AP42 Section: 11.1

Reference Number: 386

Title: Results Of The August 11 & 28, 1999 Air Emission Compliance Tests On The Mathy/Northwoods Paving Plant No. 25 Near Superior, Wisconsin,

Interpoll Laboratories, Circle Pines, MN,

September 24, 1999.

Sec. 11.1
Ref. 386

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RESULTS OF THE AUGUST 11 & 28,1999 AIR EMISSION COMPLIANCE TESTS ON THE MATHY/NORTHWOODS PAVING PLANT NO. 25 NEAR SUPERIOR, WISCONSIN

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Report Number 9-13373
September 24, 1999
KE/kce

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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 August 11 and 27, 1999 Interpoll Laboratories personnel conducted air emission compliance tests on the Mathy-Northwoods Paving Plant No. 25 located near Superior, Wisconsin. The plant was tested while fired with waste oil. On-site testing was performed on August 11 by Scott Fjelsta, Doug Peterson, and Jim Thoma. Testing on August 27 was performed by Troy Thome, Scott Fjelsta and Joe Tuma. Coordination between testing activities and plant operation was provided by Tara Wetzel of Mathy Construction. The tests were not witnessed by a representative of the Wisconsin Department of Natural Resources.

Testing on the No. 25 Asphalt Plant Stack was conducted from five test ports evenly spaced across the face of the stack. The ports are located 3.0 diameter equivalents downstream of the nearest flow disturbance and 0.50 diameter equivalents upstream of the stack exit. A 25-point traverse was used to collect representative particulate samples. Each traverse point was sampled 2.5 minutes to give a total sampling time of 62.5 minutes per run.

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 visible emission determination was performed on August 11 by Doug Peterson, a certified observer.

The O_2, CO_2, SO_2 determinations were performed in accordance with CFR Title 40, Part 60 Appendix B (revised July 1, 1998). 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 (1/6, 3/6, 5/6 of the stack diameter) to measure total hydrocarbon and carbon monoxide concentrations.

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 1-3. An overview of all results is presented in the tables on the following pages:

PARAMETER	LIMIT	MEASURED
NO.25 ASPHALT PLANT STACK (8/11/99)		
PM		
DRY CATCH ONLY . . . . . (GR/DSCF)	0.04	0.15
. . . . . (LB/HR)	N/A	18
Sulfur Dioxide		
. . . . . (ppm,w)	N/A	47.9
. . . . . (LB/HR)	N/A	9.06
Opacity		
. . . . . (%)	20%	1.46
NO.25 ASPHALT PLANT STACK (8/27/99)		
PM		
DRY CATCH ONLY . . . . . (GR/DSCF)	0.04	0.0088
. . . . . (LB/HR)	N/A	0.93

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

Mathy/Northwoods Paving Plant #25

Sulfur in Burner Fuel

S = 0.50% by weight

Mass of Oil = 7.43 lb/gallon

Mass Flow of Sulfur Dioxide from the Burner

Average burner fuel flow = 235 gallons/hour.
3235 gallons/hour x 7.43 lbs/gallon x .50/100 sulfur/oil x 2 SO2/S =
17.46 lbs SO2/hour generated in the plant drum by combustion.

Mass Flow of Sulfur Dioxide from the Plant Stack

9.06 lbs/hour

Sulfur Dioxide Capture Efficiency

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

EF = **48.11** %

comp\plt\so2test

Table 1. Summary of the Results of the August 11, 1999 NSPS Particulate Emission Compliance Test on the Northwoods Paving No. 25 Asphalt Plant Located Near Superior, Wisconsin.

ITEM		Run 1	Run 2	Run 3
Date of test		08-11-99	08-11-99	08-11-99
Time runs were done	(HRS)	840/ 945	1000/1106	1120/1225
Volumetric flow				
actual	(ACFM)	28184	28070	28322
standard	(DSCFM)	13604	14203	14050
Gas temperature	(DEG-F)	299	295	295
Moisture content	(%V/V)	28.05	24.91	26.45
Gas composition	(%V/V,dry)			
carbon dioxide		5.22	4.99	5.37
oxygen		13.51	13.53	13.27
nitrogen		81.27	81.48	81.36
Isokinetic variation	(%)	98.3	94.5	98.4
Particulate concentration				
actual	(GR/ACF)	.0706	.0828	.0701
standard	(GR/DSCF)	0.146	0.164	0.141
Part. emission rate	(LB/HR)	17.07	19.92	17.01

Note: Dry Catch Only

Table 2. Summary of the Results of the August 27, 1999 Particulate Emission Compliance Test on the Northwoods Paving Asphalt Plant No. 25 Sited Near Superior, Wisconsin.

ITEM	Run 1	Run 2	Run 3
Date of test	08-27-99	08-27-99	08-27-99
Time runs were done (HRS)	645/ 810	830/ 935	1007/1146
Volumetric flow			
actual (ACFM)	28133	27954	25603
standard (DSCFM)	12844	12884	11434
Gas temperature (DEG-F)	309	323	323
Moisture content (%V/V)	31.20	29.24	31.44
Gas composition (%V/V,dry)			
carbon dioxide	6.37	5.97	6.17
oxygen	11.96	12.65	12.45
nitrogen	81.67	81.38	81.38
Isokinetic variation (%)	105.1	99.5	102.0
Particulate concentration			
actual (GR/ACF)	.003367	.004470	.004093
standard (GR/DSCF)	.007378	.009703	.009169
Part. emission rate (LB/HR)	0.812	1.07	0.899

Note: Dry Catch Only

Table 3. Summary of the Results of the **Sulfur Dioxide** Emission Compliance Tests on the Northwoods Paving No. 25 Asphalt Plant Stack.

Date	Time (HRS)	Concentration (ppm,w)	Emission Rate (LB/HR)
No. 25 Asphalt Plant			
8-11-99	0840-0940	46.9	8.84
8-11-99	1000-1100	47.8	8.99
8-11-99	1120-1220	49.1	9.35
Avg		47.9	9.06

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.

3.1 Results of Orsat and Moisture Determinations

Test No. 1
Plant No. 25 Stack

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

	Run 1	Run 2	Run 3
Date of run	08-11-99	08-11-99	08-11-99
Dry basis (orsat)			
carbon dioxide.....	5.22	4.99	5.37
oxygen.....	13.51	13.53	13.27
nitrogen.....	81.27	81.48	81.36
Wet basis (orsat)			
carbon dioxide.....	3.76	3.75	3.95
oxygen.....	9.72	10.16	9.76
nitrogen.....	58.47	61.18	59.84
water vapor.....	28.05	24.91	26.45
Dry molecular weight.....	29.38	29.34	29.39
Wet molecular weight.....	26.18	26.51	26.38
Specific gravity.....	0.904	0.916	0.911
Water mass flow.....(LB/HR)	14877	13217	14170
FO	1.416	1.477	1.421

APPENDIX E

COMPUTER DATALOGGER PRINTOUTS

Mathy Constuction
Superior, WI
Plant 25 Stack
8/11/99
Run 1

Time	SO2 ppm, w	O2 %, d	CO2 %, w
8:40 AM	50.91	12.80	4.24
8:41 AM	48.60	12.99	4.16
8:42 AM	47.33	13.14	4.08
8:43 AM	47.19	13.23	4.02
8:44 AM	46.99	13.30	4.04
8:45 AM	48.36	13.18	4.02
8:46 AM	49.16	12.86	4.16
8:47 AM	50.64	12.89	4.16
8:48 AM	50.12	13.00	4.11
8:49 AM	49.08	13.07	4.05
8:50 AM	48.99	13.17	4.01
8:51 AM	49.67	13.14	4.00
8:52 AM	50.74	12.81	4.13
8:53 AM	52.52	12.95	4.13
8:54 AM	50.84	12.94	4.10
8:55 AM	50.16	13.09	4.04
8:56 AM	50.85	13.14	4.01
8:57 AM	51.42	13.22	3.99
8:58 AM	51.26	12.96	4.08
8:59 AM	52.02	12.79	4.15
9:00 AM	51.92	13.03	4.08
9:01 AM	51.64	13.09	4.03
9:02 AM	52.07	13.16	4.00
9:03 AM	50.37	13.47	3.87
9:04 AM	47.16	13.98	3.62
9:05 AM	45.52	13.76	3.68
9:06 AM	43.86	13.93	3.60
9:07 AM	42.84	14.05	3.53
9:08 AM	41.74	14.03	3.51
9:09 AM	42.98	14.06	3.56
9:10 AM	42.90	14.05	3.53
9:11 AM	43.47	13.78	3.63
9:12 AM	46.45	13.62	3.72
9:13 AM	47.77	13.53	3.81
9:14 AM	47.25	13.58	3.79
9:15 AM	45.72	13.62	3.75
9:16 AM	45.69	13.69	3.70
9:17 AM	47.99	13.45	3.77
9:18 AM	48.23	13.28	3.91
9:19 AM	47.60	13.43	3.86

9:20 AM	47.02	13.59	3.77
9:21 AM	48.17	13.64	3.74
9:22 AM	47.80	13.67	3.74
9:23 AM	48.94	13.45	3.85
9:24 AM	48.98	13.23	3.93
9:25 AM	49.41	13.36	3.89
9:26 AM	49.61	13.43	3.86
9:27 AM	51.12	13.60	3.79
9:28 AM	48.01	14.01	3.67
9:29 AM	44.19	13.96	3.57
9:30 AM	42.64	13.71	3.65
9:31 AM	43.25	13.64	3.68
9:32 AM	44.38	13.54	3.74
9:33 AM	51.92	13.54	3.81
9:34 AM	44.71	15.84	2.97
9:35 AM	42.44	14.32	3.26
9:36 AM	40.74	13.32	3.69
9:37 AM	42.11	12.92	3.84
9:38 AM	43.12	12.91	3.96
9:39 AM	46.23	13.03	3.93
Average	**47.58**	**13.43**	**3.85**

Mathy Constuction
Superior, WI
Plant 25 Stack

8/11/99
Test 1 Run 1

VOLUMETRIC FLOW RATE
NUMBER OF SAMPLE POINTS 25

PT. NO.		DELTA P	SQ. RT P	TEMP	TIME
1	A-1	.97	.985	298.6	8:40 AM
2	-2	1.75	1.323	298.6	
3	-3	1.5	1.225	298.6	
4	-4	1.5	1.225	298.6	
5	-5	1.55	1.245	298.6	
6	B-1	1.2	1.095	298.6	
7	-2	1.4	1.183	298.6	
8	-3	1.3	1.14	298.6	
9	-4	1.2	1.095	298.6	
10	-5	1.25	1.118	298.6	
11	C-1	.85	.922	298.6	
12	-2	1.25	1.118	298.6	
13	-3	1.1	1.049	298.6	
14	-4	1.1	1.049	298.6	
15	-5	1.2	1.095	298.6	
16	D-1	.98	.99	298.6	
17	-2	.98	.99	298.6	
18	-3	1.1	1.049	298.6	
19	-4	1.05	1.025	298.6	
20	-5	1.05	1.025	298.6	
21	E-1	.95	.975	298.6	
22	-2	.97	.985	298.6	
23	-3	1.15	1.072	298.6	
24	-4	1.1	1.049	298.6	
25	-5	1.2	1.095	298.6	
AVERAGE		1.186	1.085	298.6	9:43 AM

MOISTURE CONTENT	DATA
METER VOLUME	38.52
AVERAGE METER TEMP	78.6
GAS METER COEF. (Y)	1.0019
GAS METER DELTA H@	1.91
GRAMS OF WATER	303.
BAROMETRIC PRESSURE	28.9
STANDARD METER VOLUME	36.707
MOISTURE CONTENT	27.995
OXYGEN %	13.515
CO 2 %	5.216
STANDARD CFH	1,134,520
K STANDARD CFM	18.909

FLOW RATE	
STATIC PRESSURE	-.7
PITOT COEF.	0.84
DUCT WIDTH(IN)	31.5
DUCT LENTGH(IN)	27.5
DUCT AREA (SQ.FT.)	6.016
STACK DIA. (IN)	.
STACK AREA (SQ.FT.)	.
MOLECULAR WEIGHT (DRY)	29.375
MOLECULAR WEIGHT (WET)	26.191
STACK PRESSURE	28.849
FEET PER SECOND	78.063
ACTUAL CFM	28175.9
DRY STANDARD CFM	13615.19

Mathy Constuction
Superior, WI
Plant 25 Stack

8/11/99
Test 1 Run 1

FIELD CALCULATIONS

RAW DATA TABLE

INSTRUMENT	PPM OR %	ZERO	SPAN	GAS	C GAS	
O2 (dry)	13.43	0.07	10.85	10.9	**13.51**	dry
CO2 (wet)	3.85	0.13	11.03	11.	**3.76**	wet
SO2 (wet)	47.58	1.27	89.85	89.8	**46.95**	wet

MOISTURE	27.99	STANDARD CFH	1,134,520
FUEL FACTOR C	.	K STANDARD CFM	18.909
DSCFM	13615.2		

RESULTS

O2 % (dry)	13.51		
CO2 % (dry)	5.22		
SO2 (dry)	**65.2**	**SO2 LBS/HR**	**8.841**
		Fo	1.416

Mathy Constuction
Superior, WI
Plant No. 25 Stack
8/11/99
Run 2

Time	SO2 ppm, w	O2 %, d	CO2 %, w
10:00 AM	50.42	13.64	3.67
10:01 AM	50.09	13.56	3.69
10:02 AM	49.34	13.29	3.83
10:03 AM	49.34	13.43	3.80
10:04 AM	48.28	13.57	3.73
10:05 AM	48.25	13.66	3.68
10:06 AM	46.90	13.69	3.63
10:07 AM	47.20	13.72	3.68
10:08 AM	47.00	13.41	3.79
10:09 AM	47.45	13.46	3.77
10:10 AM	46.93	13.57	3.71
10:11 AM	47.75	13.74	3.65
10:12 AM	47.80	13.77	3.68
10:13 AM	48.07	13.78	3.67
10:14 AM	48.01	13.58	3.72
10:15 AM	49.79	13.40	3.84
10:16 AM	48.23	13.54	3.77
10:17 AM	48.48	13.64	3.76
10:18 AM	47.34	13.71	3.69
10:19 AM	46.83	13.73	3.68
10:20 AM	47.27	13.65	3.70
10:21 AM	49.18	13.38	3.83
10:22 AM	48.24	13.47	3.80
10:23 AM	47.06	13.58	3.75
10:24 AM	46.22	13.64	3.67
10:25 AM	44.89	13.70	3.62
10:26 AM	47.13	13.71	3.68
10:27 AM	47.50	13.41	3.81
10:28 AM	49.02	13.46	3.81
10:29 AM	48.31	13.46	3.77
10:30 AM	46.10	13.53	3.68
10:31 AM	45.89	13.62	3.70
10:32 AM	46.02	13.75	3.69
10:33 AM	46.59	13.53	3.74
10:34 AM	46.92	13.45	3.76
10:35 AM	48.53	13.33	3.77
10:36 AM	48.20	13.16	3.96
10:37 AM	49.77	13.32	3.90
10:38 AM	49.95	13.67	3.66
10:39 AM	49.16	13.15	3.94

10:40 AM	51.60	13.18	4.05
10:41 AM	51.35	13.05	4.03
10:42 AM	49.02	13.15	3.94
10:43 AM	48.26	13.29	3.85
10:44 AM	49.08	13.31	3.84
10:45 AM	49.19	13.30	3.88
10:46 AM	49.78	13.00	4.05
10:47 AM	51.16	13.07	4.04
10:48 AM	50.65	13.12	3.98
10:49 AM	49.96	13.23	3.93
10:50 AM	49.11	13.29	3.89
10:51 AM	49.12	13.37	3.88
10:52 AM	50.27	13.12	3.96
10:53 AM	49.89	13.02	3.99
10:54 AM	49.68	13.26	3.91
10:55 AM	46.44	13.59	3.79
10:56 AM	44.91	13.70	3.71
10:57 AM	44.68	13.74	3.64
10:58 AM	44.72	13.67	3.66
10:59 AM	46.00	13.45	3.74
Average	**48.17**	**13.46**	**3.79**

Mathy Constuction
Superior, WI
Plant No. 25 Stack

8/11/99
Test 1 Run 2

VOLUMETRIC FLOW RATE
NUMBER OF SAMPLE POINTS 25

PT. NO.		DELTA P	SQ. RT P	TEMP	TIME
1	A-1	1.4	1.183	295.5	10:00 AM
2	-2	1.6	1.265	295.5	
3	-3	1.7	1.304	295.5	
4	-4	1.8	1.342	295.5	
5	-5	1.75	1.323	295.5	
6	B-1	1.1	1.049	295.5	
7	-2	1.1	1.049	295.5	
8	-3	1.2	1.095	295.5	
9	-4	1.2	1.095	295.5	
10	-5	1.1	1.049	295.5	
11	C-1	1.1	1.049	295.5	
12	-2	1.2	1.095	295.5	
13	-3	1.2	1.095	295.5	
14	-4	1.1	1.049	295.5	
15	-5	.98	.99	295.5	
16	D-1	1.08	1.039	295.5	
17	-2	1.	1.	295.5	
18	-3	1.05	1.025	295.5	
19	-4	.98	.99	295.5	
20	-5	1.05	1.025	295.5	
21	E-1	.99	.995	295.5	
22	-2	.98	.99	295.5	
23	-3	1.1	1.049	295.5	
24	-4	1.1	1.049	295.5	
25	-5	1.1	1.049	295.5	10:05 AM
AVERAGE		1.198	1.09	295.5	

MOISTURE CONTENT	DATA
METER VOLUME	39.75
AVERAGE METER TEMP	83.6
GAS METER COEF. (Y)	1.0019
GAS METER DELTA H AT	1.91
GRAMS OF WATER	259.
BAROMETRIC PRESSURE	28.9
STANDARD METER VOLUME	37.53
MOISTURE CONTENT	24.531
OXYGEN %	13.534
CO 2 %	4.986
STANDARD CFH	1,133,974
K STANDARD CFM	18.9

FLOW RATE	
STATIC PRESSURE	-0.7
PITOT COEF.	0.84
DUCT WIDTH(IN)	31.5
DUCT LENTGH(IN)	27.5
DUCT AREA (SQ.FT.)	6.0156
STACK DIA. (IN)	0
STACK AREA (SQ.FT.)	0.0000
MOLECULAR WEIGHT (DRY)	29.339
MOLECULAR WEIGHT (WET)	26.558
STACK PRESSURE	28.849
FEET PER SECOND	77.707
ACTUAL CFM	28047.25
DRY STANDARD CFM	14263.39

Mathy Constuction
Superior, WI
Plant No. 25 Stack

8/11/99
Test 1 Run 2

FIELD CALCULATIONS

RAW DATA TABLE

INSTRUMENT	PPM OR %	ZERO	SPAN	GAS	C GAS	
O2 (dry)	13.46	0.05	10.85	10.9	**13.53**	dry
CO2 (wet)	3.79	0.13	10.83	11	**3.76**	wet
SO2 (wet)	48.17	1.65	89.13	89.8	**47.76**	wet

MOISTURE	24.53	STANDARD CFH	1,133,974
FUEL FACTOR C	0	K STANDARD CFM	18.9
DSCFM	14263.4		

RESULTS

O2 % (dry)	13.53		
CO2 % (dry)	4.99		
SO2 ppm (dry)	**63.28**	**SO2 LBS/HR**	**8.989**
		Fo	1.477

Mathy Constuction
Superior, WI
Plant No. 25 Stack
8/11/99
Run 3

Time	SO2 ppm, w	O2 %, d	CO2 %, w
11:20 AM	50.02	13.11	4.12
11:21 AM	54.10	13.46	3.89
11:22 AM	51.84	13.41	3.86
11:23 AM	51.26	13.46	3.84
11:24 AM	52.73	13.05	4.10
11:25 AM	51.76	13.13	4.01
11:26 AM	50.52	13.27	3.90
11:27 AM	50.02	13.44	3.83
11:28 AM	50.97	13.45	3.83
11:29 AM	51.53	13.45	3.90
11:30 AM	52.79	13.16	3.98
11:31 AM	53.96	13.10	3.99
11:32 AM	53.55	13.19	3.92
11:33 AM	52.11	13.36	3.90
11:34 AM	50.42	13.39	3.89
11:35 AM	49.98	13.41	3.85
11:36 AM	50.37	13.25	3.92
11:37 AM	50.76	13.04	3.98
11:38 AM	49.84	13.14	3.98
11:39 AM	50.22	13.35	3.89
11:40 AM	49.72	13.39	3.84
11:41 AM	48.01	13.37	3.84
11:42 AM	48.01	13.34	3.82
11:43 AM	49.52	12.99	4.02
11:44 AM	49.59	13.06	3.99
11:45 AM	49.76	13.12	3.94
11:46 AM	49.26	13.18	3.88
11:47 AM	48.41	13.20	3.87
11:48 AM	48.95	13.11	3.99
11:49 AM	50.19	12.83	4.10
11:50 AM	51.16	12.82	4.11
11:51 AM	52.21	12.93	4.06
11:52 AM	51.43	13.03	4.01
11:53 AM	51.44	13.05	4.05
11:54 AM	52.40	13.10	4.00
11:55 AM	52.47	12.87	4.07
11:56 AM	52.81	12.68	4.14
11:57 AM	51.91	12.89	4.11
11:58 AM	52.01	13.02	4.08
11:59 AM	48.99	13.43	3.84

12:00 PM	48.43	13.44	3.82
12:01 PM	47.53	13.39	3.79
12:02 PM	48.45	13.16	3.98
12:03 PM	48.31	13.31	3.93
12:04 PM	47.60	13.44	3.84
12:05 PM	47.58	13.57	3.79
12:06 PM	47.57	13.51	3.77
12:07 PM	48.14	13.46	3.84
12:08 PM	46.83	12.99	3.91
12:09 PM	45.91	13.11	3.87
12:10 PM	44.66	13.30	3.77
12:11 PM	43.48	13.47	3.71
12:12 PM	45.47	13.42	3.84
12:13 PM	47.22	13.44	3.82
12:14 PM	47.23	13.12	3.88
12:15 PM	47.31	12.93	3.97
12:16 PM	47.66	12.85	3.98
12:17 PM	48.80	13.04	4.01
12:18 PM	47.80	12.99	3.95
12:19 PM	48.81	12.91	4.00
Average	**49.70**	**13.20**	**3.93**

Mathy Constuction
Superior, WI
Plant No. 25 Stack

8/11/99
Test 1 Run 3

VOLUMETRIC FLOW RATE
NUMBER OF SAMPLE POINTS 25

PT. NO.		DELTA P	SQ. RT P	TEMP	TIME
1	A-1	.96	.98	294.8	11:20 AM
2	-2	1.2	1.095	294.8	
3	-3	1.1	1.049	294.8	
4	-4	1.1	1.049	294.8	
5	-5	1.3	1.14	294.8	
6	B-1	1.05	1.025	294.8	
7	-2	1.2	1.095	294.8	
8	-3	1.	1.	294.8	
9	-4	.95	.975	294.8	
10	-5	1.	1.	294.8	
11	C-1	.98	.99	294.8	
12	-2	1.15	1.072	294.8	
13	-3	1.15	1.072	294.8	
14	-4	1.15	1.072	294.8	
15	-5	1.1	1.049	294.8	
16	D-1	1.15	1.072	294.8	
17	-2	1.3	1.14	294.8	
18	-3	1.3	1.14	294.8	
19	-4	.98	.99	294.8	
20	-5	1.1	1.049	294.8	
21	E-1	1.3	1.14	294.8	
22	-2	1.7	1.304	294.8	
23	-3	1.6	1.265	294.8	
24	-4	1.7	1.304	294.8	
25	-5	1.85	1.36	294.8	12:25 PM
AVERAGE		1.215	1.097	294.8	

MOISTURE CONTENT	DATA
METER VOLUME	40.36
AVERAGE METER TEMP	85.8
GAS METER COEF. (Y)	1.0019
GAS METER DELTA H AT	1.91
GRAMS OF WATER	289.
BAROMETRIC PRESSURE	28.9
STANDARD METER VOLUME	37.53
MOISTURE CONTENT	26.616
OXYGEN %	13.268
CO 2 %	5.368
STANDARD CFH	1,146,555
K STANDARD CFM	19.109

FLOW RATE	
STATIC PRESSURE	-0.7
PITOT COEF.	0.84
DUCT WIDTH(IN)	31.5
DUCT LENTGH(IN)	27.5
DUCT AREA (SQ.FT.)	6.015625
STACK DIA. (IN)	0
STACK AREA (SQ.FT.)	0
MOLECULAR WEIGHT (DRY)	29.39
MOLECULAR WEIGHT (WET)	26.358
STACK PRESSURE	28.849
FEET PER SECOND	78.496
ACTUAL CFM	28332.15
DRY STANDARD CFM	14023.19

Mathy Constuction
Superior, WI
Plant No. 25 Stack

8/11/99
Test 1 Run 3

FIELD CALCULATIONS

RAW DATA TABLE

INSTRUMENT	PPM OR %	ZERO	SPAN	GAS	C GAS	
O2 (dry)	13.2	0.04	10.85	10.9	**13.27**	dry
CO2 (wet)	3.93	0.10	10.80	11	**3.94**	wet
SO2 (wet)	49.7	1.84	89.37	89.8	**49.11**	wet

MOISTURE	26.62	STANDARD CFH	1,146,555
FUEL FACTOR C	0	K STANDARD CFM	19.109
DSCFM	14023.2		

RESULTS

O2 % (dry)	13.27		
CO2 % (dry)	5.37		
SO2 ppm (dry)	**66.92**	**SO2 LBS/HR**	**9.345**
		Fo	1.422

APPENDIX F

GAS ANALYZER SPECIFICATIONS

Servomex

1420
Oxygen Analyser
Instruction Manual

Ref : 01420/001A/0

Order as part No. 01420001A

was (7982-2842)

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./^{0}C
Noise	0.5% of full scale, worst case
Ambient temperature	0 to 40 ^{0}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 ^{0}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 ^{0}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
Superior, WI
Plant No. 25 Stack
8/11/99
Test 1

SO2 TEI Model 43B)

	Cylynder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	1.05	1.05	200.00	0.53
Mid Level	89.90	90.35	0.45	200.00	0.22
High Level	134.00	130.96	3.04	200.00	1.52

CO2 (TEI Model 41H)

	Cylynder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.10	0.10	20.00	0.50
Mid Level	11.00	11.13	0.13	20.00	0.65
High Level	16.60	16.55	0.05	20.00	0.25

O2 (Servomex Series 1400)

	Cylynder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.07	0.07	25.00	0.28
Mid Level	10.90	10.89	0.01	25.00	0.04
High Level	21.00	20.95	0.05	25.00	0.20

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

Calibration Drift

Mathy Constuction
Superior, WI
Plant No. 25 Stack
8/11/99
Test 1

		O2					CO2					SO2			
		Initial	Final	Avg.			Initial	Final	Avg.			Initial	Final	Avg.	
1	Zero	0.07	0.07	**0.07**		1	Zero	0.10	0.16	**0.13**		1	Zero	1.05	1.48	**1.27**	
	Upscale	10.85	10.84	**10.85**			Upscale	11.13	10.92	**11.03**			Upscale	90.35	89.35	**89.85**	
2	Zero	0.07	0.03	**0.05**		2	Zero	0.16	0.10	**0.13**		2	Zero	1.48	1.81	**1.65**	
	Upscale	10.84	10.86	**10.85**			Upscale	10.92	10.74	**10.83**			Upscale	89.35	88.90	**89.13**	
3	Zero	0.03	0.04	**0.04**		3	Zero	0.10	0.10	**0.10**		3	Zero	1.81	1.86	**1.84**	
	Upscale	10.86	10.84	**10.85**			Upscale	10.74	10.85	**10.80**			Upscale	88.90	89.83	**89.37**	

*** 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 #:	88-62553	CYLINDER #:	CC 112307	CYL. PRESSURE:	2000 PSIG	P.O. #:	30283
EXP. DATE:	4/28/02	LAST ANALYSIS DATE:	4/28/99	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. #:	CLM 6824	CYL. #	CAL 014623
CONC:	9.68 %	CONC:	13.96%
INSTRUMENT:	BECKMAN PARAMAGNETIC	INSTRUMENT:	ROSEMOUNT NDIR
MODEL #:	755	MODEL #:	880A
SERIAL #:	1001419	SERIAL #:	2000418
LAST CAL.:	4/7/99	LAST CAL.:	4/14/99

Received 5-4-99

MEAN CONC.:	10.9 %	+/-	0.09 %	MEAN CONC.:	11.0 %	+/-	0.09 %
REPLICATE CONC.				REPLICATE CONC.			
DATE:	4/28/99			DATE:	4/28/99		
10.9	%			11.0	%		
10.9	%			11.0	%		
10.9	%			11.0	%		

BALANCE GAS: NITROGEN

REPLICATE DATA						REPLICATE DATA						REPLICATE DATA					
DATE:	4/28/99					DATE:	4/28/99										
Z	0.00	R	1931	C	2174	Z	0.00	R	14.0	C	11.0						
R	1930	Z	0.00	C	2173	R	14.0	Z	0.00	C	11.0						
Z	0.00	C	2171	R	1928	Z	0.00	C	11.0	R	14.0						

Z= ZERO C=CANDIDATE R=REFERENCE

ANALYST: J. ERNST APPROVED BY: Richard Sykes R. 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 1997,0-1 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 #:	1675D
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: [signature] APPROVED BY: Richard Sykes

THIS REPORT STATED ACCURATELY THE RESULTS OF THE INVESTIGATION MADE UPON THE MATERIAL SUBMITTED TO THE ANALYTICAL LABORATORY. EVERY EFFORT HAS BEEN MADE TO DETERMINE CORRECTLY 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

Pub. No. 320.070

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/WD
James Laas
(16921)

Approved By: Richard Fry/WD
Richard Fry

Pub. No. 320-9702

APPENDIX I

PROCESS RATE INFORMATION

[illegible]

EFF % (G) 81.7
[illegible]

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

DATE [illegible]

HEAVY OIL

O2	%	7.8
CO	PPMn ..	399
Prs	mBar	0.33
EFF	% (G)	82.7
XAIR	%	59
CO2	%	9.9
[illegible]		
NETT	.. F	[illegible]
AMBIENT	F	[illegible]

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

DATE 08-11-99
TIME 10:14:47

HEAVY OIL

O2	%	9.2
CO	PPMn ..	[illegible]
[illegible]		
XAIR	%	[illegible]
CO2	%	8.8
NO	PPMn ..	194
NO2	PPMn ..	[illegible]
NOx	PPMn ..	194
[illegible]		
FLUE	.. F	424.2
INLT	NOT FITTED	
AMBIENT	F	76.6

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

DATE 08-11-99
TIME 11:27:57

HEAVY OIL

O2	%	8.9
CO	PPMn ..	253
Prs	mBar	-0.03
EFF	% (G)	82.1
XAIR	%	75
CO2	%	9.0
NO	PPMn ..	235
NO2	PPMn	0
NOx	PPMn ..	235
SO2	PPMn	0
REF.	%O2 ...	3.0
NETT	.. F	[illegible]
FLUE	.. F	428.1
INLT	NOT FITTED	
AMBIENT	F	73.9

8/10/99 #17559

7200 gal.

S-F ANALYTICAL LABORATORIES

A Subsidiary of Sommer-Frey Laboratories, Inc.

Como Lube & Supply
P.O. Box 16987
1108 Port Terminal Drive
Duluth, MN 55816
Attn: Laura Lott

Received: 03/26/1999
Reported: 04/05/1999
Project#: 99002029

PO: 18282

Analytical Results

Parameter	Result	MDL	Analyzed	By	Method
99A04852 : Used Oil 3/23/99 Collected: 03/23/1999					
Aroclor 1016	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1221	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1232	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1242	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1248	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1254	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1260	<2.0 mg/Kg	2	04/01/99	GLA	8082
BTU/pound	18840 BTU/lb	100	03/26/99	HTA	D240
BTU/Gallon	138100 BTU/gal	100	03/26/99	HTA	D240
Flash Point	>210 F		03/26/99	GGG	D3828
Sulfated Ash	0.85 %	0.01	03/29/99	GGG	D874
Sulfur	0.50 %	0.04	03/29/99	HTA	D129
Lead	17.7 ppm	0.1	03/29/99	GGG	6010
Halogens as Cl	456 mg/kg	100	03/29/99	HTA	D808
Sample pH	6.10 units		03/29/99	GGG	9040B
Calcium	980 mg/kg	0.1	03/29/99	GGG	6010
Arsenic	<0.5 ppm	0.5	03/29/99	GGG	6010
Cadmium	0.5 ppm	0.1	03/29/99	GGG	6010
Chromium	2.2 ppm	0.1	03/29/99	GGG	6010

GLA - WI DNR# 999917160

Gary G. Geipel
Senior Analyst

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

Environmental Programs Daily Tracking Form

Plant #: 25 Date: 8/11/99
Location Amnicon
Plant Foreman: Richard Galarneau

AIR QUALITY MONITORING

Production:

Total Asphalt Mix Tonnage: 693.30
Diesel Fuel Gallons for Generator: 0
RAP % in mix: _____ RAP tons: _____
Mix Temperature (degrees F): 305
Hours of Operation: 4

Process fuel:

Fuel Type: Waste Amt: 1282
Burner Pressure: 42 Fuel Temp: 150
Fuel Type: _____ Amt: _____
Burner Pressure: _____ Fuel Temp: _____
Spec. Sheet Delivered: X yes _____ no

Baghouse:

Magnehelic dP: 3 1 inches of water
Photohelic dP: .15 inches of water
Optimum photohelic range from burner tune-up: .15 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: X yes _____ no
Maintenance Performed: See below

50,000 ton Blacklight Baghouse Inspection:
X yes _____ no
Number of Bags Replaced: 14 See #9

Fugitive Dust Control:

Control Measures: X yes _____ no
Water Amt. Applied: _____
Chemical Amt. Applied: _____
Speed Limit Control (mph): 20

After a short start up #9 still Some dust. While on a rain delay changed the rest of the bags so all are. found a hole rusted to clean repair

Soil Remediation:

Soil Remediation Performed: ___ yes X 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)
X yes _____ no
Systems Locked out: _____ yes _____ no
Petroleum Equipment Maintenance: Clean Screens & Nozzle

Weekly SPCC Meeting: X yes _____ no
Containment Water Released: ___ yes X no
(If yes, complete Water Drainage Form)

STORMWATER RUNOFF QUALITY

Best Mgmt.Practices (BMP)Applied: X yes __ no
Petroleum Products Secure: X yes _____ no
Site Runoff Naturally Contained on Site:
X yes _____ no
If no, has containment been constructed:
_____ yes _____ no
Erosion Control Practices used (i.e. silt fence, site seeding, slopes): _____

Rain Amount in last 24 hrs: .25 inches
Any known Petro.Contamination: ___ yes X no
Sediment Content:
X 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: _____

OPERATING DATA SUMMARY FOR ASPHALT PLANT SOURCES

Form OAS 01/29

Test Date(s): 8/10/99

General:

Plant Mfr. & Model No.: Barber-Greene BM55X350

This plant is (circle one): Portable Stationary

Type(circle all that apply): Batch Mix (Continuous Mix) (Parallel Flow Drum) Counterflow Drum

Other: _____

Pollution Control Equipment(circle one): (Baghouse) Venturi Scrubber Wet Scrubber Multiclone Cyclone If wet scrubbing: ____% scrubber water recycled

List Mfr. & Model No.: Barber-Greene

Normal pressure drop range across control equipment is .12 inches water

Was the control equipment operating normally during test?(circle one) (yes) no

If no, explain _____

Date & procedure of last maintenance/cleaning of control equipment: 8/2/99 Block Light

Fuel, 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)** _____. If other units of measure are used, specify and calculate appropriate heat input.

What other types of fuel can be burned? _____

Test No.	Fuel Input (gal/hr)	Heat Content (Btu/gal-as received)	Heat Input (Btu/hr)	% Recycle[1] (If Used)	% - 200 fines	%Moisture of Virgin Aggregate Material
Run 1	235			0	5.4	4.4
Run 2	235			0	5.4	4.4
Run 3	235			0	5.4	4.4

[1] %R= [(Recycle) ÷ (Aggregate + Recycle)]

Other Control Equipment Parameters	Design	During Testing		
Cleaning Cycles		18 sec. Pulse		
Air to Cloth Ratios				
No. of spray bars including delivery pressure	N/A	N/A		
No. of nozzles per spray bar	N/A	N/A		
		Run 1	Run 2	Run 3
pH	N/A	N/A		
Pond Depth (list units)				
Total Suspended Solids				

Describe the location of the thermocouples reading exiting dryer and mix temperature: Inlet to baghouse, mix at chute to sht for mix temp

Note: All information required must be completed and submitted as part of the performance test. Failure to submit the required information will result in an incomplete performance test report.

Form OAS01
01/29/96

Time in 15 minute intervals	Virgin (V) Aggregate Material tons per hour	Recycle (R) Material tons per hour	Asphalt (A) Material tons per hour	Total Material Throughput (V+R+A) tons per hour	Temp. of Gases Exiting Dryer °F	Drum Mix Temp. °F	Dust Collector ΔP inches w.c.	Water Flow Rate gpm	Water Supply Pressure psig
8:40	120	—	5.96		280 °	300			
8:55	123		5.94		290 °	305			
9:10	119		5.88		300	302			
9:25	118		5.99		295	298			
9:40	120		5.97		290	312			
9:55	120		5.94		280	297			
10:10	120		5.97		300	305			
10:25	121		6.00		280	300			
10:40	122		6.10		280	307			
10:55	122		6.05		275	303			
11:10	122		6.11		270	295			
11:25	121		6.05		280	307			
11:40	123		6.15		280	304			
11:55	122		6.08		280	309			
11:10	121		6.12		270	290			
11:25									

Temp.-Temperature gpm-gallons per minute w.c.-water column °F-degrees Fahrenheit psi-pounds per square inch ΔP-pressure dro

OPERATING DATA SUMMARY FOR ASPHALT PLANT SOURCES

Form O.A.

Test Date(s): 8-27-99

General:

Plant Mfr. & Model No.: Barber-Greene DM-55

This plant is (circle one): (Portable) Stationary

Type(circle all that apply): Batch Mix Continuous Mix (Parallel Flow Drum) Counterflow Drum

Other:

Pollution Control Equipment(circle one): (Baghouse) Venturi Scrubber Wet Scrubber

Multiclone Cyclone If wet scrubbing: ____% scrubber water recycled

List Mfr. & Model No.: Barber-Greene

Normal pressure drop range across control equipment is 2.5 inches water

Was the control equipment operating normally during test?(circle one) (yes) no

If no, explain

Date & procedure of last maintenance/cleaning of control equipment:

August 25, 1999

Fuel, 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) used oil. If other units of measure are used, specify and calculate appropriate heat input.

What other types of fuel can be burned? #2 diesel

Test No.	Fuel Input (gal/hr)	Heat Content (Btu/gal-as received)	Heat Input (Btu/hr)	% Recycle[1] (If Used)	% - 200 fines	%Moisture of Virgin Aggregate Material
Run 1	303			N/A		4.4
Run 2						
Run 3						

[1] %R= [(Recycle) ÷ (Aggregate + Recycle)]

Other Control Equipment Parameters	Design	During Testing		
Cleaning Cycles	18-30 sec.	20		
Air to Cloth Ratios				
No. of spray bars including delivery pressure				
No. of nozzles per spray bar				
		Run 1	Run 2	Run 3
pH	N/A			
Pond Depth (list units)				
Total Suspended Solids				

Describe the location of the thermocouples reading exiting dryer and mix temperature: Inlet to bag house & Chute from dryer.

Note: All information required must be completed and submitted as part of the performance test. Failure to submit the required information will result in an incomplete performance test report.

Form OAS0
01/29/9

Time in 15 minute intervals	Virgin (V) Aggregate Material tons per hour	Recycle (R) Material tons per hour	Asphalt (A) Material tons per hour	Total Material Throughput (V+R+A) tons per hour	Temp. of Gases Exiting Dryer °F	Drum Mix Temp. °F	Dust Collector ΔP inches w.c.	Water Flow Rate gpm	Water Supply Pressure psig
6:45	134		7.9		345	300			
7:00	131		8.04		350	300			
7:15	139		8.02		360	312			
7:30	125		7.65		355	302			
7:45	127		7.39		340	300			
8:00	122		8.02		355	308			
8:15	126		7.96		350	304			
8:30	127		7.93		348	305			
8:45	131		7.96		340	301			
9:00	132		7.91		350	300			
9:15	134		7.87		350	299			
9:30	135		7.97		330	290			
9:45	134		7.96		340	303			
10:00	132		8.02		340	310			
10:15	137		7.97		335	303			
10:30	128		7.27		330	294			
10:45	127		7.68		340	311			
11:00	—								
11:30	110		6.52		355	320			
11:45	130		7.57		345	313			

Temp.-Temperature gpm-gallons per minute w.c.-water column °F-degrees Fahrenheit psi-pounds per square inch ΔP-pressure dr

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

DATE 08-27-99
TIME 10:13:28

HEAVY OIL

O2 % 9.9
CO PPMN .. 917
Prs mBar 0.01
EFF % (G) 100.0
%AIR % 91
CO2 % 8.3

NO PPMN .. 205
NO2 PPMN ... 0
NOx PPMN .. 205
SO2 PPMN 3
REF. %O2 ... 3.0

NETT .. F -322.9
FLUE .. F -225.5
INLT NOT FITTED
AMBIENT F 97.3

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

DATE 08-27-99
TIME 08:42:57

HEAVY OIL

O2 % 10.2
CO PPMN . 1343
Prs mBar 0.01
EFF % (G) 100.0
%AIR % 96
CO2 % 8.0

NO PPMN .. 189
NO2 PPMN 0
NOx PPMN .. 189
SO2 PPMN 3
REF. %O2 ... 3.0

NETT .. F -338.2
FLUE .. F -256.9
INLT NOT FITTED
AMBIENT F 81.3

Environmental Programs Daily Tracking Form

Plant #: 25 Date: 8/27/99
Location: Amnicon
Plant Foreman: Richard Calvillo

AIR QUALITY MONITORING

Production:
Total Asphalt Mix Tonnage: 1131.35
Diesel Fuel Gallons for Generator: 0
RAP % in mix: _____ RAP tons: _____
Mix Temperature (degrees F): 305
Hours of Operation: 8

Process fuel:
Fuel Type: Waste Amt: 1892
Burner Pressure: 42 Fuel Temp: 150
Fuel Type: _____ Amt: _____
Burner Pressure: _____ Fuel Temp: _____
Spec. Sheet Delivered: X yes _____ no

Baghouse:
Magnehelic dP: 3.5 inches of water
Photohelic dP: .15 inches of water
Optimum photohelic range from burner tune-up: .15 inches of water
Photohelic malfunction: _____ yes X no
(If yes, next day DNR notification required)
Weekly Inspection of drum and door seals, ducts,photohelic, damper, & other system parts: X yes _____ no
Maintenance Performed: Stack test today

50,000 ton Blacklight Baghouse Inspection:
X yes _____ no
Number of Bags Replaced: _____

Fugitive Dust Control:
Control Measures: X yes _____ no
Water Amt. Applied: _____
Chemical Amt. Applied: _____
Speed Limit Control (mph): 10

Soil Remediation:
Soil Remediation Performed: ___ yes X 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)
X yes _____ no
Systems Locked out: X yes _____ no
Petroleum Equipment Maintenance: Clean Screens & Nozzle
Weekly SPCC Meeting: X yes _____ no
Containment Water Released: ___ yes X no
(If yes, complete Water Drainage Form)

STORMWATER RUNOFF QUALITY

Best Mgmt.Practices (BMP)Applied: X yes __ no
Petroleum Products Secure: X yes _____ no
Site Runoff Naturally Contained on Site:
X yes _____ no
If no, has containment been constructed:
_____ yes _____ no
Erosion Control Practices used (i.e. silt fence, site seeding, slopes): _____
Rain Amount in last 24 hrs: 0 inches
Any known Petro.Contamination: ___ yes ___ no
Sediment Content:
X 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: Richard Calvillo

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.

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

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

$$V_{w(std)} = 0.0472\ V_{lc}$$

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

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

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

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

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

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

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

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

Mathy Constuction
Superior, WI
Plant 25 Stack
8/11/99
Run 1

Time	SO2 ppm, w	O2 %, d	CO2 %, w
8:40 AM	50.91	12.80	4.24
8:41 AM	48.60	12.99	4.16
8:42 AM	47.33	13.14	4.08
8:43 AM	47.19	13.23	4.02
8:44 AM	46.99	13.30	4.04
8:45 AM	48.36	13.18	4.02
8:46 AM	49.16	12.86	4.16
8:47 AM	50.64	12.89	4.16
8:48 AM	50.12	13.00	4.11
8:49 AM	49.08	13.07	4.05
8:50 AM	48.99	13.17	4.01
8:51 AM	49.67	13.14	4.00
8:52 AM	50.74	12.81	4.13
8:53 AM	52.52	12.95	4.13
8:54 AM	50.84	12.94	4.10
8:55 AM	50.16	13.09	4.04
8:56 AM	50.85	13.14	4.01
8:57 AM	51.42	13.22	3.99
8:58 AM	51.26	12.96	4.08
8:59 AM	52.02	12.79	4.15
9:00 AM	51.92	13.03	4.08
9:01 AM	51.64	13.09	4.03
9:02 AM	52.07	13.16	4.00
9:03 AM	50.37	13.47	3.87
9:04 AM	47.16	13.98	3.62
9:05 AM	45.52	13.76	3.68
9:06 AM	43.86	13.93	3.60
9:07 AM	42.84	14.05	3.53
9:08 AM	41.74	14.03	3.51
9:09 AM	42.98	14.06	3.56
9:10 AM	42.90	14.05	3.53
9:11 AM	43.47	13.78	3.63
9:12 AM	46.45	13.62	3.72
9:13 AM	47.77	13.53	3.81
9:14 AM	47.25	13.58	3.79
9:15 AM	45.72	13.62	3.75
9:16 AM	45.69	13.69	3.70
9:17 AM	47.99	13.45	3.77
9:18 AM	48.23	13.28	3.91
9:19 AM	47.60	13.43	3.86

9:20 AM	47.02	13.59	3.77
9:21 AM	48.17	13.64	3.74
9:22 AM	47.80	13.67	3.74
9:23 AM	48.94	13.45	3.85
9:24 AM	48.98	13.23	3.93
9:25 AM	49.41	13.36	3.89
9:26 AM	49.61	13.43	3.86
9:27 AM	51.12	13.60	3.79
9:28 AM	48.01	14.01	3.67
9:29 AM	44.19	13.96	3.57
9:30 AM	42.64	13.71	3.65
9:31 AM	43.25	13.64	3.68
9:32 AM	44.38	13.54	3.74
9:33 AM	51.92	13.54	3.81
9:34 AM	44.71	15.84	2.97
9:35 AM	42.44	14.32	3.26
9:36 AM	40.74	13.32	3.69
9:37 AM	42.11	12.92	3.84
9:38 AM	43.12	12.91	3.96
9:39 AM	46.23	13.03	3.93
Average	**47.58**	**13.43**	**3.85**

Mathy Constuction
Superior, WI
Plant 25 Stack

8/11/99
Test 1 Run 1

VOLUMETRIC FLOW RATE
NUMBER OF SAMPLE POINTS 25

PT. NO.		DELTA P	SQ. RT P	TEMP	TIME
1	A-1	.97	.985	298.6	8:40 AM
2	-2	1.75	1.323	298.6	
3	-3	1.5	1.225	298.6	
4	-4	1.5	1.225	298.6	
5	-5	1.55	1.245	298.6	
6	B-1	1.2	1.095	298.6	
7	-2	1.4	1.183	298.6	
8	-3	1.3	1.14	298.6	
9	-4	1.2	1.095	298.6	
10	-5	1.25	1.118	298.6	
11	C-1	.85	.922	298.6	
12	-2	1.25	1.118	298.6	
13	-3	1.1	1.049	298.6	
14	-4	1.1	1.049	298.6	
15	-5	1.2	1.095	298.6	
16	D-1	.98	.99	298.6	
17	-2	.98	.99	298.6	
18	-3	1.1	1.049	298.6	
19	-4	1.05	1.025	298.6	
20	-5	1.05	1.025	298.6	
21	E-1	.95	.975	298.6	
22	-2	.97	.985	298.6	
23	-3	1.15	1.072	298.6	
24	-4	1.1	1.049	298.6	
25	-5	1.2	1.095	298.6	
AVERAGE		1.186	1.085	298.6	9:43 AM

MOISTURE CONTENT	DATA
METER VOLUME	38.52
AVERAGE METER TEMP	78.6
GAS METER COEF. (Y)	1.0019
GAS METER DELTA H@	1.91
GRAMS OF WATER	303.
BAROMETRIC PRESSURE	28.9
STANDARD METER VOLUME	36.707
MOISTURE CONTENT	27.995
OXYGEN %	13.515
CO 2 %	5.216
STANDARD CFH	1,134,520
K STANDARD CFM	18.909

FLOW RATE	
STATIC PRESSURE	-.7
PITOT COEF.	0.84
DUCT WIDTH(IN)	31.5
DUCT LENTGH(IN)	27.5
DUCT AREA (SQ.FT.)	6.016
STACK DIA. (IN)	.
STACK AREA (SQ.FT.)	.
MOLECULAR WEIGHT (DRY)	29.375
MOLECULAR WEIGHT (WET)	26.191
STACK PRESSURE	28.849
FEET PER SECOND	78.063
ACTUAL CFM	28175.9
DRY STANDARD CFM	13615.19

Mathy Constuction
Superior, WI
Plant 25 Stack

8/11/99
Test 1 Run 1

FIELD CALCULATIONS

RAW DATA TABLE

INSTRUMENT	PPM OR %	ZERO	SPAN	GAS	C GAS	
O2 (dry)	13.43	0.07	10.85	10.9	**13.51**	dry
CO2 (wet)	3.85	0.13	11.03	11.	**3.76**	wet
SO2 (wet)	47.58	1.27	89.85	89.8	**46.95**	wet

MOISTURE	27.99	STANDARD CFH	1,134,520
FUEL FACTOR C	.	K STANDARD CFM	18.909
DSCFM	13615.2		

RESULTS

O2 % (dry)	13.51		
CO2 % (dry)	5.22		
SO2 (dry)	**65.2**	**SO2 LBS/HR**	**8.841**
		Fo	1.416

Mathy Constuction
Superior, WI
Plant No. 25 Stack
8/11/99
Run 2

Time	SO2 ppm, w	O2 %, d	CO2 %, w
10:00 AM	50.42	13.64	3.67
10:01 AM	50.09	13.56	3.69
10:02 AM	49.34	13.29	3.83
10:03 AM	49.34	13.43	3.80
10:04 AM	48.28	13.57	3.73
10:05 AM	48.25	13.66	3.68
10:06 AM	46.90	13.69	3.63
10:07 AM	47.20	13.72	3.68
10:08 AM	47.00	13.41	3.79
10:09 AM	47.45	13.46	3.77
10:10 AM	46.93	13.57	3.71
10:11 AM	47.75	13.74	3.65
10:12 AM	47.80	13.77	3.68
10:13 AM	48.07	13.78	3.67
10:14 AM	48.01	13.58	3.72
10:15 AM	49.79	13.40	3.84
10:16 AM	48.23	13.54	3.77
10:17 AM	48.48	13.64	3.76
10:18 AM	47.34	13.71	3.69
10:19 AM	46.83	13.73	3.68
10:20 AM	47.27	13.65	3.70
10:21 AM	49.18	13.38	3.83
10:22 AM	48.24	13.47	3.80
10:23 AM	47.06	13.58	3.75
10:24 AM	46.22	13.64	3.67
10:25 AM	44.89	13.70	3.62
10:26 AM	47.13	13.71	3.68
10:27 AM	47.50	13.41	3.81
10:28 AM	49.02	13.46	3.81
10:29 AM	48.31	13.46	3.77
10:30 AM	46.10	13.53	3.68
10:31 AM	45.89	13.62	3.70
10:32 AM	46.02	13.75	3.69
10:33 AM	46.59	13.53	3.74
10:34 AM	46.92	13.45	3.76
10:35 AM	48.53	13.33	3.77
10:36 AM	48.20	13.16	3.96
10:37 AM	49.77	13.32	3.90
10:38 AM	49.95	13.67	3.66
10:39 AM	49.16	13.15	3.94

10:40 AM	51.60	13.18	4.05
10:41 AM	51.35	13.05	4.03
10:42 AM	49.02	13.15	3.94
10:43 AM	48.26	13.29	3.85
10:44 AM	49.08	13.31	3.84
10:45 AM	49.19	13.30	3.88
10:46 AM	49.78	13.00	4.05
10:47 AM	51.16	13.07	4.04
10:48 AM	50.65	13.12	3.98
10:49 AM	49.96	13.23	3.93
10:50 AM	49.11	13.29	3.89
10:51 AM	49.12	13.37	3.88
10:52 AM	50.27	13.12	3.96
10:53 AM	49.89	13.02	3.99
10:54 AM	49.68	13.26	3.91
10:55 AM	46.44	13.59	3.79
10:56 AM	44.91	13.70	3.71
10:57 AM	44.68	13.74	3.64
10:58 AM	44.72	13.67	3.66
10:59 AM	46.00	13.45	3.74
Average	**48.17**	**13.46**	**3.79**

Mathy Constuction **8/11/99**
Superior, WI **Test 1 Run 2**
Plant No. 25 Stack

VOLUMETRIC FLOW RATE
NUMBER OF SAMPLE POINTS 25

PT. NO.		DELTA P	SQ. RT P	TEMP	TIME
1	A-1	1.4	1.183	295.5	10:00 AM
2	-2	1.6	1.265	295.5	
3	-3	1.7	1.304	295.5	
4	-4	1.8	1.342	295.5	
5	-5	1.75	1.323	295.5	
6	B-1	1.1	1.049	295.5	
7	-2	1.1	1.049	295.5	
8	-3	1.2	1.095	295.5	
9	-4	1.2	1.095	295.5	
10	-5	1.1	1.049	295.5	
11	C-1	1.1	1.049	295.5	
12	-2	1.2	1.095	295.5	
13	-3	1.2	1.095	295.5	
14	-4	1.1	1.049	295.5	
15	-5	.98	.99	295.5	
16	D-1	1.08	1.039	295.5	
17	-2	1.	1.	295.5	
18	-3	1.05	1.025	295.5	
19	-4	.98	.99	295.5	
20	-5	1.05	1.025	295.5	
21	E-1	.99	.995	295.5	
22	-2	.98	.99	295.5	
23	-3	1.1	1.049	295.5	
24	-4	1.1	1.049	295.5	
25	-5	1.1	1.049	295.5	10:05 AM
AVERAGE		1.198	1.09	295.5	

MOISTURE CONTENT	DATA	FLOW RATE	
METER VOLUME	39.75	STATIC PRESSURE	-0.7
AVERAGE METER TEMP	83.6	PITOT COEF.	0.84
GAS METER COEF. (Y)	1.0019		
GAS METER DELTA H AT	1.91	DUCT WIDTH(IN)	31.5
GRAMS OF WATER	259.	DUCT LENTGH(IN)	27.5
BAROMETRIC PRESSURE	28.9	DUCT AREA (SQ.FT.)	6.0156
		STACK DIA. (IN)	0
STANDARD METER VOLUME	37.53	STACK AREA (SQ.FT.)	0.0000
MOISTURE CONTENT	24.531		
		MOLECULAR WEIGHT (DRY)	29.339
OXYGEN %	13.534	MOLECULAR WEIGHT (WET)	26.558
CO 2 %	4.986	STACK PRESSURE	28.849
		FEET PER SECOND	77.707
STANDARD CFH	1,133,974	ACTUAL CFM	28047.25
K STANDARD CFM	18.9	DRY STANDARD CFM	14263.39

Mathy Constuction
Superior, WI
Plant No. 25 Stack

8/11/99
Test 1 Run 2

FIELD CALCULATIONS

RAW DATA TABLE

INSTRUMENT	PPM OR %	ZERO	SPAN	GAS	C GAS	
O2 (dry)	13.46	0.05	10.85	10.9	**13.53**	dry
CO2 (wet)	3.79	0.13	10.83	11	**3.76**	wet
SO2 (wet)	48.17	1.65	89.13	89.8	**47.76**	wet

MOISTURE	24.53	STANDARD CFH	1,133,974
FUEL FACTOR C	0	K STANDARD CFM	18.9
DSCFM	14263.4		

RESULTS

O2 % (dry)	13.53		
CO2 % (dry)	4.99		
SO2 ppm (dry)	**63.28**	**SO2 LBS/HR**	**8.989**
		Fo	1.477

Mathy Constuction
Superior, WI
Plant No. 25 Stack
8/11/99
Run 3

Time	SO2 ppm, w	O2 %, d	CO2 %, w
11:20 AM	50.02	13.11	4.12
11:21 AM	54.10	13.46	3.89
11:22 AM	51.84	13.41	3.86
11:23 AM	51.26	13.46	3.84
11:24 AM	52.73	13.05	4.10
11:25 AM	51.76	13.13	4.01
11:26 AM	50.52	13.27	3.90
11:27 AM	50.02	13.44	3.83
11:28 AM	50.97	13.45	3.83
11:29 AM	51.53	13.45	3.90
11:30 AM	52.79	13.16	3.98
11:31 AM	53.96	13.10	3.99
11:32 AM	53.55	13.19	3.92
11:33 AM	52.11	13.36	3.90
11:34 AM	50.42	13.39	3.89
11:35 AM	49.98	13.41	3.85
11:36 AM	50.37	13.25	3.92
11:37 AM	50.76	13.04	3.98
11:38 AM	49.84	13.14	3.98
11:39 AM	50.22	13.35	3.89
11:40 AM	49.72	13.39	3.84
11:41 AM	48.01	13.37	3.84
11:42 AM	48.01	13.34	3.82
11:43 AM	49.52	12.99	4.02
11:44 AM	49.59	13.06	3.99
11:45 AM	49.76	13.12	3.94
11:46 AM	49.26	13.18	3.88
11:47 AM	48.41	13.20	3.87
11:48 AM	48.95	13.11	3.99
11:49 AM	50.19	12.83	4.10
11:50 AM	51.16	12.82	4.11
11:51 AM	52.21	12.93	4.06
11:52 AM	51.43	13.03	4.01
11:53 AM	51.44	13.05	4.05
11:54 AM	52.40	13.10	4.00
11:55 AM	52.47	12.87	4.07
11:56 AM	52.81	12.68	4.14
11:57 AM	51.91	12.89	4.11
11:58 AM	52.01	13.02	4.08
11:59 AM	48.99	13.43	3.84

12:00 PM	48.43	13.44	3.82
12:01 PM	47.53	13.39	3.79
12:02 PM	48.45	13.16	3.98
12:03 PM	48.31	13.31	3.93
12:04 PM	47.60	13.44	3.84
12:05 PM	47.58	13.57	3.79
12:06 PM	47.57	13.51	3.77
12:07 PM	48.14	13.46	3.84
12:08 PM	46.83	12.99	3.91
12:09 PM	45.91	13.11	3.87
12:10 PM	44.66	13.30	3.77
12:11 PM	43.48	13.47	3.71
12:12 PM	45.47	13.42	3.84
12:13 PM	47.22	13.44	3.82
12:14 PM	47.23	13.12	3.88
12:15 PM	47.31	12.93	3.97
12:16 PM	47.66	12.85	3.98
12:17 PM	48.80	13.04	4.01
12:18 PM	47.80	12.99	3.95
12:19 PM	48.81	12.91	4.00
Average	**49.70**	**13.20**	**3.93**

Mathy Constuction
Superior, WI
Plant No. 25 Stack

8/11/99
Test 1 Run 3

VOLUMETRIC FLOW RATE
NUMBER OF SAMPLE POINTS 25

PT. NO.		DELTA P	SQ. RT P	TEMP	TIME
1	A-1	.96	.98	294.8	11:20 AM
2	-2	1.2	1.095	294.8	
3	-3	1.1	1.049	294.8	
4	-4	1.1	1.049	294.8	
5	-5	1.3	1.14	294.8	
6	B-1	1.05	1.025	294.8	
7	-2	1.2	1.095	294.8	
8	-3	1.	1.	294.8	
9	-4	.95	.975	294.8	
10	-5	1.	1.	294.8	
11	C-1	.98	.99	294.8	
12	-2	1.15	1.072	294.8	
13	-3	1.15	1.072	294.8	
14	-4	1.15	1.072	294.8	
15	-5	1.1	1.049	294.8	
16	D-1	1.15	1.072	294.8	
17	-2	1.3	1.14	294.8	
18	-3	1.3	1.14	294.8	
19	-4	.98	.99	294.8	
20	-5	1.1	1.049	294.8	
21	E-1	1.3	1.14	294.8	
22	-2	1.7	1.304	294.8	
23	-3	1.6	1.265	294.8	
24	-4	1.7	1.304	294.8	
25	-5	1.85	1.36	294.8	12:25 PM
AVERAGE		1.215	1.097	294.8	

MOISTURE CONTENT	DATA
METER VOLUME	40.36
AVERAGE METER TEMP	85.8
GAS METER COEF. (Y)	1.0019
GAS METER DELTA H AT	1.91
GRAMS OF WATER	289.
BAROMETRIC PRESSURE	28.9
STANDARD METER VOLUME	37.53
MOISTURE CONTENT	26.616
OXYGEN %	13.268
CO 2 %	5.368
STANDARD CFH	1,146,555
K STANDARD CFM	19.109

FLOW RATE	
STATIC PRESSURE	-0.7
PITOT COEF.	0.84
DUCT WIDTH(IN)	31.5
DUCT LENTGH(IN)	27.5
DUCT AREA (SQ.FT.)	6.015625
STACK DIA. (IN)	0
STACK AREA (SQ.FT.)	0
MOLECULAR WEIGHT (DRY)	29.39
MOLECULAR WEIGHT (WET)	26.358
STACK PRESSURE	28.849
FEET PER SECOND	78.496
ACTUAL CFM	28332.15
DRY STANDARD CFM	14023.19

Mathy Constuction
Superior, WI
Plant No. 25 Stack

8/11/99
Test 1 Run 3

FIELD CALCULATIONS

RAW DATA TABLE

INSTRUMENT	PPM OR %	ZERO	SPAN	GAS	C GAS	
O2 (dry)	13.2	0.04	10.85	10.9	**13.27**	dry
CO2 (wet)	3.93	0.10	10.80	11	**3.94**	wet
SO2 (wet)	49.7	1.84	89.37	89.8	**49.11**	wet

MOISTURE	26.62	STANDARD CFH	1,146,555
FUEL FACTOR C	0	K STANDARD CFM	19.109
DSCFM	14023.2		

RESULTS

O2 % (dry)	13.27		
CO2 % (dry)	5.37		
SO2 ppm (dry)	**66.92**	**SO2 LBS/HR**	**9.345**
		Fo	1.422

APPENDIX F

GAS ANALYZER SPECIFICATIONS

Servomex

1420
Oxygen Analyser
Instruction Manual

Ref : 01420/001A/0

Order as part No. 01420001A

was (7982-2842)

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; ±% of full scale/24H Span drift; ±% 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./^{0}C
Noise	0.5% of full scale, worst case
Ambient temperature	0 to 40 ^{0}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 ^{0}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 ^{0}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
Superior, WI
Plant No. 25 Stack
8/11/99
Test 1

SO2 TEI Model 43B)

	Cylynder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	1.05	1.05	200.00	0.53
Mid Level	89.90	90.35	0.45	200.00	0.22
High Level	134.00	130.96	3.04	200.00	1.52

CO2 (TEI Model 41H)

	Cylynder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.10	0.10	20.00	0.50
Mid Level	11.00	11.13	0.13	20.00	0.65
High Level	16.60	16.55	0.05	20.00	0.25

O2 (Servomex Series 1400)

	Cylynder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.07	0.07	25.00	0.28
Mid Level	10.90	10.89	0.01	25.00	0.04
High Level	21.00	20.95	0.05	25.00	0.20

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

Calibration Drift

Mathy Constuction
Superior, WI
Plant No. 25 Stack
8/11/99
Test 1

		O2					CO2					SO2			
		Initial	Final	Avg.			Initial	Final	Avg.			Initial	Final	Avg.	
1	Zero	0.07	0.07	**0.07**		1	Zero	0.10	0.16	**0.13**		1	Zero	1.05	1.48	**1.27**	
	Upscale	10.85	10.84	**10.85**			Upscale	11.13	10.92	**11.03**			Upscale	90.35	89.35	**89.85**	
2	Zero	0.07	0.03	**0.05**		2	Zero	0.16	0.10	**0.13**		2	Zero	1.48	1.81	**1.65**	
	Upscale	10.84	10.86	**10.85**			Upscale	10.92	10.74	**10.83**			Upscale	89.35	88.90	**89.13**	
3	Zero	0.03	0.04	**0.04**		3	Zero	0.10	0.10	**0.10**		3	Zero	1.81	1.86	**1.84**	
	Upscale	10.86	10.84	**10.85**			Upscale	10.74	10.85	**10.80**			Upscale	88.90	89.83	**89.37**	

*** 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 #:	88-62553	CYLINDER #:	CC 112307	CYL. PRESSURE:	2000 PSIG	P.O. #:	30283
EXP. DATE:	4/28/02	LAST ANALYSIS DATE:	4/28/99	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. #:	CLM 6824	CYL. #	CAL 014623
CONC:	9.68 %	CONC:	13.96%
INSTRUMENT:	BECKMAN PARAMAGNETIC	INSTRUMENT:	ROSEMOUNT NDIR
MODEL #:	755	MODEL #:	880A
SERIAL #:	1001419	SERIAL #:	2000418
LAST CAL.:	4/7/99	LAST CAL.:	4/14/99

Received 5-4-99

MEAN CONC.:	10.9%	+/-	0.09 %	MEAN CONC.:	11.0 %	+/-	0.09 %
REPLICATE CONC.				REPLICATE CONC.			
DATE:	4/28/99			DATE:	4/28/99		
10.9	%			11.0	%		
10.9	%			11.0	%		
10.9	%			11.0	%		

BALANCE GAS: NITROGEN

REPLICATE DATA						REPLICATE DATA						REPLICATE DATA					
DATE:	4/28/99					DATE:	4/28/99										
Z	0.00	R	1931	C	2174	Z	0.00	R	14.0	C	11.0						
R	1930	Z	0.00	C	2173	R	14.0	Z	0.00	C	11.0						
Z	0.00	C	2171	R	1928	Z	0.00	C	11.0	R	14.0						

Z= ZERO C=CANDIDATE R=REFERENCE

ANALYST: J. ERNST APPROVED BY: Richard Sykes R. 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 1997.0-1 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 #:	1675D
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: [signature] APPROVED BY: Richard Sykes

THIS REPORT STATES ACCURATELY THE RESULTS OF THE INVESTIGATION AND/OR USE PERFORMED SUBMITTED TO THE ANALYTICAL LABORATORY. EVERY EFFORT HAS BEEN MADE TO DETERMINE CORRECTLY 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 /RVP
Richard Fry

(16024)

Pub. No. 320-9702

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/PWD
James Laas
(16921)

Approved By: Richard Fry/PWD
Richard Fry

Pub. No 320-9702

APPENDIX I

PROCESS RATE INFORMATION

HEAVY OIL

EFF % (G) 81.2

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

DATE 08-11-99
TIME 10:14:47

HEAVY OIL

O2	%	9.2
CO	PPMn ..	406
Prs	mBar	0.33
EFF	% (G)	82.7
XAIR	%	59
CO2	%	8.8
NO	PPMn ..	194
NO2	PPMn ..	0
NOx	PPMn ..	194
REF.	%O2 ..	3.0
NETT	.. F	423.5
FLUE	.. F	424.2
INLT	NOT FITTED	
AMBIENT	F	76.6

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

DATE 08-11-99
TIME 11:27:57

HEAVY OIL

O2	%	8.9
CO	PPMn ..	253
Prs	mBar	-0.03
EFF	% (G)	82.1
XAIR	%	75
CO2	%	9.0
NO	PPMn ..	235
NO2	PPMn	0
NOx	PPMn ..	235
SO2	PPMn	0
REF.	%O2 ...	3.0
NETT	.. F	427.5
FLUE	.. F	428.1
INLT	NOT FITTED	
AMBIENT	F	73.9

8/10/99 #17559

7200 gal.

S-F ANALYTICAL LABORATORIES

A Subsidiary of Sommer-Frey Laboratories, Inc.

Como Lube & Supply
P.O. Box 16987
1108 Port Terminal Drive
Duluth, MN 55816
Attn: Laura Lott

Received: 03/26/1999
Reported: 04/05/1999
Project#: 99002029

PO: 18282

Analytical Results

Parameter	Result	MDL	Analyzed	By	Method
99A04852 : Used Oil 3/23/99 Collected: 03/23/1999					
Aroclor 1016	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1221	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1232	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1242	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1248	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1254	<2.0 mg/Kg	2	04/01/99	GLA	8082
Aroclor 1260	<2.0 mg/Kg	2	04/01/99	GLA	8082
BTU/pound	18840 BTU/lb	100	03/26/99	HTA	D240
BTU/Gallon	138100 BTU/gal	100	03/26/99	HTA	D240
Flash Point	>210 F		03/26/99	GGG	D3828
Sulfated Ash	0.85 %	0.01	03/29/99	GGG	D874
Sulfur	0.50 %	0.04	03/29/99	HTA	D129
Lead	17.7 ppm	0.1	03/29/99	GGG	6010
Halogens as Cl	456 mg/kg	100	03/29/99	HTA	D808
Sample pH	6.10 units		03/29/99	GGG	9040B
Calcium	980 mg/kg	0.1	03/29/99	GGG	6010
Arsenic	<0.5 ppm	0.5	03/29/99	GGG	6010
Cadmium	0.5 ppm	0.1	03/29/99	GGG	6010
Chromium	2.2 ppm	0.1	03/29/99	GGG	6010

GLA - WI DNR# 999917160

Gary C. Geipel
Senior Analyst

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(414) 475-6700 FAX: (414) 475-7216
Toll-Free: 800-300-6700

Environmental Programs Daily Tracking Form

Plant #: 25 Date: 8/11/99
Location AMNICON
Plant Foreman: Richard Galarneau

AIR QUALITY MONITORING

Production:

Total Asphalt Mix Tonnage: 693.30
Diesel Fuel Gallons for Generator: 0
RAP % in mix: _____ RAP tons: _____
Mix Temperature (degrees F): 305
Hours of Operation: 4

Process fuel:

Fuel Type: WASTE Amt: 1282
Burner Pressure: 42 Fuel Temp: 150
Fuel Type: _____ Amt: _____
Burner Pressure: _____ Fuel Temp: _____
Spec. Sheet Delivered: X yes _____ no

Baghouse:

Magnehelic dP: 3 1 inches of water
Photohelic dP: .15 inches of water
Optimum photohelic range from burner tune-up: .15 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: X yes _____ no
Maintenance Performed: See below

50,000 ton Blacklight Baghouse Inspection:
X yes _____ no
Number of Bags Replaced: 14 See #9

Fugitive Dust Control:

Control Measures: X yes _____ no
Water Amt. Applied: _____
Chemical Amt. Applied: _____
Speed Limit Control (mph): 20

After a short start up #9 still some dust. while on a rain delay changed the rest of the bags so all are. Found a hole rusted to clean repair

Soil Remediation:

Soil Remediation Performed: ___ yes X 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)
X yes _____ no
Systems Locked out: _____ yes _____ no
Petroleum Equipment Maintenance: Clean Screens & Nozzle
Weekly SPCC Meeting: X yes _____ no
Containment Water Released: ___ yes X no
(If yes, complete Water Drainage Form)

STORMWATER RUNOFF QUALITY

Best Mgmt.Practices (BMP)Applied: X yes __ no
Petroleum Products Secure: X yes _____ no
Site Runoff Naturally Contained on Site:
X yes _____ no
If no, has containment been constructed:
_____ yes _____ no
Erosion Control Practices used (i.e. silt fence, site seeding, slopes): _____
Rain Amount in last 24 hrs: .25 inches
Any known Petro.Contamination: ___ yes X no
Sediment Content:
X 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: _____

OPERATING DATA SUMMARY FOR ASPHALT PLANT SOURCES

Form OAS 01/29

Test Date(s): 8/10/99

General:

Plant Mfr. & Model No.: Barber-Greene BM55X350

This plant is (circle one): Portable Stationary

Type(circle all that apply): Batch Mix (Continuous Mix) (Parallel Flow Drum) Counterflow Drum

Other: _____

Pollution Control Equipment(circle one): (Baghouse) Venturi Scrubber Wet Scrubber

Multiclone Cyclone If wet scrubbing: _____% scrubber water recycled

List Mfr. & Model No.: Barber-Greene

Normal pressure drop range across control equipment is .12 inches water

Was the control equipment operating normally during test?(circle one) (yes) no

If no, explain _____

Date & procedure of last maintenance/cleaning of control equipment: 8/2/99 Block Light

Fuel, 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)** _____. If other units of measure are used, specify and calculate appropriate heat input.

What other types of fuel can be burned? _____

Test No.	Fuel Input (gal/hr)	Heat Content (Btu/gal-as received)	Heat Input (Btu/hr)	% Recycle[1] (If Used)	% - 200 fines	%Moisture of Virgin Aggregate Material
Run 1	235			0	5.4	4.4
Run 2	235			0	5.4	4.4
Run 3	235			0	5.4	4.4

[1] %R= [(Recycle) ÷ (Aggregate + Recycle)]

Other Control Equipment Parameters	Design	During Testing
Cleaning Cycles		18 Sec. Pulse
Air to Cloth Ratios		
No. of spray bars including delivery pressure	N/A	N/A
No. of nozzles per spray bar	N/A	N/A

	Run 1	Run 2	Run 3
pH	N/A		
Pond Depth (list units)			
Total Suspended Solids			

Describe the location of the thermocouples reading exiting dryer and mix temperature: Inlet to baghouse, mix at chute to slot for mix temp

Note: All information required must be completed and submitted as part of the performance test. Failure to submit the required information will result in an incomplete performance test report.

Form OAS01
01/29/96

Time in 15 minute intervals	Virgin (V) Aggregate Material tons per hour	Recycle (R) Material tons per hour	Asphalt (A) Material tons per hour	Total Material Throughput (V+R+A) tons per hour	Temp. of Gases Exiting Dryer °F	Drum Mix Temp. °F	Dust Collector ΔP inches w.c.	Water Flow Rate gpm	Water Supply Pressure psig
8:40	120	—	5.96		280 °	300			
8:55	123		5.94		290 °	305			
9:10	119		5.88		300	302			
9:25	118		5.99		295	298			
9:40	120		5.97		290	312			
9:55	120		5.94		280	297			
10:10	120		5.97		300	305			
10:25	121		6.00		280	300			
10:40	122		6.10		280	307			
10:55	122		6.05		275	303			
11:10	122		6.11		270	295			
11:25	121		6.05		280	307			
11:40	123		6.15		280	304			
11:55	122		6.08		280	309			
11:10	121		6.12		270	290			
11:25									

Temp.-Temperature gpm-gallons per minute w.c.-water column °F-degrees Fahrenheit psi-pounds per square inch ΔP-pressure dro

OPERATING DATA SUMMARY FOR ASPHALT PLANT SOURCES

Form OA

Test Date(s): 8-27-99

General:

Plant Mfr. & Model No.: Barber-Greene DM-55

This plant is (circle one): (Portable) Stationary

Type(circle all that apply): Batch Mix Continuous Mix (Parallel Flow Drum) Counterflow Drum

Other:

Pollution Control Equipment(circle one): (Baghouse) Venturi Scrubber Wet Scrubber

Multiclone Cyclone If wet scrubbing: ____% scrubber water recycled

List Mfr. & Model No.: Barber-Greene

Normal pressure drop range across control equipment is 2.5 inches water

Was the control equipment operating normally during test?(circle one) (yes) no

If no, explain

Date & procedure of last maintenance/cleaning of control equipment:

August 25, 1999

Fuel, 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) used oil. If other units of measure are used, specify and calculate appropriate heat input.

What other types of fuel can be burned? #2 diesel

Test No.	Fuel Input (gal/hr)	Heat Content (Btu/gal-as received)	Heat Input (Btu/hr)	% Recycle[1] (If Used)	% - 200 fines	%Moisture of Virgin Aggregat Materia
Run 1	303			N/A		4.4
Run 2						
Run 3						

[1] %R= [(Recycle) ÷ (Aggregate + Recycle)]

Other Control Equipment Parameters	Design	During Testing		
Cleaning Cycles	18-30 sec.	20		
Air to Cloth Ratios				
No. of spray bars including delivery pressure				
No. of nozzles per spray bar				
		Run 1	Run 2	Run 3
pH	N/A			
Pond Depth (list units)				
Total Suspended Solids				

Describe the location of the thermocouples reading exiting dryer and mix temperature: Inlet to bag house & Chute from drum.

Note: All information required must be completed and submitted as part of the performance test. Failure to submit the required information will result in an incomplete performance test report.

Time in 15 minute intervals	Virgin (V) Aggregate Material tons per hour	Recycle (R) Material tons per hour	Asphalt (A) Material tons per hour	Total Material Throughput (V+R+A) tons per hour	Temp. of Gases Exiting Dryer °F	Drum Mix Temp. °F	Dust Collector ΔP inches w.c.	Water Flow Rate gpm	Water Supply Pressure psig
6:45	134		7.9		355	300			
7:00	131		8.04		350	300			
7:15	139		8.02		360	312			
7:30	125		7.65		355	302			
7:45	127		7.39		340	300			
8:00	122		8.02		355	308			
8:15	126		7.96		350	304			
8:30	127		7.93		348	305			
8:45	131		7.96		340	301			
9:00	132		7.91		350	300			
9:15	134		7.87		350	299			
9:30	135		7.97		330	290			
9:45	134		7.96		340	303			
10:00	132		8.02		340	310			
10:15	137		7.97		335	303			
10:30	128		7.27		330	294			
10:45	127		7.68		340	311			
11:00	—								
11:30	110		6.52		355	320			
11:45	130		7.57		345	313			

Temp.-Temperature gpm-gallons per minute w.c.-water column °F-degrees Fahrenheit psi-pounds per square inch ΔP-pressure dro

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

DATE 08-27-99
TIME 10:13:28

HEAVY OIL

O2 % 9.9
CO PPMN .. 917
Prs mBar 0.01
EFF % (G) 100.0
XAIR % 91
CO2 % 8.3

NO PPMN .. 205
NO2 PPMN 0
NOx PPMN .. 205
SO2 PPMN 3
REF. %O2 ... 3.0

NETT .. F -322.9
FLUE .. F -225.5
INLT NOT FITTED
AMBIENT F 97.3

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

DATE 08-27-99
TIME 08:42:57

HEAVY OIL

O2 % 10.2
CO PPMN . 1343
Prs mBar 0.01
EFF % (G) 100.0
XAIR % 96
CO2 % 8.0

NO PPMN .. 189
NO2 PPMN 0
NOx PPMN .. 189
SO2 PPMN 3
REF. %O2 ... 3.0

NETT .. F -338.2
FLUE .. F -256.9
INLT NOT FITTED
AMBIENT F 81.3

Environmental Programs Daily Tracking Form

Plant #: 25 Date: 8/27/99
Location: Amnicon
Plant Foreman: Richard Colucci

AIR QUALITY MONITORING

Production:
Total Asphalt Mix Tonnage: 1131.35
Diesel Fuel Gallons for Generator: 0
RAP % in mix: _____ RAP tons: _____
Mix Temperature (degrees F): 305
Hours of Operation: 8

Process fuel:
Fuel Type: Waste Amt: 1892
Burner Pressure: 42 Fuel Temp: 150
Fuel Type: _____ Amt: _____
Burner Pressure: _____ Fuel Temp: _____
Spec. Sheet Delivered: X yes _____ no

Baghouse:
Magnehelic dP: 3.5 inches of water
Photohelic dP: .15 inches of water
Optimum photohelic range from burner tune-up: .15 inches of water
Photohelic malfunction: _____ yes X no
(If yes, next day DNR notification required)
Weekly Inspection of drum and door seals, ducts, photohelic, damper, & other system parts: X yes _____ no
Maintenance Performed: Stack test today

50,000 ton Blacklight Baghouse Inspection:
X yes _____ no
Number of Bags Replaced: _____

Fugitive Dust Control:
Control Measures: X yes _____ no
Water Amt. Applied: _____
Chemical Amt. Applied: _____
Speed Limit Control (mph): 10

Soil Remediation:
Soil Remediation Performed: ___ yes X 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)
X yes _____ no
Systems Locked out: X yes _____ no
Petroleum Equipment Maintenance: Clean Screens & Nozzle
Weekly SPCC Meeting: X yes _____ no
Containment Water Released: ___ yes X no
(If yes, complete Water Drainage Form)

STORMWATER RUNOFF QUALITY

Best Mgmt.Practices (BMP)Applied: X yes __ no
Petroleum Products Secure: X yes _____ no
Site Runoff Naturally Contained on Site:
X yes _____ no
If no, has containment been constructed:
_____ yes _____ no
Erosion Control Practices used (i.e. silt fence, site seeding, slopes): _____
Rain Amount in last 24 hrs: 0 inches
Any known Petro.Contamination: ___ yes ___ no
Sediment Content:
X 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: Richard Colucci

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.

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.

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|_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.
m_g	=	Mass flow of wet flue gas, LB/HR
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

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

$$V_{w(std)} = 0.0472\ V_{lc}$$

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

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

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

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

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

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

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

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