3	.91	.954	243	
4	B-1	.86	.927	243	
5	-2	.98	.99	243	
6	-3	.89	.943	243	
7	C-1	.79	.889	243	
8	-2	.94	.97	243	
9	-3	.9	.949	243	
10	D-1	.71	.843	243	
11	-2	.87	.933	243	
12	-3	.88	.938	243	
13	E-1	.61	.781	243	
14	-2	.75	.866	243	
15	-3	.83	.911	243	
16	F-1	.49	.7	243	
17	-2	.63	.794	243	
18	-3	.76	.872	243	
19	G-1	.39	.624	243	
20	-2	.74	.86	243	
21	-3	.85	.922	243	
22	H-1	.55	.742	243	
23	-2	.64	.8	243	
25	-3	.63	.794	243	1:59 PM
AVERAGE		.769	.872	243.0	

MOISTURE CONTENT	DATA	FLOW RATE	
METER VOLUME	47.13	STATIC PRESSURE	-0.32
AVERAGE METER TEMP	81.4	PITOT COEF.	0.84
GAS METER COEF. (Y)	1.0019		
GAS METER DELTA H AT	1.91	DUCT WIDTH(IN)	23.75
GRAMS OF WATER	230.	DUCT LENTGH(IN)	63.5
BAROMETRIC PRESSURE	28.99	DUCT AREA (SQ.FT.)	10.47309
		STACK DIA. (IN)	0
STANDARD METER VOLUME	44.818	STACK AREA (SQ.FT.)	0
MOISTURE CONTENT	19.466		
		MOLECULAR WEIGHT (DRY)	29.312
OXYGEN %	14.632	MOLECULAR WEIGHT (WET)	27.11
CO 2 %	4.544	STACK PRESSURE	28.966
		FEET PER SECOND	59.251
STANDARD CFH	1,624,375	ACTUAL CFM	37232.51
K STANDARD CFM	27.073	DRY STANDARD CFM	21802.88

Mathy Constuction
Hager City, WI
Plant No. 10 Stack

9/23/99
Test 2 Run 3

FIELD CALCULATIONS

RAW DATA TABLE

INSTRUMENT	PPM OR %	ZERO	SPAN	GAS	C GAS	
O2 (dry)	14.9	0.00	11.10	10.9	**14.63**	dry
CO2 (wet)	3.7	0.12	10.98	11.1	**3.66**	wet
SO2 (wet)	3.3	1.90	87.69	89.8	**1.47**	wet

MOISTURE	19.47	STANDARD CFH	1,624,375
FUEL FACTOR C	0	K STANDARD CFM	27.073
DSCFM	21802.9		

RESULTS

O2 % (dry)	14.63		
CO2 % (dry)	4.54		
SO2 ppm (dry)	**1.83**	**SO2 LBS/HR**	**.396**
		Fo	1.38

Mathy Constuction
Hager City, WI
Plant No. 10 Stack
9/23/99
Run 3

Time	SO2 ppm, w	O2 %, d	CO2 %, w
12:55 PM	5.0	14.6	3.8
12:56 PM	5.2	14.6	3.8
12:57 PM	4.6	14.6	3.8
12:58 PM	4.3	14.6	3.8
12:59 PM	4.4	14.9	3.6
1:00 PM	4.4	15.1	3.5
1:01 PM	4.0	15.1	3.5
1:02 PM	4.3	14.9	3.6
1:03 PM	3.9	14.5	3.9
1:04 PM	3.6	14.4	3.9
1:05 PM	3.6	14.5	3.9
1:06 PM	3.8	15.1	3.5
1:07 PM	3.8	16.2	2.8
1:08 PM	3.6	16.4	2.8
1:09 PM	4.5	14.8	3.8
1:10 PM	4.1	14.2	4.1
1:11 PM	3.8	14.3	4.1
1:12 PM	3.3	14.8	3.7
1:13 PM	3.3	15.1	3.6
1:14 PM	3.3	15.1	3.5
1:15 PM	2.9	15.1	3.5
1:16 PM	2.9	15.1	3.6
1:17 PM	3.2	15.1	3.5
1:18 PM	3.0	15.0	3.6
1:19 PM	2.8	15.0	3.6
1:20 PM	3.1	15.0	3.6
1:21 PM	2.7	15.1	3.6
1:22 PM	3.1	15.1	3.6
1:23 PM	3.2	15.0	3.6
1:24 PM	3.3	15.0	3.5
1:29 PM	3.1	14.9	3.7
1:30 PM	2.7	15.2	3.5
1:31 PM	2.5	15.2	3.4
1:32 PM	2.5	15.2	3.5
1:33 PM	2.5	14.9	3.7
1:34 PM	2.7	14.6	3.8
1:35 PM	2.6	14.5	3.8
1:36 PM	3.1	14.5	3.9
1:37 PM	2.8	14.5	3.8
1:38 PM	3.6	14.6	3.9

1:39 PM	3.4	14.6	3.8
1:40 PM	3.2	14.9	3.6
1:41 PM	2.8	14.9	3.6
1:42 PM	2.7	15.0	3.6
1:43 PM	2.6	15.0	3.6
1:44 PM	2.5	14.9	3.7
1:45 PM	2.5	14.9	3.6
1:46 PM	2.8	14.9	3.6
1:47 PM	2.7	14.8	3.7
1:48 PM	3.4	14.5	3.8
1:49 PM	3.4	14.4	3.9
1:50 PM	3.5	14.4	4.0
1:51 PM	2.8	14.4	3.9
1:52 PM	2.5	14.5	3.9
1:53 PM	2.8	14.5	3.9
1:54 PM	2.9	14.6	3.8
1:55 PM	2.5	15.2	3.4
1:56 PM	2.7	15.4	3.4
1:57 PM	3.0	15.2	3.5
1:58 PM	3.0	14.9	3.7
Average=	**3.3**	**14.9**	**3.7**

APPENDIX F

GAS ANALYZER SPECIFICATIONS

INTERPOLL LABORATORIES
4500 BALL ROAD N.E
CIRCLE PINES, MN 55014-1819
(612) 786-6020

Servomex

1420
Oxygen Analyser
Instruction Manual

Ref : 01420/001A/0

Order as part No. 01420001A

was (7982-2842)

INTERPOLL LABORATORIES
4500 BALL ROAD N.E.
CIRCLE PINES, MN 55014-1819
(612) 786-6020

1.3 Sampling System

The sampling system of the analyser includes a combination filter/automatic flow control device, designed to keep a constant flow of sample gas through the measuring cell for varying input pressures and to prevent the entrance of particulate matter into the measuring cell. Excess flow is vented to the by-pass.

1.4 Specification

Performance Specification (typical)

Repeatability: Better than +/-0.2% O2 under constant conditions.

Drift: Less than 0.2% O2 per week under constant conditions. (Excluding variation due to barometric pressure changes; reading is proportional to barometric pressure.)

Outputs

Display: 3 1/2 digit LCD reading 0.0 to 100.0% oxygen with overrange capability.

Output: 0 to 1V (non-isolated) for 0 to 100% oxygen available on 'D' type connector located on the back panel of the instrument. Output impedance is less than 10 ohms.

Option: 4 - 20mA isolated, Max impedance 500 ohms.

Flow alarm output: Change over relay contact rated at 3A/115V ac, 1A/240V ac or 1A/28V dc. 4 sets of single pole changeover contacts. Alarm becomes active when sample gas flow through the analyser fails.

Sample requirements

Condition: Clean, dry gas with dew point 5 deg C below ambient temperature.

Inlet pressure: 0.5 to 3psig (3.5 to 21kPa). Inlet pressure changes within this range will change the reading by less than 0.1% O2. May be operated up to 10psig (70kPa) with degraded stability.

Flowrate: 1.5 to 6 litres/minute approximately depending on sample pressure.

Filtering: 0.6 micron replaceable filter integral to the automatic flow control device.

Response time:	Less than 15 secs. to 90% at an inlet pressure of 3psig (21kPa).
Inlet/vent connections:	1/4 inch OD tube (stainless steel) suitable for 6mm ID flexible tubing or 1/4 inch OD compression fittings.
Materials exposed to the sample:	Stainless steel, Pyrex glass, brass, platinum, epoxy resin, Viton, polypropylene and glass fibre filter.

Physical Characteristics

Case:	Steel and aluminium finished in epoxy powder paint.
Case classification:	IP 20 (IEC 529) when fitted into the Servomex 1400 series 19 inch case.
Dimensions:	See Figure 2.1.
Weight:	10Kg (22lb) approximately.

Electrical

AC Supply:	110 to 120V AC or 220 to 240V AC, +/-10%, 48 to 62Hz. Voltage selected by a voltage selector integral to the IEC supply plug.
Power required:	15VA maximum.

Environmental Limits

Operating ambient temperature:	0 to +40 deg C (32 to 104 deg F)
Storage temp. range:	-20 to +70 deg C (-4 to 158 deg F)
Relative humidity:	0-85%, non-condensing.

SPECIFICATIONS FOR ACS MODEL 3300 CO_2 NDIR

Measuring principle	NDIR single beam method
Measurable gas components and measuring range	0 - 20%
Reproducibility	±0.5% of full scale
Stability	Zero drift; ±1% of full scale/24H Span drift; ±1% of full scale/24H
Noise	0.5% of full scale
Ambient temperature	-5 to 45°C
Ambient humidity	Less than 90% RH
Response time (90% of final reading)	Electrical system; 2 sec, 3 sec, 5 sec (selectable with connector) Response of actual gas; Within 15 sec (depending on cell length)
Indicator	100 linear division
Output signal	OUTPUT 1; DC 0 - 1 V OUTPUT 2; DC 0 - 10 mV or DC 0 - 100 mV or DC 0 - 1 V or DC 4 - 20 mA (Allowable load resistance 500Ω max.)
Linearity	Better than ±2% of full scale (when linearizer is used)
Power supply	AC 115 V ± 10%, 60 Hz

Power consumption	Approx. 30 VA
Materials of gas-contacting parts	Measuring cell; SUS304 Window; CaF2 Piping; Polyethylene
Sample gas flow rate	1ℓ/min ± 0.5ℓ/min
Sample gas temperature	0 to 55°C
Purging gas flow rate	1ℓ/min (to be flowed as occasion demands)
Warmup time	Approx. 2 hours
External dimensions	200 x 250 x 541 (H x W x D) mm
Weight	Approx. 11 kg
Finish Color	MUNSELL N1.5

Remarks: For combinations of measuring ranges for the dualcomponent analyzer, inquiry should be made to the manufacturer.

SPECIFICATIONS FOR SO_2 ANALYZER
WESTERN RESEARCH MODEL 721ATZ

Measuring principle	NDUV double beam method which uses 285 nm UV light for SO_2 measurement and 585 nm visible light to compensate for contamination of all windows, detector drift or changes in the intensity of the radiation source
Range	SO_2: 0 - 500 ppm and 0 - 1000 ppm; but low range may be reduced to 0 - 100 ppm with full scale analog output; total dynamic range of 0 - 5000 ppm with 1 ppm readability
Accuracy	±2% f.s., worst case. Typically better than ±1% f.s.
Temperature drift	≤0.5% f.s./°C
Noise	0.5% of full scale, worst case
Ambient temperature	0 to 40 °C
Ambient humidity	Less than 100% RH
Response time (90% of final reading)	<5 seconds
Optical cell length	35 cm
Output signal	Panel display is digital - direct reading in ppm,w; output signal: 7 field-selectable potentiometric outputs of 1V, 2V, 5V, 10V DC and 100, 200, 500 mV DC. Two outputs per range are provided at the rear of the

	instrument, standard. Unit equipped also with 4 - 20 mA
Interferences	No known interferences from O_2, CO_2, CO or hydrocarbons; internally compensated for NO interference
Linearity	±1.5% of full scale
Power supply	AC 115 V ± 10%, 60 Hz
Power consumption	Less than 575 watts
Electronic span value	Nominal 766 @ 77 °F and 29.92 in Hg
Sample gas flow	1.0 - 5.0 LPM to give desired response time
Sample gas temperature	0 to 40 °C
Warmup time	Approximately 30 minutes
External dimensions	7 x 19 x 22 (H x W x D) inch
Weight	40 LB

APPENDIX G

MEASUREMENT SYSTEMS PERFORMANCE SPECIFICATIONS

Calibration Error

Mathy Constuction
Hager City, WI
Plant No. 10 Stack
9/23/99
Test 2

SO2 TEI Model 43B)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	2.13	2.13	150.00	1.42
Mid Level	89.80	88.53	1.27	150.00	0.85
High Level	134.00	133.81	0.19	150.00	0.13

CO2 (TEI Model 41H)

	Cylynder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.12	0.12	20.00	0.60
Mid Level	11.10	11.45	0.35	20.00	1.75
High Level	16.60	16.72	0.12	20.00	0.60

O2 (Servomex Series 1400)

	Cylynder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.11	0.11	25.00	0.44
Mid Level	10.90	11.11	0.21	25.00	0.84
High Level	21.00	21.04	0.04	25.00	0.16

**** All Calibrations must be within 2% of the span value...

Calibration Drift

Mathy Constuction
Hager City, WI
Plant No. 10 Stack
9/23/99
Test 2

		O2						CO2						SO2			
		Initial	Final	Avg.				Initial	Final	Avg.				Initial	Final	Avg.	
1	Zero	0.03	0.01	**0.02**		1	Zero	0.12	0.12	**0.12**		1	Zero	2.57	1.90	**2.24**	
	Upscale	11.08	11.14	**11.11**			Upscale	11.27	11.08	**11.18**			Upscale	88.90	88.90	**88.90**	
2	Zero	0.01	0.00	**0.01**		2	Zero	0.12	0.12	**0.12**		2	Zero	1.90	1.50	**1.70**	
	Upscale	11.14	11.10	**11.12**			Upscale	11.08	11.01	**11.05**			Upscale	88.90	87.97	**88.44**	
3	Zero	0.00	0.00	**0.00**		3	Zero	0.12	0.12	**0.12**		3	Zero	1.50	2.29	**1.90**	
	Upscale	11.10	11.10	**11.10**			Upscale	11.01	10.95	**10.98**			Upscale	87.97	87.40	**87.69**	

*** All Calibrations must be within 3% of the span value...

APPENDIX H

CALIBRATION GAS CERTIFICATION SHEETS

NATIONAL SPECIALTY GASES
630 UNITED DRIVE
DURHAM, NC
27713
(919)544-3772

CERTIFICATE OF ANALYSIS * EPA PROTOCOL MIXTURES

REFERENCE #:	88-63277	CYLINDER #:	CC103657	CYL. PRESSURE:	2000 PSIG	P.O. #:	30756
EXP. DATE:	6/28/02	LAST ANALYSIS DATE:	6/28/99	CUSTOMER:	TWIN CITY OXYGEN		

METHOD: ANALYZED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY AND CERTIFICATION OF GASEOUS CALIBRATION STANDARDS-SEPTEMBER 1997:G-1 THIS STANDARD SHOULD NOT BE USED WHEN ITS GAS PRESSURE IS BELOW 1.0 MEGAPASCALS (150 PSIG).

COMPONENT:	OXYGEN	**COMPONENT:**	CARBON DIOXIDE
STANDARD		**STANDARD**	
SRM #:	2658A	SRM #:	1675B
CYL. #:	CAL 014513	CYL. #	CAL 014623
CONC:	9.397%	CONC:	14.0%
INSTRUMENT:	BECKMAN PARAMAGNETIC	**INSTRUMENT:**	ROSEMOUNT NDIR
MODEL #:	755	MODEL #:	880A
SERIAL #:	1001419	SERIAL #:	2000418
LAST CAL.:	6/15/99	LAST CAL.:	6/3/99

MEAN CONC.:	10.9%	+/-	0.09 %	MEAN CONC.:	11.1%	+/-	0.09 %
REPLICATE CONC.				REPLICATE CONC.			
DATE:	6/28/99			DATE:	6/28/99		
10.9	%			11.1	%		
10.9	%			11.1	%		
10.9	%			11.1	%		

BALANCE GAS: NITROGEN

REPLICATE DATA						REPLICATE DATA						REPLICATE DATA
DATE:	6/28/99					DATE:	6/28/99					
Z	0	R	9.40	C	10.9	Z	0	R	14.0	C	11.1	
R	9.40	Z	0	C	10.9	R	14.0	Z	0	C	11.1	
Z	0	C	10.9	R	9.40	Z	0	C	11.1	R	14.0	

Z= ZERO C=CANDIDATE R=REFERENCE

ANALYST:

APPROVED BY: Richard Sykes

ASSAYED AT NATIONAL SPECIALTY GASES, 630 UNITED DRIVE, DURHAM, NC 27713 (919)544-3772

NATIONAL SPECIALTY GASES

630 UNITED DRIVE
DURHAM, NC
27713
(919)544-3772

CERTIFICATE OF ANALYSIS * EPA PROTOCOL MIXTURES

REFERENCE #.	88-59508	CYLINDER #:	CC 46433	CYL. PRESSURE:	2000 PSIG	P.O. #:	28599
EXP. DATE:	8/17/01	LAST ANALYSIS DATE:	8/17/98	CUSTOMER:	TWIN CITY OXYGEN		

METHOD: ANALYZED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY AND CERTIFICATION OF GASEOUS CALIBRATION STANDARDS-SEPTEMBER 1997:G-1 THIS STANDARD SHOULD NOT BE USED WHEN ITS GAS PRESSURE IS BELOW 1.0 MEGAPASCALS (150 PSIG)

COMPONENT:	OXYGEN	COMPONENT:	CARBON DIOXIDE
STANDARD		STANDARD	
SRM #:	2659A	SRM #:	1675B
CYL. #:	CLM 6947	CYL. #	CLM 6481
CONC:	20.72 %	CONC:	14.01 %
INSTRUMENT:	BECKMAN PARAMAGNETIC	INSTRUMENT:	ROSEMOUNT NDIR
MODEL #:	755	MODEL #:	880A
SERIAL #:	1001419	SERIAL #:	2000418
LAST CAL.:	8/10/98	LAST CAL.:	8/9/98
MEAN CONC.:	21.0 % +/- 0.17 %	MEAN CONC.:	16.6 % +/- 0.13 %
REPLICATE CONC.		REPLICATE CONC.	
DATE:	8/17/98	DATE:	8/17/98
21.0	%	16.6	%
21.0	%	16.7	%
21.1	%	16.6	%

BALANCE GAS: NITROGEN

REPLICATE DATA						REPLICATE DATA						REPLICATE DATA
DATE: 8/17/98						DATE: 8/17/98						
Z	0	R	20.7	C	21.0	Z	0	R	14.0	C	16.6	
R	20.7	Z	0	C	21.0	R	14.0	Z	0	C	16.7	
Z	0	C	21.1	R	20.7	Z	0	C	16.6	R	14.0	

Z=ZERO C=CANDIDATE R=REFERENCE

ANALYST: Kara Jensen

APPROVED BY: Richard Sykes

THIS REPORT STATES ACCURATELY THE RESULTS OF THE INVESTIGATION MADE UPON THE MATERIAL SUBMITTED TO THE ANALYTICAL LABORATORY. EVERY EFFORT HAS BEEN MADE TO DETERMINE OBJECTIVELY THE INFORMATION REQUESTED, HOWEVER, IN CONNECTION WITH THIS REPORT, NATIONAL SPECIALTY GASES SHALL HAVE NO LIABILITY IN EXCESS OF ITS ESTABLISHED CHARGE FOR THE SERVICE.
ASSAYED AT: NATIONAL SPECIALTY GASES, 630 UNITED DRIVE, DURHAM, NC 27713. (919)544-3772

For Technical Information Call
1-800-752-1597

AIR PRODUCTS

Air Products and Chemicals, Inc. * 12722 S. Wentworth Avenue, Chicago, IL 60628

ISO CERTIFICATION: 9002

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS STANDARD

PERFORMED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY AND CERTIFICATION OF GASEOUS CALIBRATION STANDARDS (PROCEDURE #G1)

Customer:
AIR PRODUCTS & CHEMICALS, INC.
373 CANTERBURY ROAD
SHAKOPEE MN 55379

Order No: CSS-838253-01
Batch No: 861-43720
PO: 26902
Release:

Cylinder No: SG9153312BAL
Bar Code No: DNN870
Cylinder Pressure*: 2000 psig
Certification Date: 12/15/97
Expiration Date: 12/15/99

CERTIFIED CONCENTRATION		REFERENCE STANDARDS			ANALYTICAL INSTRUMENTATION			
Component	Certified Concentration	Cylinder Number	Standard Type	Standard Concentration	Instrument Make/Model	Serial Number	Last Calibration	Measurement Principal
SULFUR DIOXIDE	89.8±1.76 PPM	SG9137979	GMIS R	253.6 PPM	HORIB VIA-510	85079208	12/04/97	NON DISPERSIVE INFRARED
NITROGEN	Balance Gas							

* STANDARD SHOULD NOT BE USED BELOW 150 PSIG

Analyst: James Laas

Approved By: Richard Fry /RVD
Richard Fry

For Technical Information Call
1-800-752-1597

AIR PRODUCTS

Air Products and Chemicals, Inc. * 12722 S. Wentworth Avenue, Chicago, IL 60628

ISO CERTIFICATION: 9002

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS STANDARD

PERFORMED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY AND CERTIFICATION OF GASEOUS CALIBRATION STANDARDS (PROCEDURE #G1)

Customer:
AIR PRODUCTS & CHEMICALS, INC.
373 CANTERBURY ROAD
SHAKOPEE MN 55379

Order No: CSS-109413-01
Batch No: 861-52469
PO:
Release:

Cylinder No: SG9148857BAL
Bar Code No: DGG814
Cylinder Pressure*: 2000 psig
Certification Date: 01/05/1999
Expiration Date: 01/05/2001

CERTIFIED CONCENTRATION		REFERENCE STANDARDS			ANALYTICAL INSTRUMENTATION			
Component	Certified Concentration	Cylinder Number	Standard Type	Standard Concentration	Instrument Make/Model	Serial Number	Last Calibration	Measurement Principal
SULFUR DIOXIDE	134 ±1.5 PPM	SG9151666BAL	GMIS R	252.9 PPM	HORIBA VIA-510	85079208	12/27/98	NON DISPERSIVE INFRARED
NITROGEN	Balance Gas							

* STANDARD SHOULD NOT BE USED BELOW 150 PSIG

Analyst: James Laas

Approved By: Richard Fry

(1692

APPENDIX I

PROCESS RATE INFORMATION

3.1 Results of Orsat and Moisture Determinations

Test No. 1
No. 10 Asphalt Plant Stack

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

	Run 1	Run 2	Run 3
Date of run	09-23-99	09-23-99	09-23-99
Dry basis (orsat)			
carbon dioxide............	3.97	4.54	4.54
oxygen....................	15.12	14.51	14.63
nitrogen..................	80.91	80.95	80.83
Wet basis (orsat)			
carbon dioxide............	3.26	3.63	3.66
oxygen....................	12.43	11.61	11.78
nitrogen..................	66.53	64.79	65.08
water vapor...............	17.77	19.96	19.48
Dry molecular weight........	29.24	29.31	29.31
Wet molecular weight........	27.24	27.05	27.11
Specific gravity............	0.941	0.934	0.936
Water mass flow......(LB/HR)	12527	14607	14772
FO	1.456	1.407	1.381

3.2 Results of Particulate Determinations

Test No. 1
No. 10 Asphalt Plant Stack

Results of Particulate Loading Determinations-------Method 5

	Run 1	Run 2	Run 3
Date of run	09-23-99	09-23-99	09-23-99
Time run start/end.....(HRS)	755/ 912	1130/1233	1255/1359
Static pressure......(IN.WC)	-0.32	-0.32	-0.32
Cross sectional area (SQ.FT)	10.47	10.47	10.47
Pitot tube coefficient......	.84	.84	.84
Water in sample gas			
condenser.............(ML)	0.0	0.0	0.0
impingers..........(GRAMS)	153.0	215.0	218.0
desiccant..........(GRAMS)	12.0	15.0	12.0
total..............(GRAMS)	165.0	230.0	230.0
Total particulate material.. ....collected(grams)	0.3064	0.5569	0.6236
Gas meter coefficient.......	1.0019	1.0019	1.0019
Barometric pressure..(IN.HG)	28.99	28.99	28.99
Avg. orif.pres.drop..(IN.WC)	0.88	1.81	1.93
Avg. gas meter temp..(DEF-F)	80.0	79.2	81.4
Volume through gas meter....			
at meter conditions...(CF)	37.86	45.55	47.13
standard conditions.(DSCF)	36.00	43.48	44.82
Total sampling time....(MIN)	72.00	60.00	60.00
Nozzle diameter.........(IN)	.220	.255	.255
Avg.stack gas temp ..(DEG-F)	227	258	245
Volumetric flow rate........			
actual..............(ACFM)	33783	36617	37291
dry standard.......(DSCFM)	20666	20879	21766
Isokinetic variation.....(%)	96.0	102.6	101.4
Particulate concentration...			
actual............(GR/ACF)	0.08030	0.11264	0.12526
dry standard.....(GR/DSCF)	0.13132	0.19763	0.21458
Particle mass rate...(LB/HR)	23.262	35.367	40.053

3.3 Results of Opacity Determinations

Test No. 1
Asphalt Plant No. 10

RESULTS OF OPACITY OBSERVATIONS ——————————EPA Method 9

MINUTE	SECONDS				SIX MINUTE AVERAGES
	0	15	30	45	
1	0	5	0	5	
2	0	0	0	0	
3	0	10	0	5	
4	5	5	5	0	
5	0	5	5	5	
6	5	10	5	0	3.13
7	0	0	5	0	2.92
8	0	0	5	0	3.13
9	0	5	0	5	2.92
10	5	10	5	5	3.33
11	0	10	0	5	3.33
12	0	5	5	5	3.13
13	0	5	0	0	3.13
14	0	5	5	0	3.33
15	5	0	5	0	3.33
16	5	0	0	5	2.71
17	0	10	5	5	2.92
18	5	5	5	5	3.13
19	0	5	0	0	3.13
20	0	0	0	0	2.71
21	0	10	0	0	2.71
22	5	5	15	5	3.54
23	5	5	0	5	3.33
24	0	5	5	10	3.33
25	5	5	5	0	3.75
26	0	10	5	5	4.58
27	10	5	0	5	5.00
28	5	5	5	10	4.79
29	5	0	10	5	5.00
30	0	0	0	5	4.38
31	0	5	10	15	5.00
32	5	0	5	0	4.58
33	0	5	0	0	3.96
34	0	0	5	0	3.13
35	0	0	0	0	2.29
36	5	5	5	10	3.13
37	0	5	5	5	2.50
38	0	5	0	0	2.29
39	10	0	10	5	3.13
40	0	5	5	5	3.54
41	0	0	5	0	3.75
42	15	0	5	0	3.54
43	0	5	10	5	3.75
44	5	5	10	5	4.58
45	5	5	5	10	4.58
46	0	5	0	0	4.17
47	0	0	5	0	4.17
48	5	5	0	5	3.96
49	5	0	0	0	3.33
50	0	0	0	0	2.29
51	5	0	0	5	1.67
52	0	0	5	0	1.67
53	0	5	10	0	2.08
54	0	0	5	0	1.67
55	0	5	10	0	2.08
56	5	5	0	5	2.71
57	0	5	5	0	2.71
58	0	5	0	0	2.71
59	0	0	5	0	2.29
60	5	0	5	0	2.50

Average Opacity	**3.19**
Highest six-minute average	**5.00**

Observer : Doug Peterson
Cert Date : 4-7-99
Date of Observation : 9-23-99
Time of Observation : 0755-0855

3.4 Results of Sulfur Dioxide Determinations

Test No. 1
No. 10 Asphalt Plant Stack

Results of Sulfur Dioxide Determinations————————————————Method 6C

	Run 1	Run 2	Run 3
Date of run	9-23-99	9-23-99	9-23-99
Time run start/end (HRS)	0755-0855	1130-1230	1255-1355
Total sampling time (MIN)	60	60	60
Moisture content (%V/V)	17.72	19.94	19.47
Oxygen content (%V/V dry)	15.12	14.51	14.63
Volumetric flow rate (DSCFM)	20665	21068	21803
SO_2 concentration			
ppm wet	2.07	2.07	1.47
SO_2 emission rate (LB/HR)	0.52	0.54	0.40

4 RESULTS OF FUEL ANALYSIS

INTERPOLL LABORATORIES, INC.
(612)786-6020

Mathy Construction
Sample Log No. 13517-17

Results of Waste Oil Analysis

Source:	Plant No. 10 Stack
Sample Description:	Test 1
Sample Type:	Waste Oil

Parameter	Units	Method	As Received
Gross heating value	BTU/LB	ASTM D240	18938
Sulfur	%	ASTM D129	0.36[a]
Ash	%	ASTM D482	0.59
Density	LB/GAL at 60°F	ASTM D1298	7.311
Specific gravity	60/60°F	ASTM D1298	0.8779

Respectfully submitted,

David J. Schneider, Manager
Chemistry Department

DJS/cg

---

[a] As requested by Mathy Construction, the sample was analyzed following the cited ASTM method. This method, however, is not applicable to the analysis of used oils.

10/21/99

Form OAS01
June 1999

OPERATING DATA SUMMARY FOR ASPHALT SOURCES

Test Date(s): 9/23

Ge[illegible]l Information: *All blanks must be filled in, use N/A where appropriate, circle all that apply*

his plant is: Portable [moved around for majority of year] [✓ Stationary [in one place for a majority of year]]

Plant Type: [✓ Batch Mix] Parallel Flow Drum [✓ Counterflow Drum] Continuous Mix

ther________________________

Pollution Control Equipment: [✓ Fabric Filter] Multiclone Cyclone Venturi Scrubber Wet Scrubber If wet scrubber:____% scrubber water recycled

uel, Material Processed, and Control Equipment Information:

Itemize all fuels and materials added to the combustion process during the test period. List fuel type used during testing (if oil, specify type) waste Oil. If other units of measure are used, specify and calculate appropriate heat input.

hat other types of fuel can be burned? ________________________

Test No.	Fuel Input (gal/hr)	Heat Content (Btu/gal-as received)	Heat Input (Btu/hr)	% - 200 fines	% Moisture of Virgin Aggregate Material
Run 1	258			6.7%	3.2
Run 2	324			5.6%	3.2
Run 3	324				3.2

Other Control Equipment Parameters	**Design**	**During Testing**
[illegible]leaning Cycles *(fabric filter)*	6 Sec.	
Air to Cloth Ratios *(fabric filter)*		
No. of spray bars and psi *(scrubber)*	N.A.	
No. of nozzles per spray bar *(scrubber)*	N.A.	
Water flow rate in gpm *(scrubber)*	N.A.	

escribe the location of the thermocouples reading exiting dryer and mix temperature:________________________

ote:

- *All information required must be completed and submitted as part of the performance test report. Failure to submit the required information will result in an incomplete performance test report.*
- *This form provides only a summary of the operating conditions during the performance test. Additional and more detailed records are required to meet the requirements of Minn. R. 7017.2035. This form is to be submitted as part of the performance test report to: North, Metro, or South District, Performance Test Coordinator, Minnesota Pollution Control Agency, 520 Lafayette Rd., St. Paul, MN 55155-4194.*

Time in 15 minute intervals	Virgin (V) Material tph	Asphalt (A) Material tph	Total Throughput (V+A) tph	Temp. of Gases Exiting Dryer °F	Hot Mix Temp. °F	Dust Collector ΔP inches w. c.	Water Flow Rate gpm	Water Supply Pressure psig
7:55	160	9.12	169.12	240	282	.13	7.0	
8:10	160	9.12	169.12	240	283	.13	7.0	
8:25	160	9.12	169.12	245	282	.15	7.0	
8:40	160	9.12	169.12	250	288	.14	7.0	
8:55	160	9.12	169.12	250	286	.14	7.0	
9:10	160	9.12	169.12	250	279	.15	7.0	
	~~180~~	~~10.26~~						
11:30	180	10.26	190.26	270	283	.14	7.0	
11:45	180	10.26	190.26	260	280	.16	7.0	
12:00	180	10.26	190.26	265	290	.16	7.0	
12:15	180	10.26	190.26	270	277	.15	7.0	
12:30	180	10.26	190.26	265	290	.16	7.0	
12:55	180	10.26	190.26	270	290	.16	7.0	
1:10	180	10.26	190.26	270	291	.15	6.5	
1:25	180	10.26	190.26	260	279	.15	6.5	
1:40	180	10.26	190.26	260	278	.16	6.5	
1:55	180	10.26	190.26	260	290	.17	6.5	

tph - tons per hour

°F-degrees Fahrenheit
inches w. c.- inches of water column

ΔP - pressure drop

Temp.-Temperature
psig-pressure per square inch gauge

gpm-gallons per minute

OSI
ENVIRONMENTAL, INC.

7200 Gals
Bobcat
Pit 10
9-22-99

USED OIL BURNER FUEL ANALYSIS RESULTS

As a burner of used oil, subject to EPA regulations Part 279, and additional individual state requirements, OSI Environmental, Inc. is providing the following analytical data which is representative of the burner fuel you are receiving.

OSI location:	**CNR Group 3**
Date effective:	**September 2, 1999**
Analysis #	**13272**

Constituency/ Property	**Analysis Results**
Arsenic	**< 4 ppm**
Cadmium	**0 ppm**
Chromium	**1 ppm**
Total Halogens	**550 ppm**
Lead	**48 ppm**
Flashpoint	**> 200 F**
Sulfur % by wgt.	**0.29%**
Ash % by wgt.	**0.60%**
Specific gravity	**.8852**
Acidity	**Neutral**
PCB's	**Non-detect**
BTU/gallon	**136,846**

These results should provide total assurance that OSI Environmental, Inc. is providing burner fuel that meets your requirements for burning, as well as those of the state and the EPA.

20401 County Road 81 • Suite 100 • Rogers, MN 55374 • (612) 428-8775 • (800) 628-7657 • Fax (612) 428-8792

```
*** KANE-MAY ***
 ** KM QUINTOX **

DATE      09-23-99
TIME      11:46:09

    HEAVY OIL

O2   % .... 11.5
CO   PPM .... 44
Prs  mBar   0.02
EFF  % (G)  82.1
XAIR % ..... 121
CO2  % ..... 7.1

NO   PPM ... 126
NO2        FAULT
NOx  PPM ... 132
SO2  PPM ..... 0


NETT .. F  285.6
FLUE .. F  354.0
INLT  NOT FITTED
AMBIENT  F  68.3
```

```
*** KANE-MAY ***
** KM QUINTOX **

DATE      09-23-99
TIME      08:19:49

    HEAVY OIL

O2   % .... 12.8
CO   PPM .... 40
Prs  mBar   0.02
EFF  % (G)  83.2
XAIR % ..... 158
CO2  % ..... 6.1

NO   PPM ... 104
NO2        FAULT
NOx  PPM ... 109
SO2  PPM ..... 0


NETT .. F  225.5
FLUE .. F  287.7
INLT  NOT FITTED
AMBIENT  F  62.2
```

```
*** KANE-MAY ***
** KM QUINTOX **

DATE      09-23-99
TIME      13:15:49

    HEAVY OIL

O2   % .... 11.0
CO   PPM .... 47
Prs  mBar   0.02
EFF  % (G)  83.6
XAIR % ..... 110
CO2  % ..... 7.4

NO   PPM ... 130
NO2        FAULT
NOx  PPM ... 137
SO2  PPM ..... 0


NETT .. F  261.9
FLUE .. F  332.6
INLT  NOT FITTED
AMBIENT  F  70.7
```

Environmental Programs Daily Tracking Form

Plant #: 10 Date: 9-23-99
Location: Hager City
Plant Foreman: Bernie

AIR QUALITY MONITORING

Production:

Total Asphalt Mix Tonnage: 1894.00
Diesel Fuel Gallons for Generator: ______
RAP % in mix: ______ RAP tons: ______
Mix Temperature (degrees F): 285
Hours of Operation: 11

Process fuel:

Fuel Type: Waste Oil Amt: 2912
Burner Pressure: 38 Fuel Temp: 150
Fuel Type: ______ Amt: ______
Burner Pressure: ______ Fuel Temp: ______
Spec. Sheet Delivered: [✓ yes] no

Baghouse:

Magnehelic dP: 7.0 / 6.5 inches of water
Photohelic dP: .15 inches of water
Optimum photohelic range from burner tune-up: .13 - .23 inches of water
Photohelic malfunction: yes [✓ no]
(If yes, next day DNR notification required)
Weekly Inspection of drum and door seals, ducts, photohelic, damper, & other system parts: [✓ yes] no
Maintenance Performed: Cleaned Back of Drum + Burner Head

50,000 ton Blacklight Baghouse Inspection: [✓ yes] no
Number of Bags Replaced: ______

Fugitive Dust Control:

Control Measures: [✓ yes] no
Water Amt. Applied: ______
Chemical Amt. Applied: ______
Speed Limit Control (mph): 5

Soil Remediation:

Soil Remediation Performed: yes [✓ no]
Type: ______ commercial ______ own spill
Documented: ______ yes
(If yes, Complete Contaminated Soil Tracking form and Monthly Soil Remediation Summary form)

SPILL PREVENTION PLAN (SPCC)

Plant Inspection Conducted per SPCC Inspection Outline (Attachment # 9)
[✓ yes] no
Systems Locked out: [✓ yes] no
Petroleum Equipment Maintenance: Cleaned Burning Oil Strainer
Weekly SPCC Meeting: [✓ yes] no
Containment Water Released: yes [✓ no]
(If yes, complete Water Drainage Form)

STORMWATER RUNOFF QUALITY

Best Mgmt.Practices (BMP) Applied: [✓ yes] no
Petroleum Products Secure: [✓ yes] no
Site Runoff Naturally Contained on Site:
[✓ yes] no
If no, has containment been constructed:
______ yes ______ no
Erosion Control Practices used (i.e. silt fence, site seeding, slopes): Berm's
Rain Amount in last 24 hrs: — inches
Any known Petro.Contamination: yes [✓ no]
Sediment Content:
[✓ Low] Medium High
(Water Containment Drainage documentation is covered by SPCC)

To the best of my ability and to the extent that I am able to observe under the conditions of this site, I have due diligently completed this daily form. Signature means that the inspections have been completed and any observed deficiencies have been noted and communicated to the supervisors.

Plant Foreman's Signature: Bernard

APPENDIX J

PROCEDURES

Particulate Loading and Emission Rates

The particulate emission rates were determined per EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1992). In this procedure a preliminary velocity profile of the gases in the flue is obtained by means of a temperature and velocity traverse. On the basis of these values, sampling nozzles of appropriate diameter are selected to allow isokinetic sampling, a necessary prerequisite for obtaining a representative sample.

The sampling train consists of a heated glass-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. The sampling module also houses the impinger case and a Drierite filled column. The sampling module is connected by means of an umbilical cord to the control module. The control module houses the dry test gas meter, the calibrated orifice, a leakless pump, two inclined manometers, and all controls required for operating the sampling train.

Particulate samples are collected as follows: The sample gas is drawn through the sampling probe isokinetically and passed through a 4-inch diameter Gelman Type A/E glass fiber filter where particulates are removed. The sample gas is then passed through an ice-cooled impinger train and a desiccant-packed column which absorbs remaining moisture. The sample gas then passes through a vacuum pump followed by a dry test gas meter. The gas meter integrates the sample gas flow throughout the course of the test. A calibrated orifice attached to the outlet of the gasmeter provides real time flow rate data.

A representative particulate sample was acquired by sampling for equal periods of time at the centroid of a number of equal area regions in the duct. The sampling rate is adjusted at each test point maintaining isokinetic sampling conditions. Nomographs are used for rapid determination of the sampling rate.

Particulate Loading and Emission Rates

When sampling is complete the filter is removed with tweezers and placed in a clean container. The nozzle, pitot tube and inlet side of the filter holder are quantitatively washed with acetone and the washings are stored in a second container. A brush is often used in the cleaning step to help dislodge deposits. The samples are returned to the laboratory where they are logged in and analyzed. The volume of the acetone rinse ("probe wash") is noted and the rinse is transferred to a tared 120 cc porcelain evaporating dish. The acetone is then evaporated off at 97 - 105 °F. At this elevated temperature condensation of atmospheric moisture is prevented. The acetone-free sample is then dried at 105 °C for 30 minutes, cooled in a desiccator over Drierite, and weighed to the nearest 0.01 mg. The filter sample is transferred to a 6 inch watch glass and dried at 105 °C for two hours. The filter and watch glass are then cooled in a desiccator and the filter weighed to the nearest 0.01 mg. All weighings are performed in a balance room where the relative humidity is maintained at less than 50%. Microscopic examination of the samples is performed if any unusual characteristics are observed. The weight of the acetone rinse blank is subtracted from the samples. The Drierite column is weighed on-site and the water absorbed by the Drierite is added to the condensate to give the total amount of absorbed water.

Method 3A——Determination of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources (Instrumental Analyzer Procedure)

1. Applicability and Principle

1.1 **Applicability.** This method is applicable to the determination of oxygen (O_2) and carbon dioxide (CO_2) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 **Principle.** A sample is continuously extracted from the effluent stream: a portion of the sample stream is conveyed to an instrumental analyzer(s) for determination of O_2 and CO_2 concentration(s). Performance specifications and test procedures are provided to ensure reliable data.

2. Range and Sensitivity

Same as Method 6C, Sections 2.1 and 2.2, except that the span of the monitoring system shall be selected such that the average O_2 or CO_2 concentration is not less than 20 percent of the span.

3. Definitions

3.1 **Measurement System.** The total equipment required for the determination of the O_2 or CO_2 concentration. The measurement system consists of the same major subsystems as defined in Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, Response Time, and Calibration Curve. Same as Method 6C, Sections 3.2 through 3.8, and 3.10.

3.3 **Interference Response.** The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. Measurement System Performance Specifications

Same as Method 6C, Sections 4.1 through 4.4.

5. Apparatus and Reagents

5.1 **Measurement System.** Any measurement system for O_2 or CO_2 that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 **Sample Probe.** A leak-free probe, of sufficient length to traverse the sample points.

5.1.2 **Sample Line.** Tubing, to transport the sample gas from the probe to the moisture removal system. A heated sample line is not required for systems that measure the O_2 or CO_2 concentration on a dry basis, or transport dry gases.

5.1.3 Sample Transport Line, Calibration Value Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as Method 6C, Sections 5.1.3 through 5.1.9, and 5.1.11, except that the requirements to use stainless steel, Teflon, and nonreactive glass filters do not apply.

5.1.4 **Gas Analyzer.** An analyzer to determine continuously the O_2 or CO_2 concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer. The requirements for measuring and controlling the analyzer flow rate are not applicable if data are presented that demonstrate the analyzer is insensitive to flow variations over the range encountered during the test.

5.2 **Calibration Gases.** The calibration gases for CO_2 analyzers shall be CO_2 in N_2 or CO_2 in air. Alternatively, CO_2/SO_2, O_2/SO_2, or $O_2/CO_2/SO_2$ gas mixtures in N_2 may be used. Three calibration gases, as specified Section 5.3.1 through 5.3.3 of Method 6C, shall be used. For O_2 monitors that cannot analyze zero gas, a calibration gas concentration equivalent to less than 10 percent of the span may be used in place of zero gas.

6. Measurement System Performance Test Procedures

Perform the following procedures before measurement of emissions (Section 7).

6.1 **Calibration Concentration Verification.** Follow Section 6.1 of Method 6C, except if calibration gas analysis is required, use Method 3 and change the acceptance criteria for agreement among Method 3 results to 5 percent (or 0.2 percent by volume, whichever is greater).

6.2 **Interference Response.** Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the type of gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.

6.3 Measurement System Preparation, Analyzer Calibration Error, and Sampling System Bias Check. Follow Sections 6.2 through 6.4 of Method 6C.

7. Emission Test Procedure

7.1 **Selection of Sampling Site and Sampling Points.** Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 3.

7.2 **Sample Collection.** Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the sampling system bias check. Maintain constant rate sampling (i.e., ± 10 percent) during the entire run. The sampling time per run shall be the same as for tests conducted using Method 3 plus twice the system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed to determine the average effluent concentration.

7.3 **Zero and Calibration Drift Test.** Follow Section 7.4 of Method 6C.

8. Quality Control Procedures

The following quality control procedures are recommended when the results of this method are used for an emission rate correction factor, or excess air determination. The tester should select one of the following options for validating measurement results:

8.1 If both O_2 and CO_2 are measured using Method 3A, the procedures described in Section 4.4 of Method 3 should be followed to validate the O_2 and CO_2 measurement results.

8.2 If only O_2 is measured using Method 3A, measurements of the sample stream CO_2 concentration should be obtained at the sample by-pass vent discharge using an Orsat or Fyrite analyzer, or equivalent. Duplicate samples should be obtained concurrent with at least one run. Average the duplicate Orsat or Fyrite analysis results for each run. Use the average CO_2 values for comparison with the O_2 measurements in accordance with the procedures described in Section 4.4 of Method 3.

8.3 If only CO_2 is measured using Method 3A, concurrent measurements of the sample stream CO_2 concentration should be obtained using an Orsat or Fyrite analyzer as described in Section 8.2. For each run, differences greater than 0.5 percent between the Method 3A results and the average of the duplicate Fyrite analysis should be investigated.

9. Emission Calculation

For all CO_2 analyzers, and for O_2 analyzers that can be calibrated with zero gas, follow Section 8 of Method 6C, except express all concentrations as percent, rather than ppm.

For O_2 analyzers that use a low-level calibration gas in place of a zero gas, calculate the effluent gas concentration using Equation 3A-1.

$$C_{gas} = \frac{C_{ma} - C_{oa}}{C_m - C_o} - (\overline{C} - C_m) + C_{ma} \quad Eq.\ 3A - 1$$

Where:

C_{gas} = Effluent gas concentration, dry basis, percent.
C_{ma} = Actual concentration of the upscale calibration gas, percent.
C_{oa} = Actual concentration of the low-level calibration gas, percent.
C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, percent.
C_o = Average of initial and final system calibration bias check responses for the low-level gas, percent.

$\overline{C}$ = Average gas concentration indicated by the gas analyzer, dry basis, percent.

10. Bibliography

Same as bibliography of Method 6C.

Method 6C—Determination of Sulfur Dioxide Emissions From Stationary Sources (Instrumental Analyzer Procedure)

1. Applicability and Principle

1.1 **Applicability.** This method is applicable to the determination of sulfur dioxide (SO_2) concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations.

1.2 **Principle.** A gas sample is continuously extracted from a stack, and a portion of the sample is conveyed to an instrumental analyzer for determination of SO_2 gas concentration using an ultraviolet (UV), nondispersive infrared (NDIR), or fluorescence analyzer. Performance specifications and test procedures are provided to ensure reliable data.

2. Range and Sensitivity

2.1 **Analytical Range.** The analytical range is determined by the instrumental design. For this method, a portion of the analytical range is selected by choosing the span of the monitoring system. The span of the monitoring system shall be selected such that the pollutant gas concentration equivalent to the emission standard is not less than 30 percent of the span. If at any time during a run the measured gas concentration exceeds the span, the run shall be considered invalid.

2.2 **Sensitivity.** The minimum detectable limit depends on the analytical range, span, and signal—to—noise ratio of the measurement system. For a well designed system, the minimum detectable limit should be less than 2 percent of the span.

3. Definitions

3.1 **Measurement System.** The total equipment required for the determination of gas concentration. The measurement system consists of the following major subsystems:

3.1.1 **Sample Interface.** That portion of a system used for one or more of the following: sample acquisition, sample transport, sample conditioning, or protection of the analyzers from the effects of the stack effluent.

3.1.2 **Gas Analyzer.** That portion of the system that senses the gas to be measured and generates an output proportional to its concentration.

3.1.3 **Data Recorder.** A strip chart recorder, analog computer, or digital recorder for recording measurement data from the analyzer output.

3.2 **Span.** The upper limit of the gas concentration measurement range displayed on the data recorder.

3.3 **Calibration Gas.** A known concentration of a gas in an appropriate diluent gas.

3.4 **Analyzer Calibration Error.** The difference between the gas concentration exhibited by the gas analyzer and the known concentration of the calibration gas when the calibration gas is introduced directly to the analyzer.

3.5 **Sampling System Bias.** The difference between the gas concentrations exhibited by the measurement system when a known concentration gas is introduced at the outlet of the sampling probe and when the same gas is introduced directly to the analyzer.

3.6 **Zero Drift.** The difference in the measurement system output reading from the initial calibration response at the zero concentration level after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

3.7 **Calibration Drift.** The difference in the measurement system output reading from the initial calibration response at a mid-range calibration value after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

3.8 **Response Time.** The amount of time required for the measurement system to display 95 percent of a step change in gas concentration on the data recorder.

3.9 **Interference Check.** A method for detecting analytical interferences and excessive biases through direct comparison of gas concentrations provided by the measurement system and by a modified Method 6 procedure. For this check, the modified Method 6 samples are acquired at the sample by-pass discharge vent.

3.10 **Calibration Curve.** A graph or other systematic method of establishing the relationship between the analyzer response and the actual gas concentration introduced to the analyzer.

4. Measurement System Performance Specifications

4.1 **Analyzer Calibration Error.** Less than ± 2 percent of the span for the zero, mid-range, and high-range calibration gases.

4.2 **Sampling System Bias.** Less than ± 5 percent of the span for the zero, and mid— or high-range calibration gases.

4.3 **Zero Drift.** Less than ± 3 percent of the span over the period of each run.

4.4 **Calibration Drift.** Less than ± 3 percent of the span over the period of each run.

4.5 **Interference Check.** Less than ± 7 percent of the modified Method 6 result for each run.

5. Apparatus and Reagents

5.1 **Measurement System.** Any measurement system for SO_2 that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1. The essential components of the measurement system are described below:

5.1.1 **Sample Probe.** Glass, stainless steel, or equivalent, of sufficient length to traverse the sample points. The sampling probe shall be heated to prevent condensation.

5.1.2 **Sample Line.** Heated (sufficient to prevent condensation) stainless steel or Teflon tubing, to transport the sample gas to the moisture removal system.

5.1.3 **Sample Transport Lines.** Stainless steel or Teflon tubing, to transport the sample from the moisture removal system to the sample pump, sample flow rate control, and sample gas manifold.

5.1.4 **Calibration Valve Assembly.** A three—way valve assembly, or equivalent, for blocking the sample gas flow and introducing calibration gases to the measurement system at the outlet of the sampling probe when in the calibration mode.

5.1.5 **Moisture Removal System.** A refrigerator-type condenser or similar device (e.g., permeation dryer), to remove condensate continuously from the sample gas while maintaining minimal contact between the condensate and the sample gas. The moisture removal system is not necessary for analyzers that can measure gas concentrations on a wet basis; for these analyzers, (1) heat the sample line and all interface components up to the inlet of the analyzer sufficiently to prevent condensation, and (2) determine the moisture content and correct the measured gas concentrations to a dry basis using appropriate methods, subject to the approval of the Administrator. The determination of sample moisture content is not necessary for pollutant analyzers that measure concentrations on a wet basis when (1) a wet basis CO_2 analyzer operated according to Method 3A is used to obtain simultaneous measurements, and (2) the pollutant/CO_2 measurements are used to determine emissions in units of the standard.

5.1.6 **Particulate Filter.** An in-stack or heated (sufficient to prevent water condensation) out—of—stack filter. The filter shall be borosilicate or quartz glass wool, or glass fiber mat. Additional filters at the inlet or outlet of the moisture removal system and inlet of the analyzer may be used to prevent accumulation of particulate material in the measurement system and extend the useful life of the components. All filters shall be fabricated of materials that are nonreactive to the gas being sampled.

5.1.7 **Sample Pump.** A leak-free pump, to pull the sample gas through the system at a flow rate sufficient to minimize the response time of the measurement system. The pump may be constructed of any material that is nonreactive to the gas being sampled.

5.1.8 **Sample Flow Rate Control.** A sample flow rate control valve and rotameter, or equivalent, to maintain a constant sampling rate within 10 percent.

(Note: The tester may elect to install a back-pressure regulator to maintain the sample gas manifold at a constant pressure in order to protect the analyzer(s) from over pressurization, and to minimize the need for flow rate adjustments.)

5.1.9 **Sample Gas Manifold.** A sample gas manifold, to divert a portion of the sample gas stream to the analyzer, and the remainder to the by-pass discharge vent. The sample gas manifold should also include provisions for introducing calibration gases directly to the analyzer. The manifold may be constructed of any material that is nonreactive to the gas being sampled.

5.1.10 **Gas Analyzer.** A UV or NDIR absorption or fluorescence analyzer, to determine continuously the SO_2 concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer.

(Note: Housing the analyzer(s) in a clean, thermally-stable, vibration-free environment will minimize drift in the analyzer calibration.)

5.1.11 **Data Recorder.** A strip chart recorder, analog computer, or digital recorder, for recording measurement data. The data recorder resolution (i.e., readability) shall be 0.5 percent of span. Alternatively, a digital or analog meter having a resolution of 0.5 percent of span may be used to obtain the analyzer responses and the readings may be recorded manually. If this alternative is used, the readings shall be obtained at equally spaced intervals over the duration of the sampling run. For sampling run durations of less than 1 hour, measurements at 1—minute intervals or a minimum of 30 measurements, whichever is less restrictive, shall be obtained. For sampling run durations greater than 1 hour, measurements at 2—minute intervals or a minimum of 96 measurements, whichever is less restrictive, shall be obtained.

5.2 **Method 6 Apparatus and Reagents.** The apparatus and reagents described in Method 6, and shown by the schematic of the sampling train in Figure 6C-2, to conduct the interference check.

5.3 **SO2 Calibration Gases.** The calibration gases for the gas analyzer shall be SO_2 in N_2 or SO_2 in air. Alternatively, SO_2/CO_2, SO_2/O_2, or $SO_2/CO_2/O_2$ gas mixtures in N_2 may be used. For fluorescence-based analyzers, the O_2 and CO_2 concentrations of the calibration gases as introduced to the analyzer shall be within 1 percent (absolute) O_2 and 1 percent (absolute) CO_2 of the O_2 and Co_2 concentrations of the effluent samples as introduced to the analyzer. Alternatively, for fluorescence-based analyzers, use calibration blends of SO_2 in air and the nomographs provided by the vendor to determine the quenching correction factor (the effluent O_2 and CO_2 concentrations must be known). Use three calibration gases as specified below:

5.3.1 **High-Range Gas.** Concentration equivalent to 80 to 100 percent of the span.

5.3.2 **Mid-Range Gas.** Concentration equivalent to 40 to 60 percent of the span.

5.3.3 **Zero Gas.** Concentration of less than 0.25 percent of the span. Purified ambient air may be used for the zero gas by passing air through a charcoal filter, or through one or more impingers containing a solution of 3 percent H_2O_2.

6. Measurement System Performance Test Procedures

Perform the following procedures before measurement of emissions (Section 7).

6.1 **Calibration Gas Concentration Verification**. There are two alternatives for establishing the concentrations of calibration gases. Alternative Number 1 is preferred.

6.1.1 **Alternative Number 1**—Use of calibration gases that are analyzed following the Environmental Protection Agency Traceability Protocol Number 1 (see Citation 1 in the Bibliography). Obtain a certification from the gas manufacturer that Protocol Number 1 was followed.

6.1.2 **Alternative Number 2**—Use of calibration gases not prepared according to Protocol Number 1. If this alternative is chosen, obtain gas mixtures with a manufacturer's tolerance not to exceed ± 2 percent of the tag value. Within 6 months before the emission test, analyze each of the calibration gases in triplicate using Method 6. Citation 2 in the Bibliography describes procedures and techniques that may be used for this analysis. Record the results on a data sheet (example is shown in Figure 6C-3). Each of the individual SO_2 analytical results for each calibration gas shall be within 5 percent (or 5 PPM, whichever is greater) of the triplicate set average; otherwise, discard the entire set, and repeat the triplicate analyses. If the average of the triplicate analyses is within 5 percent of the calibration gas manufacturer's cylinder tag value, use the tag value; otherwise, conduct at least three additional analyses until the results of six consecutive runs agree with 5 percent (or 5 PPM, whichever is greater) of their average. Then use this average for the cylinder value.

6.2 **Measurement System Preparation**. Assemble the measurement system by following the manufacturer's written instructions for preparing and preconditioning the gas analyzer and, as applicable, the other system components. Introduce the calibration gases in any sequence, and make all necessary adjustments to calibrate the analyzer and the data recorder. Adjust system components to achieve correct sampling rates.

6.3 **Analyzer Calibration Error**. Conduct the analyzer calibration error check by introducing calibration gases to the measurement system at any point upstream of the gas analyzer as follows:

6.3.1 After the measurement system has been prepared for use, introduce the zero, mid-range, and high-range gases to the analyzer. During this check, make no adjustments to the system except those necessary to achieve the correct calibration gas flow rate at the analyzer. Record the analyzer responses to each calibration gas on a form similar to Figure 6C-4.

Note: A calibration curve established prior to the analyzer calibration error check may be used to convert the analyzer response to the equivalent gas concentration introduced to the analyzer. However, the same correction procedure shall be used for all effluent and calibration measurements obtained during the test.

6.3.2 The analyzer calibration error check shall be considered invalid if the gas concentration displayed by the analyzer exceeds ± 2 percent of the span for any of the calibration gases. If an invalid calibration is exhibited, take corrective action, and repeat the analyzer calibration error check until acceptable performance is achieved.

6.4 **Sampling System Bias Check.** Perform the sampling system bias check by introducing calibration gases at the calibration valve installed at the outlet of the sampling probe. A zero gas and either the mid-range or high-range gas, whichever most closely approximates the effluent concentrations, shall be used for this check as follows:

6.4.1 Introduce the upscale calibration gas, and record the gas concentration displayed by the analyzer on a form similar to Figure 6C-5. Then introduce zero gas, and record the gas concentration displayed by the analyzer. During the sampling system bias check, operate the system at the normal sampling rate, and make no adjustments to the measurement system other than those necessary to achieve proper calibration gas flow rates at the analyzer. Alternately introduce the zero and upscale gases until a stable response is achieved. The tester shall determine the measurement system response time by observing the times required to achieve a stable response for both the zero and upscale gases. Note the longer of the two times as the response time.

6.4.2 The sampling system bias check shall be considered invalid if the difference between the gas concentrations displayed by the measurement system for the analyzer calibration error check and for the sampling system bias check exceeds ± 5 percent of the span for either the zero or upscale calibration gas. If an invalid calibration is exhibited, take corrective action, and repeat the sampling system bias check until acceptable performance is achieved. If adjustment to the analyzer is required, first repeat the analyzer calibration error check, then repeat the sampling system bias check.

7. Emission Test Procedure

7.1 **Selection of Sampling Site and Sampling Points.** Select a measurement site and sampling points using the same criteria that are applicable to Method 6.

7.2 **Interference Check Preparation.** For each individual analyzer, conduct an interference check for at least three runs during the initial field test on a particular source category. Retain the results, and report them with each test performed on that source category. If an interference check is being performed, assemble the modified Method 6 train (flow control valve, two midget impingers containing 3 percent H_2O_2, and dry gas meter) as shown in Figure 6C-2. Install the sampling train to obtain a sample at the measurement system sample by-pass discharge vent. Record the initial dry gas meter reading.

7.3 **Sample Collection.** Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the sampling system bias check. Maintain constant rate sampling (i.e., ± 10 percent) during the entire run. The sampling time per run shall be the same as for Method 6 plus twice the system response time. For each run, use only those measurements obtained after twice response time of the measurement system has elapsed, to determine the average effluent concentration. If an interference check is being performed, open the flow control valve on the modified Method 6 train concurrent with the initiation of the sampling period, and adjust the flow to 1 liter per minute (± 10 percent).

(Note: If a pump is not used in the modified Method 6 train, caution should be exercised in adjusting the flow rate since overpressurization of the impingers may cause leakage in the impinger train, resulting in positively biased results).

7.4 **Zero and Calibration Drift Tests.** Immediately preceding and following each run, or if adjustments are necessary for the measurement system during the run, repeat the sampling system bias check procedure described in Section 6.4 (Make no adjustments to the measurement system until after the drift checks are completed.) Record and analyzer's responses on a form similar to Figure 6C-5.

7.4.1 If either the zero or upscale calibration value exceeds the sampling system bias specification, then the run is considered invalid. Repeat both the analyzer calibration error check procedure (Section 6.3) and the sampling system bias check procedure (Section 6.4) before repeating the run.

7.4.2 If both the zero and upscale calibration values are within the sampling system bias specification, then use the average of the initial and final bias check values to calculate the gas concentration for the run. If the zero or upscale calibration drift value exceeds the drift limits, based on the difference between the sampling system bias check responses immediately before and after the run, repeat both the analyzer calibration error check procedure (Section 6.3) and the sampling system bias check procedure (Section 6.4) before conducting additional runs.

7.5 **Interference Check (if performed).** After completing the run, record the final dry gas meter reading, meter temperature, and barometric pressure. Recover and analyze the contents of the midget impingers, and determine the SO_2 gas concentration using the procedures of Method 6. (It is not necessary to analyze EPA performance audit samples for Method 6.) Determine the average gas concentration exhibited by the analyzer for the run. If the gas concentrations provided by the analyzer and the modified Method 6 differ by more than 7 percent of the modified Method 6 result, the run is invalidated.

8. Emission Calculation

The average gas effluent concentration is determined from the average gas concentration displayed by the gas analyzer, and is adjusted for the zero and upscale sampling system bias checks, as determined in accordance with Section 7.4. The average gas concentration displayed by the analyzer may be determined by integration of the area under the curve for chart recorders, or by averaging all of the effluent measurements. Alternatively, the average may be calculated from measurements recorded at equally spaced intervals over the entire duration of the run. For sampling run durations of less than 1 hour, measurements at 1—minute intervals or a minimum of 30 measurements, whichever is less restrictive, shall be used. For sampling run durations greater than 1 hour, measurements at 2—minute intervals or a minimum of 96 measurements, whichever is less restrictive, shall be used. Calculate the effluent gas concentration using Equation 6C-1.

$$\overline{C}_{gas} = (C - Co)\,\frac{C_{ma}}{C_m - Co} \quad Eq.\ 6C - 1$$

Where:

C_{gas} = Effluent gas concentration, dry basis, PPM.

$\overline{C}$ = Average gas concentration indicated by gas analyzer, dry basis, PPM.

Co = Average of initial and final system calibration bias check responses for the zero gas, PPM.

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, PPM.

C_{ma} = Actual concentration of the upscale calibration gas, PPM.

9. Bibliography

1. Traceability Protocol for Establishing True Concentrations of Gases Used for Calibrations and Audits of Continuous Source Emission Monitors: Protocol Number 1. U.S. Environmental Protection Agency, Quality Assurance Division. Research Triangle Park, NC. June 1978.

2. Westlin, Peter R. and J. W. Brown. Methods for Collecting and Analyzing Gas Cylinder Samples. Source Evaluation Society Newsletter. 3(3):5-15. September 1978.

|_See_CFR_paper_publication_for_illustration_0809

|_See_CFR_paper_publication_for_illustration_0810

APPENDIX K

CALCULATION EQUATIONS

METHOD 2
CALCULATION EQUATIONS

$$\overline{V_s} = 85.49\ C_p\ (\sqrt{\Delta p})_{avg}\ \sqrt{\frac{T_{s(avg)}}{P_s\ M_s}}$$

$$Q_{s,\,d} = 60\ (1\ - B_{ws})\ \overline{V_s}\ A\ (\frac{528}{T_{s\ (avg)}})\ (\frac{P_s}{29.92})$$

$$Q_a = 60\ \overline{V_s}\ A$$

$$\dot{m}_g = \frac{4.995\ Q_{s,\,d}\ G_d}{1\ -\ B_{ws}}$$

$$RH^* = 100\ (vp_{twb}\ -\ 0.0003641\ P_s\ (T_{db}\ -\ T_{wb}))/vp_{tdb}$$

$$B_{ws}^* = RH(vp_{tdb})/P_s$$

$$\rho = \frac{4.585\ x\ 10^{-2}\ P_s M_s}{T_s\ (avg)}$$

*Alternate equations for calculating moisture content from wet bulb and dry bulb data.

SYMBOLS

A = Cross Sectional area of stack, SQ. FT.

A_n = Cross sectional area of nozzle, SQ. FT.

B_{ws} = Water vapor in gas stream, proportion by volume

C_p = Pitot tube coefficient, dimensionless

C_a = Concentration of particulate matter in stack gas, wet basis, GR/ACF

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, GR/DSCF

EA = Excess air, percent by volume

γ = Dry test meter correction factor, dimensionless

G_d = Specific gravity (relative to air), dimensionless

I = Isokinetic variation, percent by volume

M_d = Molecular weight of stack gas, dry basis, g/g - mole.

$\dot{m}_g$ = Mass flow of wet flue gas, LB/HR

$\dot{m}_p$ = Particulate mass flow, LB/HR

M_s = Molecular weight of stack gas, wet basis, g/g mole.

M_p = Total amount of particulate matter collected, g

P_{bar} = Atmospheric pressure, IN. HG. (uncompensated)

P_g = Stack static gas pressure, IN. WC.

P_s = Absolute pressure of stack gas, IN. HG.

P_{std} = Standard absolute pressure, 29.92 IN. HG.

A_a = Actual volumetric stack gas flow rate, ACFM

$Q_{s,d}$ = Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM

RH = Relative humidity, %

T_{db} = Dry bulb temperature of stack gas, °F

T_{wb} = Wet bulb temperature of stack gas, °F

$T_{m(avg)}$ = Absolute average dry gas meter temperature, °R

$T_{s(avg)}$ = Absolute average stack temperature, °R

T_{std} = Standard absolute temperature, 528 °R (68 °F)

θ = Total sampling time, min.

V_{lc} = Total volume of liquid collected in impingers and silica gel, ml

V_m = Volume of gas sample as measured by dry gas meter, CF

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, DSCF

$V_{w(std)}$ = Volume of water vapor in the gas sample corrected to standard conditions, SCF

$\bar{V}_s$ = Average actual stack gas velocity, FT/SEC

vp_{tdb} = Vapor pressure at T_{db}, IN. HG.

vp_{twb} = Vapor pressure at T_{wb}, IN. HG.

$\overline{\Delta H}$ = Average pressure differential across the orifice meter, IN. WC.

ΔP = Velocity pressure of stack gas, IN. WC.

γ = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

METHOD 3
CALCULATION EQUATIONS

$$\%EA = \frac{100(\%O_2 - 0.5\%\ CO)}{0.264\%\ N_2 - \%O_2 + 0.5\%\ CO}$$

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

$$M_s = M_d\ (I - B_{ws}) + 0.18\ B_{ws}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

METHOD 5
CALCULATION EQUATIONS

$$V_{m(std)} = 17.65 \; V_m \; \gamma \; \left(\frac{P_{bar} + \overline{\Delta H}/13.6}{T_{m(avg)}} \right)$$

$$V_{w(std)} = 0.0472 \; V_{Is}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

$$I = 0.0944 \; \left(\frac{T_{s(avg)} \; V_{m(std)}}{P_s \; V_s \; A_n \; \theta \; (I - B_{ws})} \right)$$

$$C_s = \frac{15.43 \; M_p}{V_{m(std)}}$$

$$C_a = \frac{272.3 \; M_p \; P_s}{T_{s(avg)} \; (V_{w(std)} + V_{m(std)})}$$

$$(\dot{m}_p)_1 = 8.5714 \; x \; 10^{-3} \; C_s \; Q_{s,\,d}$$

$$(\dot{m}_p)_2 = \frac{1.3228 \ x \ 10^{-1} \ M_p \ A}{\theta \ A_n}$$

$$\dot{m}_p = \frac{(\dot{m}_p)_1 + (\dot{m}_p)_2}{2}$$

Report No. 9-13517

MATHY-MONARCH PAVING

PLANT NO. 10 - HAGER CITY

CALCULATION OF (LB/KLB FLUE GAS)

		TEST 1		
PARAMETER	**UNITS**	**RUN 1**	**RUN 2**	**RUN 3**
Qs,d	DSCFM	20666	20879	21766
Mass Flow	(LB/HR)	111795	111795	111795
Flow	(DSCFM)	21657	21657	21657
**Mfg	(LB/HR)	106679	107779	112358
Mfg	(KLB/HR)	106.6794	107.7789	112.3577
Mp	(LB/HR)	23.26	35.37	40.05
E	(LB/KLB)	0.218036	0.328172	0.356451

Where:

Qs,d = Flow from each individual run of particulate.

Mass Flow (Method 2 sheet)

Flow (Flow at bottom of Method 2 sheet)

** Mfg = Mass Flow ((LB/HR)/DSCFM)*DSCFM

Mp = Pounds per hour of particulate (each individual run)

E = Emission rate in LB/KLB Flue Gas

APPENDIX L

SAMPLING TRAIN CALIBRATION DATA

INTERPOLL LABORATORIES, INC.
(612) 786-6020

EPA Method 5 Gas Metering System Quality Control Check Data Sheet

Job Mathy / Monarch Paving
Date 9-23-99
Operator E Juers
Module No. 14

Instructions:
Operate the control module at a flow rate equal to ΔH@ for 10 minutes before attaching the umbilical.

Record the following data:

Bar press 28.99 in.Hg $\theta =$ 1.0019 ΔH@ 1.91 in.WC.

Time (min)	Volume (CF)	Meter Temp (°F)	
		Inlet	Outlet
▨	(154.60)	▨	▨
2.5	156.55	76	89
5.0	158.52	78	77
7.5	160.46	79	76
10	162.40	79	76
▨	V_m = 7.8	Avg(t_m) = 77.5 °F	

Calculate Y_{cm} as follows:

$$Y_{cm} = \frac{1.786}{\theta \; V_m} \left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cm} = \frac{1.786}{(\qquad)(\qquad)} \left[\frac{(77.5) + 460}{(28.99)}\right]^{0.5} \quad 4.31$$

Y_{cm} = .986

If Y_{cm} is not within the range of 0.97 to 1.03, "the volume metering system should be investigated before beginning."

CFR Title 40, Part 60, Appendix A, Method 5, Section 4.4.1

INTERPOLL LABORATORIES, INC.
(612) 786-6020

Meter Calibration Sheet EPA/Method 5

Date 12/5/98
Bar. Press 28.70 IN.HG
Wet Test Meter No. AL-20

Control Module No. 14
Serial No. DTM 1334123
Technician Jutt

ΔH (IN.WC.)		Gas Volume Wet Test Meter	* Cal Index	* Diff Wet Test Meter ΔP_w	Gas Volume Dry Test Meter (ft³)		Gas Temperatures			Time	Meter Coeff.	Orifice Const.	C_i
							Wet Test T_w (°F)	Dry Test					
Nominal	Actual	(ft³)	(%)	(IN.WC.)	V_{di}	V_{do}		t_{di} (°F)	t_{do} (°F)	(Min/ Sec)	Y	ΔH@	
0.5		2	99.6	0.01	972.09	974.13	62.5	79	66	5:07	.9938	1.87	
1.2		3	99.8	0.025	974.64	978.70	62.5	82	66	6:45	1.0017	1.94	
2		3	100.00	0.055	989.78	993.34	62.5	86	67	4:34	1.0042	1.91	
3.3		5	100.00	0.09	985.24	989.28	62.5	87	66	4:02	1.0079	1.88	
										Avg	1.0019	1.90	

Positive leak check performed by Jutt

Meter was in tolerance ☒

Approved

Meter was not in tolerance ☐: readjusted linkage

Meter was not in tolerance ☐:changed dry test meter

Date 12/6/98

*Based on [illegible]20 wet test meter calibration in April 1997 against Bell Prover (NBS Traceable) - Carl Poe Co.

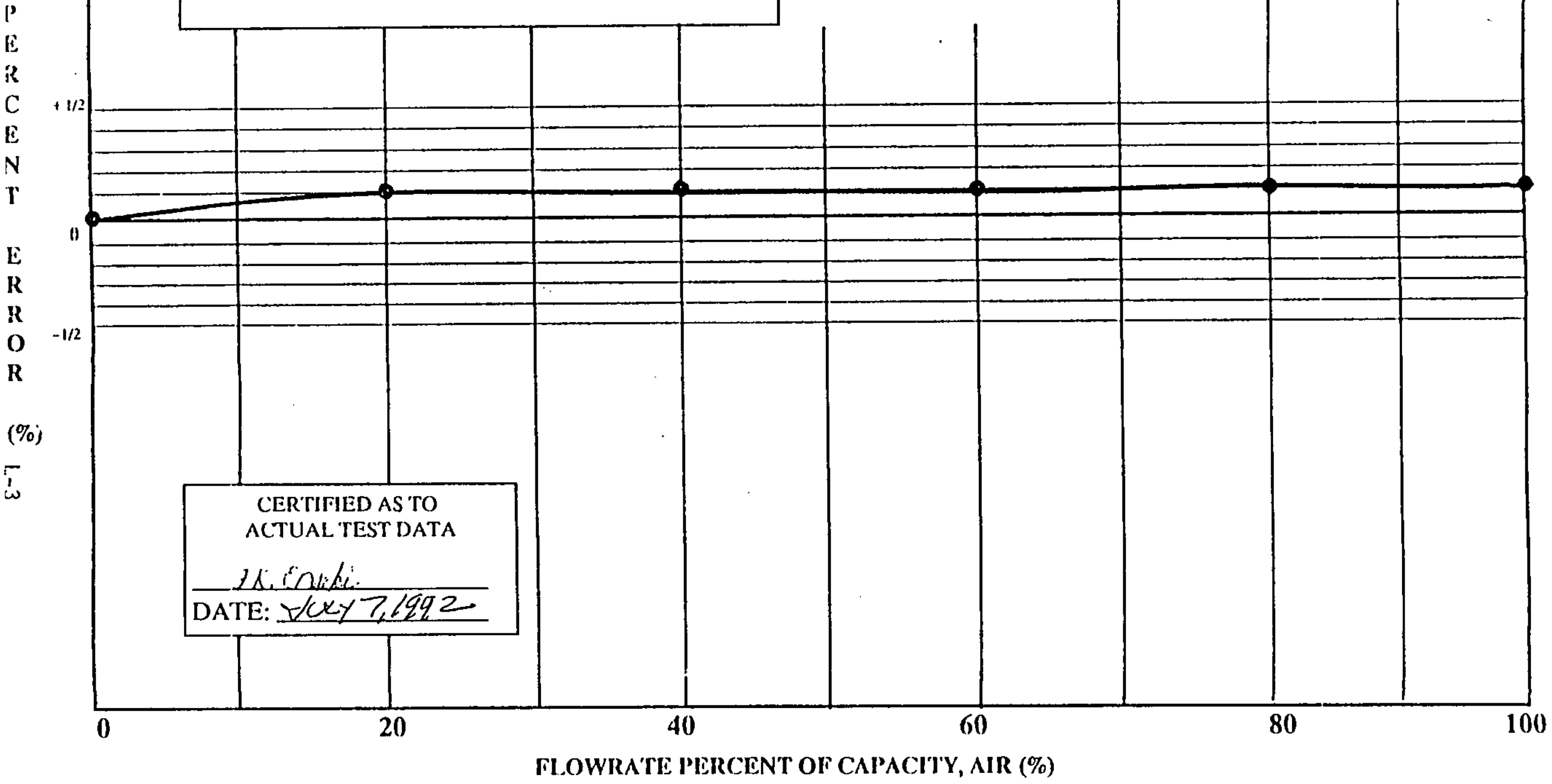
CURVE NUMBER 12

Equimeter
INCORPORATED A BTR Company
805 Liberty Blvd., DuBois, PA 15801

TEST METER PERFORMANCE

METER SIZE: R-275 STD
SERIAL NUMBER: 1334123
CUSTOMER NAME: CONTROLS & METERS, INC.
ORDER NUMBER: G13-73640-001

Meter Box #
14



CERTIFIED AS TO
ACTUAL TEST DATA

DATE: JULY 7, 1992

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: November 9, 1999

Meter Box No. : 14 (Rockwell Dry Test Meter Serial No. 1334123)

Date of Last Calibration: December 5, 1998
Calibration Technician: D. Van Hoever
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
March 11, 1999	9-12472	1000.00	1153.57	153.57	153.57
July 27-28, 1999	9-13204	154.00	496.20	342.20	495.77
August 2-3, 1999	9-13234	506.40	734.87	228.47	724.24
August 11, 1999	9-13290	735.20	862.89	127.69	851.93
August 17-19, 1999	9-13324	887.60	1426.71	539.11	1391.04
August25-26, 1999	9-13372	428.90	739.57	364.67	1755.71
Aug 30-Sept 3, 1999	9-13405	739.85	1487.98	748.13	2503.84
September 9, 1999	9-13439	488.08	791.60	303.52	2807.36
September 14-20,1999	9-13471	791.90	2151.50	1359.60	4166.96
September 23, 1999	9-13517	154.60	293.98	139.38	4306.34

* Total volume through meter since last calibration.

INTERPOLL LABORATORIES, INC.
(612) 786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 6-4-99
Technician E. Juers
Mercury Column Barometer No. Lab
Aneroid Barometer No. 10724004

Actual Mercury Barometer Read	Ambient Temp.	Temperature Correction Factor	Adjusted Mercury Barometer Read	Initial Aneroid Barometer Read	Difference ($P_{ba} - P_{bm}$)
29.18	76	.124+.001	29055	29.05	0

Has this barometer shown any consistent problems with calibration? Yes/No. If yes, explain.

Offset -1422

Slope 1254

Has problem been alleviated? Yes/No. How?

Note: Aneroid barometers will be calibrated periodically against a mercury column barometer. The aneroid barometer to be calibrated should be placed in close proximity to the mercury barometer and left to equilibrate for 20 - 30 minutes before calibrating. Aneroid barometer will be calibrated to the adjusted mercury barometer readings.

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INTERPOLL LABORATORIES, INC.
(612) 786-6020

Temperature Measurement Device Calibration Sheet

Unit Under Test:
Vendor Omega
Model HH81
Range -330 → 2501.6 °F
Date of Calibration 2-5-99
Method of Calibration:
Serial Number 77JX 1106
Thermocouple Type K
Technician E. JURIS
PDT No. 57

☐ Comparison against ASTM mercury in glass thermometer using a thermostatted and insulated aluminum block designed to provide uniform temperature. The temperature is adjusted by adjusting the voltage on the block heater cartridge.

☒ Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is ± 0.1% of span (2100°F) ± 1 degree (for negative temperatures add ± 2 degrees). The CL-300 simulates exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp (°F) Nominal	Temperature of Standard or Simulated Temp (°F)	Response of Unit Under Test (°F)	Deviation	
			Δt (°F)	(%)
0		-1.6	1.6	.38
100		96.9	3.1	.55
200		199	1	.15
300		297	3	.39
400		397	3	.35
500		498	2	.20
600		599	1	.09
700		698	2	.17
800		800	0	0
900		899	1	.08
1000		999	1	.07
1100		1098	2	.13
1200		1200	0	0
1300		1298	2	.11
1400		1401	1	.05
1500		1499	1	.05
1600		1602	2	.10
1700		1699	1	.05
1800		1802	2	.09
1900		1899	1	.04
2000		2000	0	0
2100		2097	3	.12
		Averages:	1 54	.14

OF = off scale response by unit under test (°F)
☒ Unit in tolerance

% dev = 100 Δt/(460 + t)
☐ Unit was not in tolerance: recalibrated - See new calibration sheet.