AP42 Section:	Chapters 1 and 3
Related:	2
Title:	Source Test Review, Scott paper Company, Paper Machine No. 19, Chester, PA Roy F, Weston Inc for Pennsylvania Dept of Environmental Protection May 1996

PDEP0011

COMMONWEALTH OF PENNSYLVANIA
Department of Environmental Protection
May 6, 1996
717-787-9483

SUBJECT: Source Test Review
Scott Paper Company
Paper Machine No. 19.
Chester, Delaware County

TO: Sachin Shankar
Air Pollution Control Engineer
Southeast Regional Office

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Boilers/Process Heaters NG/#2FO-fired

Scott Paper Company, Inc. operates a paper mill at its facility in Chester, Delaware County. Paper Machine No. 19 has two hoods, wet-end and dry-end, equipped with direct-fired heaters for the purpose of providing supplemental heat to aid in the drying of paper products as they pass over a Through-Dryer drum. Each dryer hood is direct-fired with natural gas/No. 2 fuel oil burners manufactured by Urquhart Company which heat the drying air supply to a temperature of approximately 500 °F. The burners are rated at 65 MMBtu/hr (dry end) and 50 MMBtu/hr (wet end). The hoods are designed to allow some of the moisture-laden exhaust air to be recirculated to the heaters while the remainder is exhausted to a single stack.

Roy F. Weston, Inc. conducted testing for RACT on the above mentioned dryer hoods shared exhaust stack to determine the emissions of nitrogen oxides (NO_x) on January 11, 1996. The results are acceptable to the Department.

The following information was extracted from the test report:

Paper Machine No. 19 Test Results

Run No.	1	2	3
Test Date	01/11/96	01/11/96	01/11/96
Test Period	1000-1100	1115-1215	1245-1345
NOx Emission Concentration [ppm/v]	14.6	14.3	13.5
NOx Emission Rate [lb./MMBtu]	0.113*	0.118*	0.105*
Allowable NOx Emission Rate [lb./MMBtu]	0.2	0.2	0.2

* Determined using f-factors.

cc: RACT File OP 23-0014
Data File - Source Testing
Compliance and Enforcement - Scott Kepner
Reading File, Source Testing Section
Division of Permits
EPA/RSL

LBD:TRB:BR:br

ROY F. WESTON, INC.

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DEP AIR QUALITY CONTROL
BUR. OF SOURCE TESTING AND MONITORING

WESTON
MANAGERS DESIGNERS/CONSULTANTS

NO_x EMISSIONS TEST REPORT
NO. 19 PAPER MACHINE
DRYER HOOD EXHAUST

Prepared For:

SCOTT PAPER COMPANY
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FOR TB

Thomas Bernstiel
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FEBRUARY 1996

Work Order No. 01051-044-001

TABLE OF CONTENTS

Section	Title	Page
1	**INTRODUCTION**	1-1
2	**DESCRIPTION OF SAMPLING LOCATION**	2-1
	2.1 NO. 19 PAPER MACHINE DRYER HOOD EXHAUST	2-1
3	**SAMPLING AND ANALYTICAL METHODS**	3-1
	3.1 GAS VOLUMETRIC FLOWRATE MEASUREMENTS	3-1
	3.2 MOISTURE CONTENT MEASUREMENTS	3-1
	3.3 EPA METHOD 7E AND 3A - OXIDES OF NITROGEN, CARBON DIOXIDE AND OXYGEN	3-4
4	**TEST RESULTS AND DISCUSSIONS**	4-1
APPENDIX A	**RAW AND REDUCED FIELD DATA**	A-1
APPENDIX B	**PROCESS OPERATIONS DATA**	B-1
APPENDIX C	**SAMPLE CALCULATIONS**	C-1
APPENDIX D	**EQUIPMENT CALIBRATIONS AND NO_x INTERFERENCE CHECK DATA**	D-1
APPENDIX E	**LIST OF PROJECT PARTICIPANTS**	E-1

LIST OF FIGURES

Figure No.	Title	Page
2-1	NO. 19 PAPER MACHINE DRYER HOOD EXHAUST STACK-PORT AND TRAVERSE POINT LOCATIONS	2-3
3-1	EPA METHOD 4 MOISTURE SAMPLING TRAIN	3-2
3-2	EPA METHOD 7E AND 3A - CONTINUOUS EMISSIONS MONITORING SYSTEM	3-4

LIST OF TABLES

Table No.	Title	Page
1-1	SUMMARY OF OXIDES OF NITROGEN EMISSIONS TEST RESULTS	1-2
4-1	VELOCITY AND MOISTURE TEST DATA AND TEST RESULTS	4-2
4-2	CEM TEST DATA AND TEST RESULTS - RUN 1	4-3
4-3	CEM TEST DATA AND TEST RESULTS - RUN 2	4-4
4-4	CEM TEST DATA AND TEST RESULTS - RUN 3	4-5

SECTION 1
INTRODUCTION

Scott Paper Company (SCOTT), a wholly owned subsidiary of the Kimberly-Clark Corporation, retained Roy F. Weston, Inc. (WESTON®) to perform an emissions test program at the SCOTT facility located in Chester, Pennsylvania. This test report presents the test results and procedures used during the NO_x emission testing of the No. 19 Paper Machine Dryer Hood Exhaust. The object of the test program was to demonstrate compliance with emission limits for oxides of nitrogen (NO_x) as required by the Pennsylvania Department of Environmental Protection (PA DEP) Plan Approval No. 23-315-006A.

Testing was conducted on January 11, 1996. A detailed test protocol prepared in September 1995 and approved by PA DEP was followed during the test program. SCOTT personnel monitored the process operations for Paper Machine No. 19 during the test periods.

Table 1-1 summarizes the results of the test program. Tables 4-1 through 4-4 provide a more detailed analysis of the test data. Descriptions of the process, test location, test equipment, and test procedures used during the test program are also included in this report. Support information is contained in five appendices. Raw and reduced test data is contained in Appendix A. Appendix B contains process information. Sample calculations are outlined in Appendix C. Appendix D contains the equipment calibration records and Appendix E is a list of WESTON project personnel.

TABLE 1-1

SCOTT PAPER COMPANY
PAPER MACHINE NUMBER 19 DRYER HOOD EXHAUST

SUMMARY OF OXIDES OF NITROGEN EMISSIONS TEST RESULTS

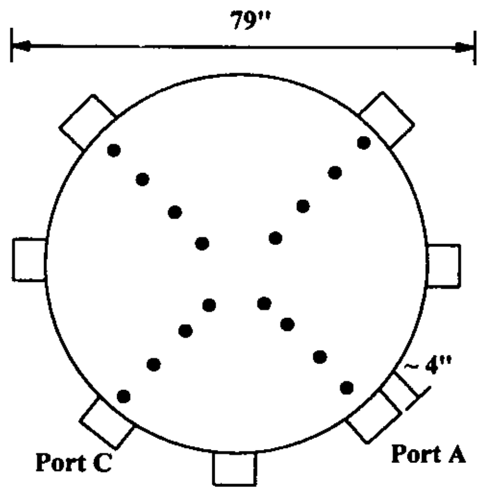
Test Run No.	Test Date	Test Period	Measured Concentration (ppm/v)	Emission Rates (lb/hr)	Emission Rates lb/MMBtu Natural Gas	PA DEP Allowable Emission Rate (lb/MMBtu) Natural Gas
One	1/11/96	1000-1100	14.6	10.41	0.113	0.2
Two	1/11/96	1115-1215	14.3	8.95	0.118	
Three	1/11/96	1245-1345	13.5	8.62	0.105	
Average	---	---	**14.1**	**9.33**	**0.112**	

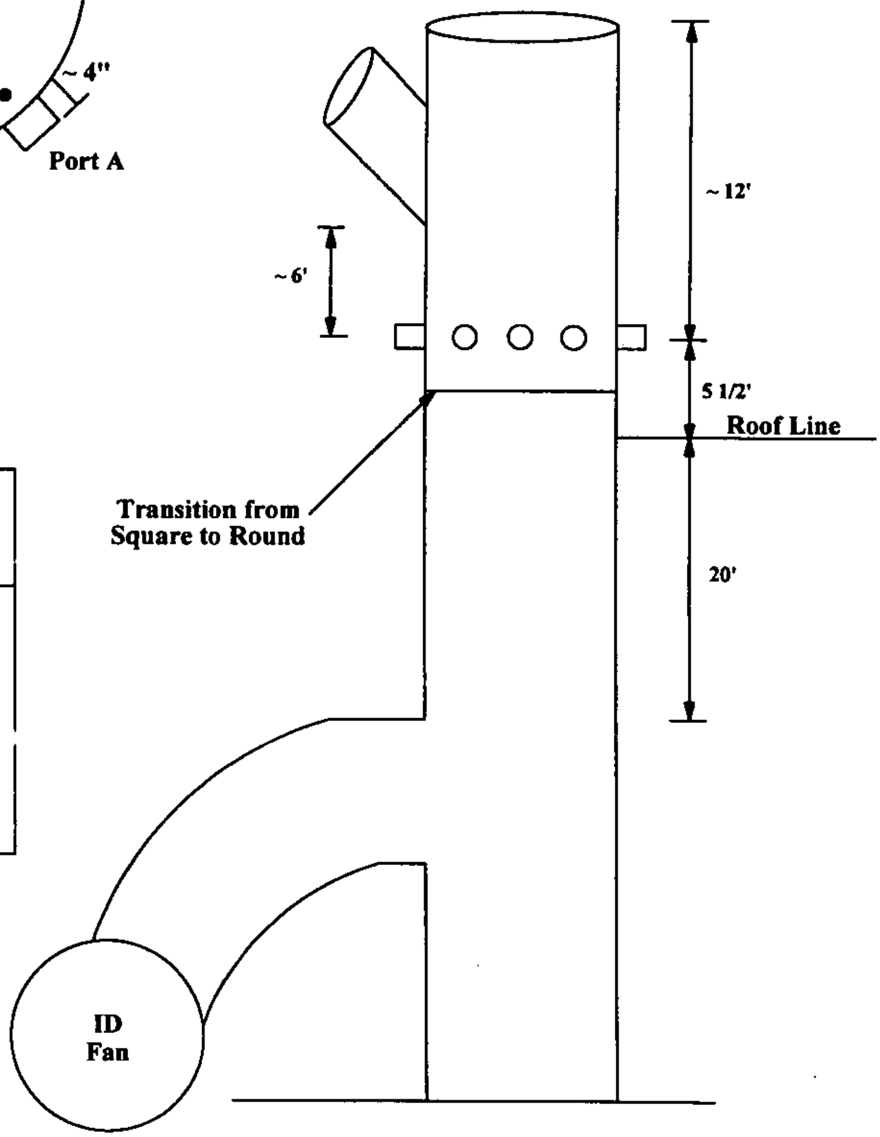
SECTION 2
DESCRIPTION OF SAMPLING LOCATION

2.1 NO. 19 PAPER MACHINE DRYER HOOD EXHAUST

Eight 4" test ports, were located in a straight section of the 79" diameter exhaust stack immediately above the square to round transition. The sample ports were located approximately 30 feet downstream from the ID fan servicing the dryer hood and approximately 12 feet upstream from the stack exit. Approximately 6 feet downstream from the test ports and 6 feet upstream of the stack exit is a side duct that is no longer in service and is dead-ended. Figure 2-1 provides a schematic of the sampling location.

SCOTT PAPER COMPANY
CHESTER, PENNSYLVANIA





Traverse Point Number	Distance from Inside Near Wall (Inches)
1	2 1/2
2	8 3/8
3	15 3/8
4	25 1/2
5	53 1/2
6	67 5/8
7	74 3/4
8	80 1/2

DRAWING NOT TO SCALE

FIGURE 2-1
NO. 19 PAPER MACHINE DRYER HOOD EXHAUST STACK
PORT AND TRAVERSE POINT LOCATIONS

SECTION 3

SAMPLING AND ANALYTICAL METHODS

U.S. EPA Reference Methods (40CFR60, Appendix A) were used throughout the test program. Table 3-1 summarizes the emission test parameters and test methods. The specific sampling procedures are discussed in the following sections.

3.1 GAS VOLUMETRIC FLOWRATE MEASUREMENTS

The gas velocities on the No. 19 Paper Machine Dryer Hood exhaust were measured using EPA Methods 1 and 2. Stack geometry measurements and traverse point distances were measured and calculated according to EPA Method 1 procedures. Flue gas velocity measurements were performed utilizing "S-Type" pitot tubes and inclined manometers. Flue gas temperatures were measured with calibrated digital pyrometers equipped with chromel-alumel (K-type) thermocouples. One velocity measurement was conducted in conjunction with each NO_x test run. The volumetric flow rate was corrected to dry standard cubic feet per minute (dscfm) and used along with the NO_x concentration data to calculate the mass emission rates of NO_x in units of pounds per hour.

3.2 MOISTURE CONTENT MEASUREMENTS

EPA Method 4 was used to measure moisture content of the stack gas. Figure 3-1 presents a diagram of the EPA Method 4 test train. One moisture determination was conducted in conjunction with each NO_x test run. The sampling train consisted of a stainless steel probe connected to a series of four impingers using a flexible hose. The first two impingers each contained 100 mls of distilled water, the third was dry, and the fourth contained 300 grams of dry pre-weighed silica gel. The impingers were maintained in a crushed ice bath during each test run. A Nutech control console with leakless vacuum pump, a calibrated dry gas

TABLE 3-1

REFERENCE TEST METHODS

TEST PARAMETER	METHOD[1]
Stack gas velocity and volumetric flowrate	EPA 1,2
Gas Composition (CO_2, O_2)	EPA 3A
Moisture content	EPA 4
NO_x concentration (as NO_2)	EPA 7E

[1] "Standards of Performance for New Stationary Sources" Code of Federal Regulations, Title 40, Part 60, Appendix A, Reference Methods.

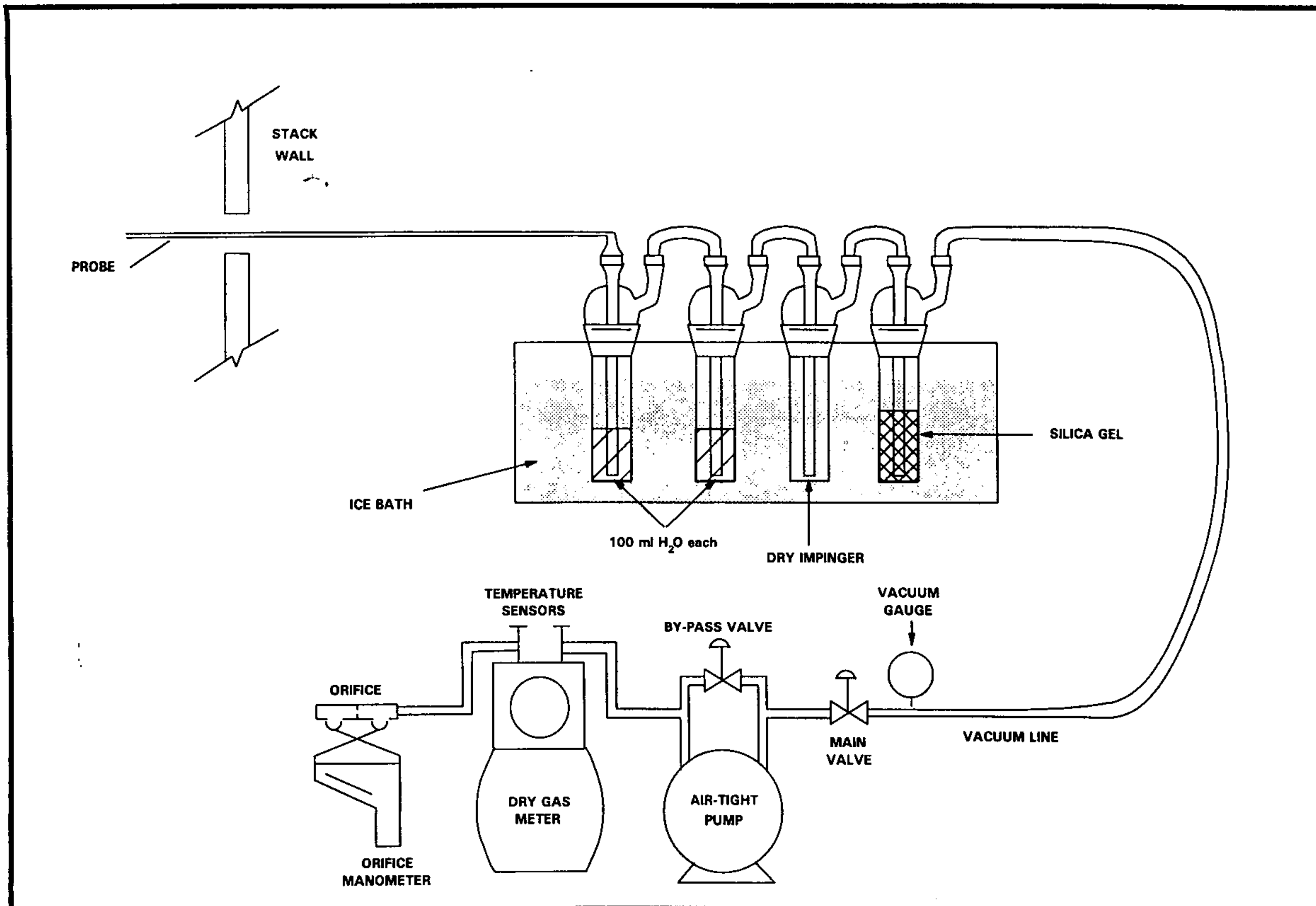


FIGURE 3-1
EPA METHOD 4 MOISTURE SAMPLING TRAIN

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meter, a calibrated orifice and an inclined manometer, were connected to the last impinger via an umbilical cord. The moisture content of the stack gas was determined by measuring the difference between the final and initial volumes of liquid, the silica gel weight and the volume of gas sampled to calculate the moisture content of the stack gas.

3.3 EPA METHOD 7E AND 3A - OXIDES OF NITROGEN, CARBON DIOXIDE AND OXYGEN

A Continuous Emissions Monitoring (CEM) system was used to measure oxides of nitrogen (NO_x), carbon dioxide and oxygen flue gas concentrations. A TECO Model 42H Chemiluminescent analyzer was used to measure NO_x ($NO+NO_2$) concentrations by EPA Method 7E. An Infrared Industries Model 702 analyzer was used to measure carbon dioxide concentrations and a Siemens Oxymat® 5-paramegnetic analyzer was used to measure oxygen concentrations, in accordance with EPA Method 3A. A diagram of the CEM system is presented in Figure 3-2.

A stainless steel probe was used to collect a sample at the centroid of the stack. The sample was drawn through a heated Teflon® sample line to the sample conditioner. An unheated Teflon® line was used to transfer the sample from the conditioner to the analyzers. The output from the analyzers was recorded on a strip chart and digitized by a Molytek® data logger. The data logger sampled the instrument output every 5 seconds to form one-minute averages. The one-minute averages were then output to the hard drive of a computer.

The analyzers were set up and calibrated directly by introduction of calibration gas standards to the analyzer through a calibration manifold. The manifold vented excess gas to the atmosphere to maintain the system at ambient pressure. The direct calibration sequence consisted of alternate injections of zero and mid-range gases with appropriate

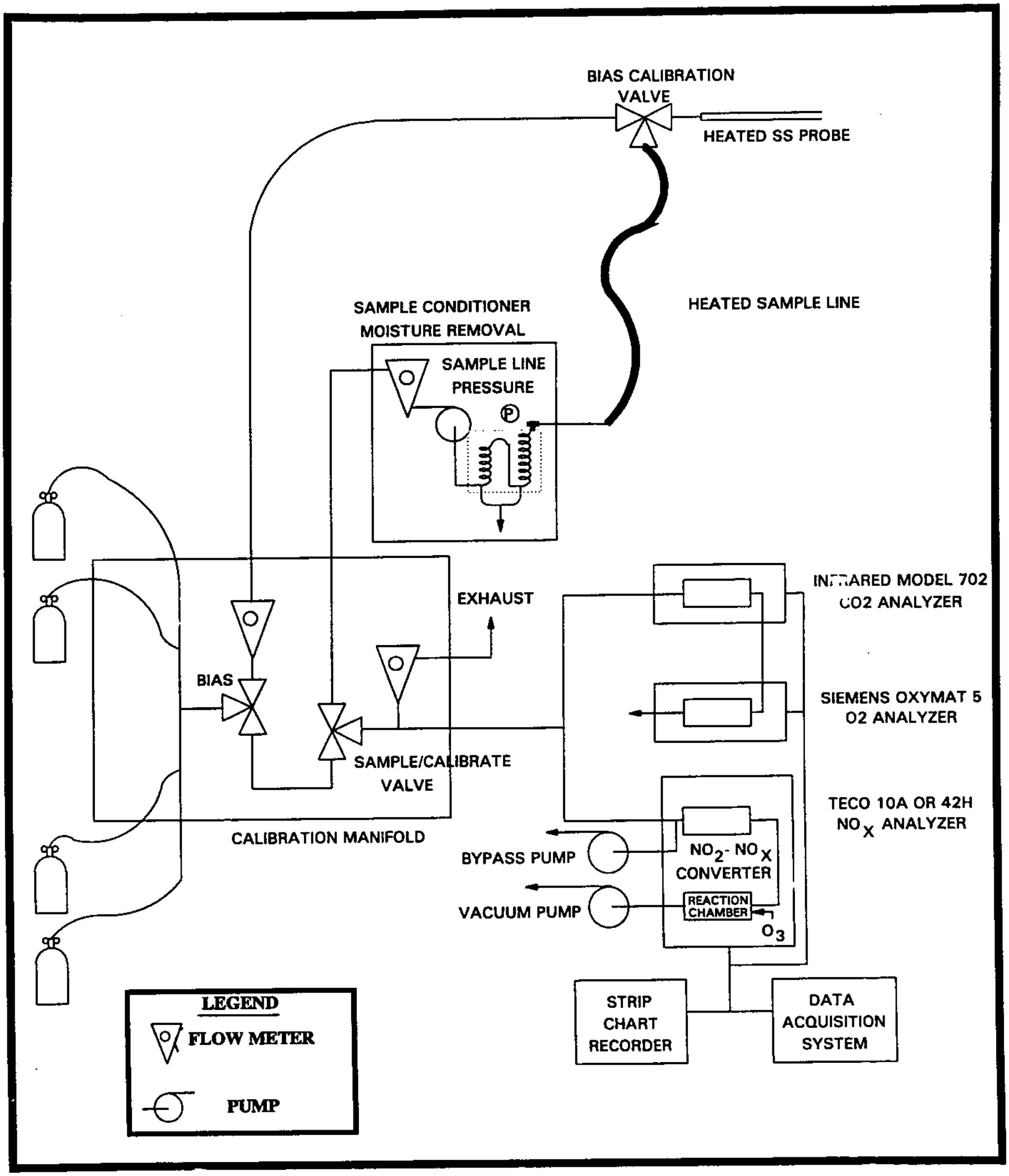

FIGURE 3-2
EPA METHOD 7E and 3A
CONTINUOUS EMISSIONS MONITORING SYSTEM

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adjustments made until the desired responses were obtained. The high range and low range standards were then introduced in sequence without further adjustment.

The sample line integrity was verified by conducting pre-and post-test bias checks. The sampling system bias test consisted of introducing the zero gas and one calibration standard to the valve or tee at the probe end with the system operating normally. Calibration gas was supplied in excess and was permitted to flow out through the probe to maintain sampling system pressure. The bias check responses were compared to the internal calibration response to prove sample line integrity.

Interference check data for the TECO Model 42H chemiluminescent analyzer is included in Appendix D with the equipment calibration records.

SECTION 4
TEST RESULTS AND DISCUSSIONS

The test results are summarized in Table 1-1. Table 4-1 of this section provides detailed velocity, moisture and gas composition test data and test results. Table 4-2 through 4-4 provide detailed test data and test results for NO_x, O_2 and CO_2. EPA Methods 3A, 4 and 7E were performed simultaneously during each test run. Velocity traverse measurements (EPA Method 1 and 2) were performed during each NO_x test period.

The velocity traverse for run one was conducted via two test ports (90° offset) as outlined in the test protocol. The results of this traverse indicated a high amount of turbulence within the flue gas stream and subsequent velocity traverses were conducted utilizing all eight test ports.

Test data and test results herein are believed to be representative of process emissions encountered during the test periods.

TABLE 4-1
SCOTT PAPER COMPANY
CHESTER, PA.
PAPER MACHINE #19 EXHAUST
VELOCITY AND MOISTURE TEST DATA AND TEST RESULTS

				ONE	TWO	THREE	AVERAGES
Run Number				ONE	TWO	THREE	AVERAGES
Date				01-11-96	01-11-96	01-11-96	
Time				1000-1100	1115-1215	1245-1345	
Volumetric Flow Data							
					Velocity Head, in. H2O		
	R1		R2, R3				
PORT A	Point 1	PORT A	Point 1	0.25	0.17	0.15	
	Point 2		Point 2	0.25	0.14	0.14	
	Point 3		Point 3	0.28	0.09	0.10	
	Point 4		Point 4	0.32	0.10	0.10	
	Point 5	PORT B	Point 1	2.20	0.02	0.04	
	Point 6		Point 2	4.10	0.01	0.02	
	Point 7		Point 3	4.80	0.15	0.13	
	Point 8		Point 4	3.70	0.21	0.19	
PORT C	Point 1	PORT C	Point 1	0.66	0.11	0.09	
	Point 2		Point 2	0.89	0.09	0.08	
	Point 3		Point 3	1.00	0.05	0.06	
	Point 4		Point 4	0.52	0.02	0.01	
	Point 5	PORT D	Point 1	0.63	0.13	0.15	
	Point 6		Point 2	1.40	0.10	0.12	
	Point 7		Point 3	3.30	0.06	0.08	
	Point 8		Point 4	5.20	0.01	0.03	
		PORT E	Point 1		4.00	3.90	
			Point 2		3.20	3.50	
			Point 3		2.20	2.50	
			Point 4		1.50	1.30	
		PORT F	Point 1		4.50	4.20	
			Point 2		4.80	4.60	
			Point 3		3.70	4.00	
			Point 4		2.60	2.90	
		PORT G	Point 1		4.80	5.00	
			Point 2		5.30	5.50	
			Point 3		4.90	5.10	
			Point 4		3.10	3.30	
		PORT H	Point 1		3.70	3.50	
			Point 2		3.10	3.40	
			Point 3		2.60	3.00	
			Point 4		1.60	1.80	
Velocity Data							
Square Root of Delta P, (in. H20)^.5				1.20426	1.05881	1.07994	1.1143372
Pitot Tube Coefficient (Cp)				0.84	0.84	0.84	0.84
Barometric Pressure (Pb), in. Hg				30.34	30.34	30.34	30.34
Static Pressure (Pg), in. H2O				-2.60	-2.60	-2.60	-2.60
Stack Pressure (Ps), in. Hg				30.15	30.15	30.15	30.15
Stack Diameter (I.D.), in.				79.0	79.0	79.0	79.0
Stack Cross-sectional Area, ft^2				34.04	34.04	34.04	34.04
Moisture Data							
Time period				1007-1047	1120-1200	1235-1315	
Delta H				1.5	1.5	1.5	1.5
Meter temp. (deg.F)				41	48	53.5	47.5
Sample volume (act.)				25.369	25.067	25.406	25.281
Volume H_2O imp. (ml)				154	155	146	151.7
Weight chnge sil. gel (g)				5.3	6.2	12.0	7.8
Meter box cal.				0.995	0.995	0.995	0.995
Std. vol. of H_2O vapor coll., cu.ft.				7.50	7.59	7.44	7.51
Sample volume (std.)[1]				27.063	26.373	26.443	26.626
Moisture (Bws)				0.217	0.223	0.220	0.220
Stack Gas Data							
Temperature (ts), °F				219	217	218	218.1
CO2 Concentration (CO2), %				1.6	1.5	1.6	1.6
O2 Concentration (O2), %				18.1	18.0	18.3	18.1
Molecular Weight (Ms), lb/lb-mole				26.6	26.5	26.6	26.6
Velocity (Vs), ft/sec				79.6	70.0	71.4	73.6
Volumetric Flow Rate,							
At Stack Conditions (Qa), ACFM				162500	142900	145700	150367
At Standard Conditions (Qs), DSCFM [1]				99700	87200	89200	92033

(1) Standard conditions = 68 deg. F. (20 deg. C.) and 29.92 in Hg (760 mmHg)

TABLE 4-2
SCOTT PAPER COMPANY
CHESTER, PENNSYLVANIA
PAPER MACHINE # 19 EXHAUST
CEM TEST DATA AND TEST RESULTS
TEST DATE: 11 JANUARY 1996
TIME PERIOD: 1000-1100
TEST RUN 1

Date	Time	CO_2 (%)	O_2 (%)	NO_x (ppm)
11 Jan 96	10:00	1.7	17.9	14.3
11 Jan 96	10:01	1.6	17.9	14.3
11 Jan 96	10:02	1.7	17.9	14.3
11 Jan 96	10:03	1.6	17.9	14.3
11 Jan 96	10:04	1.6	17.9	14.3
11 Jan 96	10:05	1.6	17.9	14.1
11 Jan 96	10:06	1.6	17.9	13.8
11 Jan 96	10:07	1.6	17.9	13.8
11 Jan 96	10:08	1.6	17.9	13.8
11 Jan 96	10:09	1.6	17.9	13.8
11 Jan 96	10:10	1.6	17.9	13.8
11 Jan 96	10:11	1.7	17.9	13.8
11 Jan 96	10:12	1.7	17.9	13.8
11 Jan 96	10:13	1.7	17.9	13.8
11 Jan 96	10:14	1.7	17.9	13.8
11 Jan 96	10:15	1.7	17.9	14.1
11 Jan 96	10:16	1.6	17.9	14.3
11 Jan 96	10:17	1.6	17.9	14.3
11 Jan 96	10:18	1.6	17.9	14.3
11 Jan 96	10:19	1.6	17.9	14.0
11 Jan 96	10:20	1.6	17.9	13.8
11 Jan 96	10:21	1.6	17.9	14.3
11 Jan 96	10:22	1.6	17.9	14.3
11 Jan 96	10:23	1.6	17.9	14.3
11 Jan 96	10:24	1.6	17.9	14.3
11 Jan 96	10:25	1.6	17.9	14.0
11 Jan 96	10:26	1.6	17.9	13.8
11 Jan 96	10:27	1.6	17.9	13.8
11 Jan 96	10:28	1.6	17.9	13.8
11 Jan 96	10:29	1.6	17.9	13.8
11 Jan 96	10:30	1.6	17.9	13.8
11 Jan 96	10:31	1.6	17.9	13.8
11 Jan 96	10:32	1.6	17.9	13.8
11 Jan 96	10:33	1.6	17.9	13.8
11 Jan 96	10:34	1.6	17.9	13.8
11 Jan 96	10:35	1.6	17.9	13.8
11 Jan 96	10:36	1.6	17.9	13.8
11 Jan 96	10:37	1.6	17.9	13.5
11 Jan 96	10:38	1.6	17.9	13.3
11 Jan 96	10:39	1.6	17.9	13.8
11 Jan 96	10:40	1.6	17.9	13.8
11 Jan 96	10:41	1.6	17.9	13.8
11 Jan 96	10:42	1.6	17.9	13.5
11 Jan 96	10:43	1.6	17.9	13.2
11 Jan 96	10:44	1.6	17.9	13.2
11 Jan 96	10:45	1.6	17.8	13.2
11 Jan 96	10:46	1.6	17.8	13.2
11 Jan 96	10:47	1.7	17.8	13.2
11 Jan 96	10:48	1.7	17.8	13.2
11 Jan 96	10:49	1.7	17.8	13.6
11 Jan 96	10:50	1.7	17.8	13.7
11 Jan 96	10:51	1.7	17.8	13.5
11 Jan 96	10:52	1.7	17.8	13.2
11 Jan 96	10:53	1.7	17.8	13.2
11 Jan 96	10:54	1.7	17.8	13.2
11 Jan 96	10:55	1.6	17.8	13.5
11 Jan 96	10:56	1.6	17.8	13.7
11 Jan 96	10:57	1.6	17.8	13.2
11 Jan 96	10:58	1.6	17.9	13.6
11 Jan 96	10:59	1.7	17.9	13.7
11 Jan 96	11:00	1.7	17.9	13.7

	CO_2	O_2	NO_x
Average	1.6	17.9	13.8
Bias Zero	0.00	0.10	0.15
Bias Standard	10.10	12.25	55.65
Standard Value	10.00	12.34	59.40
Bias Corrected Average	1.6	18.1	14.6
Volumetric Flow (dscf/min)	99700	99700	99700
Mass Rate (lb/hr)			10.41

TABLE 4-3
SCOTT PAPER COMPANY
CHESTER, PENNSYLVANIA
PAPER MACHINE # 19 EXHAUST
CEM TEST DATA AND TEST RESULTS
TEST DATE: 11 JANUARY 1996
TIME PERIOD: 1115-1215
TEST RUN 2

Date	Time	CO2 (%)	O2 (%)	NOx (ppm)
11 Jan 96	11:15	1.6	17.3	27.5
11 Jan 96	11:16	1.6	17.9	13.9
11 Jan 96	11:17	1.6	17.9	13.8
11 Jan 96	11:18	1.6	17.9	13.8
11 Jan 96	11:19	1.6	17.9	13.8
11 Jan 96	11:20	1.6	17.9	13.8
11 Jan 96	11:21	1.6	17.9	13.8
11 Jan 96	11:22	1.6	17.9	13.8
11 Jan 96	11:23	1.6	17.9	13.8
11 Jan 96	11:24	1.6	17.9	13.8
11 Jan 96	11:25	1.6	17.9	13.3
11 Jan 96	11:26	1.6	17.9	13.3
11 Jan 96	11:27	1.6	17.9	13.8
11 Jan 96	11:28	1.6	17.9	13.8
11 Jan 96	11:29	1.6	17.9	13.8
11 Jan 96	11:30	1.6	17.9	13.3
11 Jan 96	11:31	1.6	17.9	13.2
11 Jan 96	11:32	1.6	17.9	13.2
11 Jan 96	11:33	1.6	17.9	13.2
11 Jan 96	11:34	1.6	17.9	13.2
11 Jan 96	11:35	1.6	17.9	13.2
11 Jan 96	11:36	1.6	17.9	13.2
11 Jan 96	11:37	1.6	17.9	13.2
11 Jan 96	11:38	1.6	17.9	13.2
11 Jan 96	11:39	1.6	17.9	13.2
11 Jan 96	11:40	1.6	17.9	13.2
11 Jan 96	11:41	1.6	17.9	13.2
11 Jan 96	11:42	1.6	17.9	13.2
11 Jan 96	11:43	1.6	17.9	13.2
11 Jan 96	11:44	1.6	17.9	13.2
11 Jan 96	11:45	1.6	17.9	13.2
11 Jan 96	11:46	1.6	17.9	13.2
11 Jan 96	11:47	1.6	17.9	13.2
11 Jan 96	11:48	1.6	17.9	13.2
11 Jan 96	11:49	1.6	17.9	13.2
11 Jan 96	11:50	1.6	17.9	13.2
11 Jan 96	11:51	1.6	17.9	13.2
11 Jan 96	11:52	1.6	17.9	13.2
11 Jan 96	11:53	1.6	17.8	13.2
11 Jan 96	11:54	1.6	17.8	13.2
11 Jan 96	11:55	1.6	17.8	13.2
11 Jan 96	11:56	1.6	17.8	13.2
11 Jan 96	11:57	1.6	17.8	13.2
11 Jan 96	11:58	1.6	17.8	13.2
11 Jan 96	11:59	1.6	17.8	13.2
11 Jan 96	12:00	1.6	17.8	13.2
11 Jan 96	12:01	1.6	17.8	13.2
11 Jan 96	12:02	1.6	17.8	13.2
11 Jan 96	12:03	1.6	17.8	13.2
11 Jan 96	12:04	1.6	17.8	13.2
11 Jan 96	12:05	1.6	17.8	13.2
11 Jan 96	12:06	1.6	17.8	13.2
11 Jan 96	12:07	1.6	17.8	13.2
11 Jan 96	12:08	1.6	17.8	13.2
11 Jan 96	12:09	1.6	17.8	13.2
11 Jan 96	12:10	1.6	17.8	13.1
11 Jan 96	12:11	1.6	17.9	12.5
11 Jan 96	12:12	1.6	17.8	12.6
11 Jan 96	12:13	1.6	17.8	12.7
11 Jan 96	12:14	1.6	17.9	12.7
11 Jan 96	12:15	1.6	17.9	12.7
Average		1.6	17.9	13.5
Bias Zero		0.05	0.10	0.20
Bias Standard		10.10	12.25	55.40
Standard Value		10.00	12.34	59.40
Bias Corrected Average		1.5	18.0	14.3
Volumetric Flow (dscf/min)		87200	87200	87200
Mass Rate (lb/hr)				8.95

TABLE 4-4
SCOTT PAPER COMPANY
CHESTER, PENNSYLVANIA
PAPER MACHINE # 19 EXHAUST
CEM TEST DATA AND TEST RESULTS
TEST DATE: 11 JANUARY 1996
TIME PERIOD: 1245-1345
TEST RUN 3

Date	Time	CO2 (%)	O2 (%)	NOx (ppm)
11 Jan 96	12:45	1.6	18.1	12.7
11 Jan 96	12:46	1.6	18.1	12.7
11 Jan 96	12:47	1.6	18.1	12.7
11 Jan 96	12:48	1.6	18.2	12.7
11 Jan 96	12:49	1.6	18.2	12.9
11 Jan 96	12:50	1.6	18.2	12.8
11 Jan 96	12:51	1.6	18.2	12.9
11 Jan 96	12:52	1.6	18.2	12.9
11 Jan 96	12:53	1.6	18.2	12.8
11 Jan 96	12:54	1.6	18.2	12.8
11 Jan 96	12:55	1.6	18.2	12.8
11 Jan 96	12:56	1.6	18.2	12.8
11 Jan 96	12:57	1.6	18.2	12.8
11 Jan 96	12:58	1.6	18.2	12.8
11 Jan 96	12:59	1.6	18.2	12.8
11 Jan 96	13:00	1.6	18.2	12.8
11 Jan 96	13:01	1.6	18.2	12.8
11 Jan 96	13:02	1.6	18.2	12.8
11 Jan 96	13:03	1.6	18.2	12.8
11 Jan 96	13:04	1.6	18.2	12.8
11 Jan 96	13:05	1.6	18.2	12.8
11 Jan 96	13:06	1.6	18.2	12.8
11 Jan 96	13:07	1.6	18.2	12.8
11 Jan 96	13:08	1.6	18.2	12.8
11 Jan 96	13:09	1.6	18.2	12.8
11 Jan 96	13:10	1.6	18.2	12.8
11 Jan 96	13:11	1.6	18.2	12.8
11 Jan 96	13:12	1.6	18.2	12.8
11 Jan 96	13:13	1.6	18.2	12.8
11 Jan 96	13:14	1.6	18.2	12.8
11 Jan 96	13:15	1.6	18.2	12.8
11 Jan 96	13:16	1.6	18.2	12.8
11 Jan 96	13:17	1.6	18.2	12.8
11 Jan 96	13:18	1.6	18.2	12.8
11 Jan 96	13:19	1.6	18.2	12.8
11 Jan 96	13:20	1.6	18.2	12.8
11 Jan 96	13:21	1.6	18.1	12.8
11 Jan 96	13:22	1.6	18.1	12.8
11 Jan 96	13:23	1.6	18.2	12.8
11 Jan 96	13:24	1.6	18.2	12.8
11 Jan 96	13:25	1.6	18.1	12.8
11 Jan 96	13:26	1.6	18.1	12.8
11 Jan 96	13:27	1.6	18.1	12.8
11 Jan 96	13:28	1.6	18.1	12.8
11 Jan 96	13:29	1.6	18.1	12.8
11 Jan 96	13:30	1.6	18.1	12.8
11 Jan 96	13:31	1.6	18.1	12.8
11 Jan 96	13:32	1.6	18.1	12.8
11 Jan 96	13:33	1.6	18.1	12.8
11 Jan 96	13:34	1.6	18.1	12.8
11 Jan 96	13:35	1.6	18.1	12.8
11 Jan 96	13:36	1.6	18.1	12.8
11 Jan 96	13:37	1.6	18.1	12.8
11 Jan 96	13:38	1.6	18.1	12.8
11 Jan 96	13:39	1.6	18.1	12.8
11 Jan 96	13:40	1.6	18.1	12.8
11 Jan 96	13:41	1.6	18.1	12.8
11 Jan 96	13:42	1.6	18.1	12.8
11 Jan 96	13:43	1.6	18.1	12.8
11 Jan 96	13:44	1.6	18.1	13.2
11 Jan 96	13:45	1.6	18.1	13.2
Average		1.6	18.2	12.8
Bias Zero		0.05	0.25	0.30
Bias Standard		10.00	12.35	55.40
Standard Value		10.00	12.34	59.40
Bias Corrected Average		1.6	18.3	13.5
Volumetric Flow (dscf/min)		89200	89200	89200
Mass Rate (lb/hr)				8.62

APPENDIX A

RAW AND REDUCED FIELD DATA

T6 Source 0953

WESTON

CLIENT: Scott
PLANT: CHESTER
LOCATION: Paper Machine 19
OPERATOR: TB

CEM CALIBRATION DATA SHEET

DATE: 1-11-96
RUN NO.: 1
START: 1000
STOP: 1100

		INTERNAL CALIBRATION			SYSTEM BIAS PRE-TEST		POST-TEST			
	TIME		0845		0937		1101			
		KNOWN	ANAL. RESP.	% DIFF.	ANAL. RESP.	% DIFF.	ANAL. RESP.	% DIFF.	% DRIFT	AVG BIAS
CO	ZERO	0.0								
ppm	LOW									
range	MID									
	HIGH									
CO2	ZERO	0.0	0		0		0			0
%	LOW	4.96								
range	MID	10.01	10.1		10.1		10.1			10.1
20	HIGH	17.57								
O2	ZERO	0.0	0		0.1		0.1			0.1
%	LOW	6.76								
range	MID	12.34	12.2		12.2		12.3			12.25
25	HIGH	20.34								
NOx	ZERO	0.0	0.1		0.1		0.2			0.15
ppm	LOW									
range 100	MID	59.4	58.1		56.2		55.1			55.65
	HIGH									
THC	ZERO	0.0	0.1		1.0		0.8			0.9
ppm	LOW	25.88	24.5		25.9		23.6			24.75
range 100	MID	55.1								
	HIGH	90.5								
SO2	ZERO	0.0								
ppm	LOW									
range	MID									
	HIGH									
	ZERO	0.0								
	LOW									
range	MID									
	HIGH									

5... - 56.2

WESTON
MANAGERS DESIGNERS/CONSULTANTS

CEM CALIBRATION DATA SHEET

CLIENT: SCOTT
PLANT: CHESTER
LOCATION: Paper Machine 19
OPERATOR: TB

DATE: 1-11-96
RUN NO.: 2
START: 1115
STOP: 1215

			INTERNAL CALIBRATION		SYSTEM BIAS PRE-TEST		SYSTEM BIAS POST-TEST			
		TIME			1101		1216			
		KNOWN	ANAL. RESP.	% DIFF.	ANAL. RESP.	% DIFF.	ANAL. RESP.	% DIFF.	% DRIFT	AVG BIAS
CO	ZERO	0.0								
ppm	LOW									
range	MID									
	HIGH									
CO2	ZERO	0.0			0		0.1			0.05
%	LOW									
range	MID	10.0			10.1		10.1			10.1
20	HIGH									
O2	ZERO	0.0			0.1		0.1			0.1
%	LOW									
range	MID	12.34			12.3		12.2			12.25
25	HIGH									
NOx	ZERO	0.0			0.2		0.2			0.2
ppm	LOW									
range	MID	59.4			55.1		55.7			55.4
	HIGH									
THC	ZERO	0.0			0.8		1.5			1.15
ppm	LOW	25.6			23.6		24.6			24.1
range	MID									
	HIGH									
SO2	ZERO	0.0								
ppm	LOW									
range	MID									
	HIGH									
	ZERO	0.0								
	LOW									
range	MID									
	HIGH									

WESTON

CLIENT: Scott
PLANT: Chester
LOCATION: PM 19
OPERATOR: TB

CEM CALIBRATION DATA SHEET

DATE: 1-11-96
RUN NO.: 3
START: 1245
STOP: 1345

			INTERNAL CALIBRATION		SYSTEM BIAS PRE-TEST		SYSTEM BIAS POST-TEST			
	TIME				1216		1348			
		KNOWN	ANAL. RESP.	% DIFF.	ANAL. RESP.	% DIFF.	ANAL. RESP.	% DIFF.	% DRIFT	AVG BIAS
CO	ZERO	0.0								
ppm	LOW									
range	MID									
	HIGH									
CO_2	ZERO	0.0			0.1		0			0.05
%	LOW									
range	MID				10.1		9.9			10.0
20	HIGH									
O_2	ZERO	0.0			0.1		0.4			0.25
%	LOW									
range	MID				12.2		12.5			12.35
25	HIGH									
NOx	ZERO	0.0			0.2		0.4			0.3
ppm	LOW									
range	MID				55.7		55.5			55.6
	HIGH									
THC	ZERO	0.0			1.5		0.9			1.2
ppm	LOW				24.6		26.4			25.5
range	MID									
	HIGH									
SO_2	ZERO	0.0								
ppm	LOW									
range	MID									
	HIGH									
	ZERO	0.0								
	LOW									
range	MID									
	HIGH									

WESTON

TRAVERSE POINT LOCATION FOR CIRCULAR AND RECTANGULAR DUCTS

PLANT Scott Chester, PA

DATE 1-5-95

SAMPLING LOCATION Boiler #19

INSIDE OF FAR WALL TO OUTSIDE OF PORT (DISTANCE A) 83"

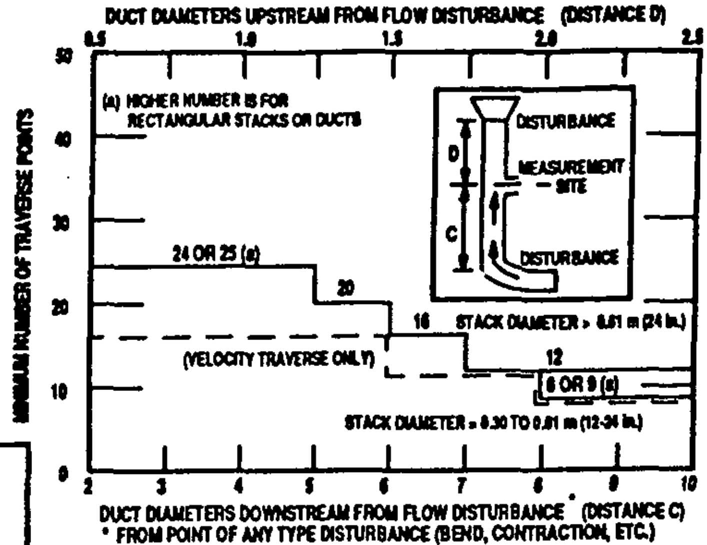
INSIDE OF NEAR WALL TO OUTSIDE OF PORT (DISTANCE B) 4"

STACK I.D. (DISTANCE A - DISTANCE B) 79"

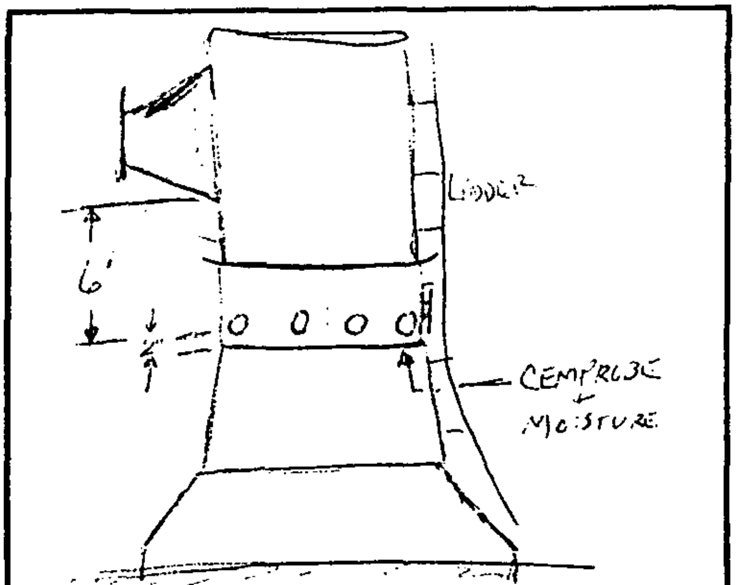
NEAREST UPSTREAM DISTURBANCE (C) 2"

NEAREST DOWNSTREAM DISTURBANCE (D) 6'

CALCULATOR



RECTANGULAR DUCT EQUIVALENT DIAMETER DETERMINATION FOR THE MINIMUM NUMBER OF TRAVERSE POINTS $= \frac{2LW}{L+W}$



SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	1 FRACTION OF STACK I.D.	2 STACK I.D.	3 PRODUCT OF COLUMNS 1 AND 2 (TO NEAREST 1/8 INCH)	4 DISTANCE B (PORT DEPTH)	5 TRAVERSE POINT LOCATION FROM OUTSIDE OF PORT (SUM OF COLUMNS 3 AND 4)
1	.032	79"	2.500	4"	6.500
2	.105		8.325		12.325
3	.194		15.325		19.325
4	.323		25.500		29.500
5	.677		53.500		57.500
6	.806		63.625		67.625
7	.895		70.750		74.750
8	.968		76.500		80.500
9					
10					
11					
12					

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

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WESTON

GAS VELOCITY AND VOLUME DATA FORM

Company: SCOTT PAPER

Plant: Chester, PA

Location: Boiler #19

Date: 1/11/96 Run No.: ONE

Operators: BN/SD

Barometric Pressure, in. Hg: 30.34

Stack Diameter, in.: 78"

Cross Sectional Area (AS), ft^2:

Pitot Tube ID No.: P110 Cp: .84

Pitot Tube Leak Check: Good

Notes:

24-Hour Clock Time	Traverse Point Number	Velocity Head (Δp), in. H_2O	Stack Temperature (T_s), °F	Static Pressure (P_{static}), in. H_2O	Cyclonic Flow Determination: Δp at 0° Reference	Cyclonic Flow Determination: Angle (α) which yields a null Δp
1015	1	.25 ~~.84~~	187			
	2	.25 ~~.82~~	218			
	3	.28 ~~.84~~	219			
	4	.32 ~~.82~~	219			
	5	~~.5~~ .22	224			
	6	~~.7~~ .41	224			
	7	~~.8~~ 4.8	224	-2.6	.04	<5°
	8	~~.1~~ 3.7	223	-2.7	.04	<5°
	1	.66	219			
	2	.89	219			
	3	1.0	219			
	4	.52	219			
	5	.63	221			
	6	1.4	221			
	7	3.3	223	-2.7	.03	<15°
	8	5.2	223	-2.5	.02	<15°
			218.8			
		Avg. $\sqrt{\Delta p}$	Avg. T_s	Avg. P_{static}		Avg. α[a]

[a] Avg. α must be ≤20° to be acceptable

WESTON

GAS VELOCITY AND VOLUME DATA FORM

Company: SCOTT PAPER
Plant: Chester, PA
Location: Boiler # 19
Date: 1/11/96 Run No.: TWO
Operators: BH/SD
Barometric Pressure, in. Hg: 30.34

Stack Diameter, in.: [illegible]"
Cross Sectional Area (AS), ft^2:
Pitot Tube ID No.: 7110 Cp: .84
Pitot Tube Leak Check: GOOD
Notes: * Traverse Point "A" is the point where the CEM probe was located; then [illegible] [illegible] from [illegible] to "H"

24-Hour Clock Time	Traverse Point Number	Velocity Head (Δp), in. H_2O	Stack Temperature (T_s), °F	Static Pressure (P_{static}), in. H_2O	Cyclonic Flow Determination	
					Δp at 0° Reference	Angle (α) which yields a null Δp
1200	A 1	.17	216			
	2	.14	217			
	3	.09	217			
	4	.10	218			
	B 1	.02	195			
	2	.01	210			
	3	.15	218			
	4	.21	218			
	C 1	.11	199			
	2	.09	209			
	3	.05	216			
	4	.02	218			
	D 1	.13	216			
	2	.10	217			
	3	.06	218			
	4	.01	218			
	E 1	4.0	219			
	2	3.2	220			
	3	2.2	220			
	4	1.5	219			
	F 1	4.5	220			
	2	4.8	221			
	3	3.7	221			
	4	2.6	221			
	G 1	4.8	221			
	2	5.3	222			
	3	4.9	222			
	4	3.1	222			
	H 1	3.7	219			
	2	3.1	221			
	3	2.6	221			
	4	Avg. $\sqrt{\Delta p}$	Avg. T_s	Avg. P_{static}		Avg. α[a]
			217.2			

[a] [illegible] 20° to be acceptable.

WESTON

GAS VELOCITY AND VOLUME DATA FORM

Company: SCOTT PAPER

Plant: Chester, PA

Location: Boiler #18

Date: 1/11/96 Run No.: Three

Operators: BH / SD

Barometric Pressure, in. Hg: 30.34

Stack Diameter, in.: 79"

Cross Sectional Area (AS), ft^2:

Pitot Tube ID No.: P110 Cp: .84

Pitot Tube Leak Check: GOOD

Notes: *Traverse Point "A" is where the CEM Probe was located; they go clockwise from "A" to "H".

24-Hour Clock Time	Traverse Point Number	Velocity Head (Δp), in. H_2O	Stack Temperature (T_s), °F	Static Pressure (P_{static}), in. H_2O	Cyclonic Flow Determination	
					Δp at 0° Reference	Angle (α) which yields a null Δp
1230	A 1	.15	215			
	2	.14	215			
	3	.10	217			
	4	.10	217			
	B 1	.04	200			
	2	.02	208			
	3	.13	220			
	4	.19	220			
	C 1	.09	201			
	2	.08	215			
	3	.06	220			
	4	.01	220			
	D 1	.15	219			
	2	.12	220			
	3	.08	221			
	4	.03	220			
	E 1	3.9	221			
	2	3.5	220			
	3	2.5	220			
	4	1.3	219			
	F 1	4.2	222			
	2	4.6	222			
	3	4.0	220			
	4	2.9	221			
	G 1	5.0	223			
	2	5.5	224			
	3	5.1	223			
	4	3.3	223			
	H 1	3.5	220			
	2	3.4	220			
	3	3.6	220			
	4	1.8	220			
		Avg. $\sqrt{\Delta p}$	Avg. T_s 218.3	Avg. P_{static}		Avg. α[a]

[a] Avg. α must be ≤ 20° to be acceptable

MOISTURE DETERMINATION FORM

Plant Scott Creek Date 1/11/96
Sample location Boiler #15 Run No. ONE
Operator BJ/SD Barometric Pressure (P_b), in. Hg 30.34
Initial leak rate Good .003 CFM @ 15 in. Hg
Final leak rate Good .000 CFM @ 5" in. Hg
Control box number #5 - Nutech Control box Y .9950
Comments: GAS Generated

	24-hr CLOCK TIME	GAS METER READING, ft^3	ORIFICE METER PRESSURE DIFFERENTIAL (ΔH), in. H_2O	DRY GAS METER TEMPERATURE (T_m) INLET, °F	DRY GAS METER TEMPERATURE (T_m) OUTLET, °F
STOP	10:47	75.280	1.5	45/47/48	33/34/40
START	10:07	49.911	1.5	40/40/44	36/37/38
	40	TOTAL V_m	AVG. ΔH	AVG. T_m	
		25.369	1.5	41.0	

Impinger volume

Final, ml 242 + 112 354
Initial, ml 200 ml
Net, ml 154 mL

Silica gel weight

Final, g 305.3
Initial, g 300 g
Net, g 5.3

CALCULATIONS

(1) P_b = 30.34
(2) Total V_m = 25.369
(3) Avg. ΔH = 1.5
(4) Meter box cal. (Y) = .9950
(5) Avg. T_m = 41.0
(6) Net ml = 154
(7) Net g = 5.3

(8) $$V_{m(std)} = \frac{17.64 \times Y \times V_m \times (P_b + \frac{\Delta H}{13.6})}{(T + 460)} = \frac{17.64 \times \quad \times \quad (\quad + \frac{\quad}{13.6})}{(\quad + 460)}$$

$V_{m(std)}$ = 27.063

(9) $V_{w(std)}$ = (0.04707 * Net ml) + (0.04715 * Net g) =

$V_{w(std)}$ = (0.04707 *   ) + (0.04715 *   ) = 7.49625

(10) $$\% M = \frac{100 \times V_{w(std)}}{V_{w(std)} + V_{m(std)}} = \frac{100 \times}{\quad + \quad}$$ = 21.69%

WESTON

MOISTURE DETERMINATION FORM

Plant Scott Paper Date 1/11/95

Sample location Boiler #19 Run No. 1-W

Operator BU/ST Barometric Pressure (P_b), in. Hg 30.34

Initial leak rate .005 CFM @ 15" in. Hg

Final leak rate .003 CFM @ 5" in. Hg

Control box number Vtech #15 Control box Y .9950

Comments: GAS converted

	24-hr CLOCK TIME	GAS METER READING, ft^3	ORIFICE METER PRESSURE DIFFERENTIAL (ΔH), in. H_2O	DRY GAS METER TEMPERATURE (T_m) INLET, °F	OUTLET, °F
STOP	12:00	100.411	1.5	52/53/53	45/45/46
START	11:20	75.344	1.5	48/51/51	43/44/44
		TOTAL V_m	AVG. ΔH	AVG. T_m	
		25.067	1.5	48.0	

Impinger volume

Final, ml 355 ml

Initial, ml 200 ml

Net, ml 155 ml

Silica gel weight

Final, g 306.2 g

Initial, g 300 g

Net, g 6.2 g

CALCULATIONS

(1) P_b = 30.34

(2) Total V_m = 25.067

(3) Avg. ΔH = 1.5

(4) Meter box cal. (Y) = .9950

(5) Avg. T_m = 48.0

(6) Net ml = 155 ml

(7) Net g = 6.2 g

(8) $$V_{m(std)} = \frac{17.64 \times Y \times V_m \times (P_b + \frac{\Delta H}{13.6})}{(T + 460)} = \frac{17.64 \times \quad \times \quad (\quad + \frac{\quad}{13.6})}{(\quad + 460)}$$

$V_{m(std)}$ = 26.372

(9) $V_{w(std)}$ = (0.04707 * Net ml) + (0.04715 * Net g) =

$V_{w(std)}$ = (0.04707 *) + (0.04715 *) = 7.58816

(10) $$\% M = \frac{100 \times V_{w(std)}}{V_{w(std)} + V_{m(std)}} = \frac{100 \times}{\quad + \quad}$$ 22.34%

WESTON

MOISTURE DETERMINATION FORM

Plant: Scott Paper Date: 1/11/96
Sample location: Boiler #15 Run No.: Three
Operator: BH/SD Barometric Pressure (P_b), in. Hg: 30.34
Initial leak rate: Good/.002 CFM @ 15 in. Hg
Final leak rate: Good/.000 CFM @ 5" in. Hg
Control box number: Nutech #15 Control box Y: .9950
Comments: Gas Generated

	24-hr CLOCK TIME	GAS METER READING, ft^3	ORIFICE METER PRESSURE DIFFERENTIAL (ΔH), in. H_2O	DRY GAS METER TEMPERATURE (T_m) INLET, °F	DRY GAS METER TEMPERATURE (T_m) OUTLET, °F
STOP	13:15	125.926	1.5	58/57/57	51/51/51
START	12:35	100.520	1.5	54/54/58	48/48/51
		TOTAL V_m	AVG. ΔH	AVG. T_m	
		25.406	1.5	53.5	

Impinger volume

Final, ml: 346 ml
Initial, ml: 200 ml
Net, ml: 146 ml

Silica gel weight

Final, g: 312.0 g
Initial, g: 300 g
Net, g: 12 g

CALCULATIONS

(1) P_b = 30.34
(2) Total V_m = 25.406
(3) Avg. ΔH = 1.5
(4) Meter box cal. (Y) = .9950
(5) Avg. T_m = 53.5
(6) Net ml = 146 g
(7) Net g = 12 g

(8) $$V_{m(std)} = \frac{17.64 \times Y \times V_m \times (P_b + \frac{\Delta H}{13.6})}{(T + 460)} = \frac{17.64 \times \quad \times \quad (\quad + \frac{\quad}{13.6})}{(\quad + 460)}$$

$V_{m(std)}$ = 26.44

(9) $V_{w(std)}$ = (0.04707 * Net ml) + (0.04715 * Net g) =

$V_{w(std)}$ = (0.04707 *) + (0.04715 *) = 7.43802

(10) $$\% M = \frac{100 \times V_{w(std)}}{V_{w(std)} + V_{m(std)}} = \frac{100 \times}{\quad + \quad}$$ = 21.9 %

WESTON

g:\shared\airteam\forms\epa4.drw

APPENDIX B

PROCESS OPERATIONS DATA

WESTON
MANAGERS DESIGNERS/CONSULTANTS

SHEET 1 of 4

CLIENT/SUBJECT Kimberly-Clark W.O. NO.
TASK DESCRIPTION Gas Usage Data - Paper Machine 19 TASK NO.
PREPARED BY T. Bernstiel DEPT DATE
MATH CHECK BY DEPT DATE
METHOD REV. BY DEPT DATE
APPROVED BY
DEPT DATE

Gas Usage Data 11 January 1996

		East Meter		West Meter	
RUN	Time	Usage Rate (SCFH)	Cumulative Total (SCF)	Usage Rate (SCFH)	Cumulative Total (SCF)
Pre-1	1009	46610	12475767		
Post-1	1110	45370	12523144		
Pre-1	1012			34740	8911123
Post-1	1112			34070	8945910
Post-2	1157	46350	12559769		
Post-2	1159	?		34730	8972251
Pre-3	1311	47160	12617617		
Post-3	1417	46240	12669358		
Pre-3	1312			34730	9014404
Post-3	1419			35130	9053112

Gas NUMBERS

RUN #1 #1 PRE

10:09 am - 12475907 std. cf
~~3x~~
46,610 scfh

11:10 am - 12,523,144 std.
45390 scfh

#2

10:12 am - 8911023X std. cf
34,740 scfh

11:12 am - 8945290 std.
34070 scfh

RUN #2
unit #1
@ 11:10 - 12523144 std. cf.
45390 scfh

unit #2
@ 11:12 8945290 std cf.
34070 SCFH

Run 2 unit #1
@ 1157 12559709 Std CF
46350 SCFH

unit # 2
@ 1159 8972251 . Std. CF
34730 SCFH

RUN #3
unit # 1
@13:11 12617617 Std CF.
47160 SCFH

unit #2
13:12
9014404 . std. CF.
34730 SCFH

unit #1
@ 14:17
12669358 Std. CF.
46240 SCFH

unit #2
@ 1419
9053112 . Std CF
35130 SCFH

APPENDIX C

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS FOR VOLUMETRIC FLOW (EPA METHOD 2,3 AND 4)

Client: SCOTT PAPER	Plant: CHESTER, PA.
Test Number: Run 2	Test Date: 01-11-96
Test Location: PAPER MACHINE 19	Test Period: 1115-1215

1. Volume of dry gas sampled at standard conditions (68 deg F, 29.92 in. Hg), dscf.

$$Vm(std) = \frac{17.64 \times Y \times Vm \times \left(Pb + \frac{delt\ H}{13.6} \right)}{(Tm + 460)}$$

$$Vm(std) = \frac{17.64 \times 0.9950 \times 25.067 \times \left(30.34 + \frac{1.500}{13.6} \right)}{48.00 + 460} = 26.373$$

Where:

Vm(std)	=	Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscf.
Vm	=	Volume of gas sample measured by the dry gas meter at meter conditions, dcf.
Pb	=	Barometric Pressure, in Hg.
delt H	=	Average pressure drop across the orifice meter, in H_20.
Tm	=	Average dry gas meter temperature , deg F.
Y	=	Dry gas meter calibration factor.
17.64	=	Factor that includes ratio of standard temperature (528 deg R) to standard pressure (29.92 in. Hg), deg R/in. Hg.
13.6	=	Specific gravity of mercury.

2. Volume of water vapor in the gas sample corrected to standard conditions, scf.

Vw(std)	=	(0.04707 x Vwc) + (0.04715 x Wwsg)
Vw(std)	=	(0.04707 x 155.0) + (0.04715 x 6.2) = 7.588

Where:

Vw(std)	=	Volume of water vapor in the gas sample corrected to standard conditions, scf.
Vwc	=	Volume of liquid condensed in impingers, ml.
Wwsg	=	Weight of water vapor collected in silica gel, g.
0.04707	=	Factor which includes the density of water (0.002201 lb/ml), the molecular weight of water (18.0 lb/lb-mole), the ideal gas constant 21.85 (in. Hg) (ft^3)/lb-mole)(deg R); absolute temperature at standard conditions (528 deg R), absolute pressure at standard conditions (29.92 in. Hg), ft^3/ml.
0.04715	=	Factor which includes the molecular weight of water (18.0 lb/lb-mole), the ideal gas constant 21.85 (in. Hg) (ft^3)/lb-mole)(deg R); absolute temperature at standard conditions (528 deg R), absolute pressure at standard conditions (29.92 in. Hg), and 453.6 g/lb, ft^3/g.

3. Moisture content

$$Bws = \frac{Vw(std)}{Vw(std) + Vm(std)}$$

$$Bws = \frac{7.588}{7.588 + 26.373} = 0.223$$

Where:

Bws	=	Proportion of water vapor, by volume, in the gas stream, dimensionless.

4. Mole fraction of dry gas.

Md	=	$1 - Bws$
Md	=	$1 - 0.223 = 0.777$

Where:

Md	=	Mole fraction of dry gas, dimensionless.

5. Dry molecular weight of gas stream, lb/lb-mole.

MWd	=	$(0.440 \times \% CO_2) + (0.320 \times \% O_2) + (0.280 \times (\% N_2 + \% CO))$
MWd	=	$(0.440 \times 1.50) + (0.320 \times 18.00) + (0.280 \times (80.50 + 0.00))$
	=	28.96

Where:

MWd	=	Dry molecular weight, lb/lb-mole.
$\% CO_2$	=	Percent carbon dioxide by volume, dry basis.
$\% O_2$	=	Percent oxygen by volume, dry basis.
$\% N_2$	=	Percent nitrogen by volume, dry basis.
$\% CO$	=	Percent carbon monoxide by volume, dry basis.
0.440	=	Molecular weight of carbon dioxide, divided by 100.
0.320	=	Molecular weight of oxygen, divided by 100.
0.280	=	Molecular weight of nitrogen or carbon monoxide, divided by 100.

6. Actual molecular weight of gas stream (wet basis), lb/lb-mole.

MWs = (MWd x Md) + (18 x (1−Md))

MWs = (28.96 x 0.777) + (18 x (1−0.777)) = 26.51

Where:

MWs = Molecular weight of wet gas, lb/lb-mole.

18 = Molecular weight of water, lb/lb-mole.

7. Average velocity of gas stream at actual conditions, ft/sec.

$$Vs = 85.49 \times Cp \times ((\text{delt p})^{\wedge}1/2)\text{avg} \times \left(\frac{\text{Ts (avg)}}{\text{Ps} \times \text{MWs}}\right)^{\wedge}1/2$$

$$Vs = 85.49 \times 0.84 \times 1.058815 \times \left(\frac{677}{30.15 \times 26.51}\right)^{\wedge}1/2 = 69.99$$

Where:

Vs = Average gas stream velocity, ft/sec.

85.49 = Pitot tube constant, $\text{ft/sec} \times \frac{(\text{lb/lb-mole})(\text{in. Hg})^{\wedge}1/2}{(\text{deg R})(\text{in H2O})}$

Cp = Pitot tube coefficient, dimensionless.

Ts = Absolute gas stream temperature, deg R = Ts, deg F + 460.

Ps = Absolute gas stack pressure, in. Hg. = $\text{Pb} + \frac{\text{P(static)}}{13.6}$

delt p = Velocity head of stack, in. H_2O.

8. Average gas stream volumetric flowrate at actual conditions, wacf/min.

$$Qs(act) = 60 \times Vs \times As$$

$$Qs(act) = 60 \times 69.99 \times 34.04 = 142900$$

Where:

Qs(act) = Volumetric flowrate of wet stack gas at actual conditions, wacf/min.

As = Cross-sectional area of stack, ft^2.

9. Average gas stream dry volumetric flowrate at standard conditions, dscf/min.

$$Qs(std) = 17.64 \times Md \times \frac{Ps}{Ts} \times Qs(act)$$

$$Qs(std) = 17.64 \times 0.777 \times \frac{30.15}{677} \times 142900$$

$$= 87200$$

Where:

Qs(std) = Volumetric flowrate of dry stack gas at standard conditions, dscf/min.

SAMPLE CALCULATIONS FOR BIAS CORRECTION AND EMISSION RATES OF OXIDES OF NITROGEN

Client: SCOTT PAPER
Test Number: RUN 2
Test Location: PAPER MACHINE 19

Plant: CHESTER, PA.
Test Date: 01-11-96
Test Period: 1115-1215

1. Bias corrected value of oxides of nitrogen as NO2.

$$C(corr) = \frac{AVG - ZERO}{BIAS - ZERO} \times SPAN\ GAS$$

$$C(corr) = \frac{13.5 - 0.2}{55.4 - 0.2} \times 59.4$$

$$C(corr) = 14.3$$

Where:

AVG = Average NOx concentration for the test run as NO2 as reported by the analyzer.

ZERO = The average of pre and post test zero bias check of the complete system with "zero" air.

BIAS = The average of pre and post test bias check of the complete system with the calibration span gas.

SPAN GAS = The calibration gas closest to the gas stream concentration, which was used for a BIAS check.

C(corr) = Bias corrected value of oxides of nitrogen as NO2.

2. **Oxides of nitrogen emission rate, lbs/hr.**

$$MR(NOx) = \frac{C(corr) \times Qs(std) \times 46.01 \times 60 \text{ min/hr}}{385.35 \times 10^6}$$

$$MR(NOx) = \frac{14.3 \times 87200 \times 46.01 \times 60 \text{ min/hr}}{385.35 \times 10^6}$$

$$MR(NOx) = 8.95$$

Where:

MR(NOx) = Oxides of nitrogen emission rate, lbs/hr.

Qs(std) = Average volumetric gas stream flow rate at standard conditions, dscf/min.

46.01 = Molecular weight of NO_2.

385.35 = Conversion of 1 lb•mole of gas to scf

10^6 = Conversion factor from ppm

3. **Oxides of nitrogen emission rate, lbs/MMBtu[1].**

$$E1 = Cd \bullet Fc \bullet (100 / \%CO2)$$

$$E1 = (14.3 \bullet 1.194e-7) \bullet 1040 \bullet (100 / 1.5)$$

$$E1 = 0.1184$$

Where:

E1 = Emission rate in lb/MMBtu

Cd = NOx concentration measured on dry basis (ppm/v)

Fc = Published F– factor for natural gas (1040 scf/MMbtu)

1.194e–7 = Conversion factor from ppm NOx to lb/dscf

1 40CFR60 \Appendix A Reference Method 19

APPENDIX D

EQUIPMENT CALIBRATIONS AND NO_x INTERFERENCE CHECK DATA

WESTON
MANAGERS DESIGNERS CONSULTANTS

INTERFERENCE RESPONSE CHECK
OXIDES OF NITROGEN
TECO MODEL 42H CHEMILUMINESCENT ANALYZER
DATA SUMMARY

TEST GAS	INSTRUMENT RESPONSE (ppm)
Zero Air	0.2
Oxides of Nitrogen (NO_x) - 48.6 ppmv	49.1
Sulfur Dioxide (SO_2) - 250.8 ppmv	1.1
Oxygen (O_2) - 20.9% (Zero Air)	0.4
Carbon Dioxide (CO_2) - 9.9%	0
Carbon Monoxide (CO) - 800 ppmv (Zero Air)	0.2

NO_x ANALYZER CATALYST EFFICIENCY CHECK
MAY 1994
MODEL 42H

DATE	TIME	NO_x
18 May 94	13.35	44.17
18 May 94	13.36	44.09
18 May 94	13.37	43.93
18 May 94	13.38	43.81
18 May 94	13.39	43.72
18 May 94	13.40	43.54
18 May 94	13.41	43.61
18 May 94	13.42	43.73
18 May 94	13.43	43.58
18 May 94	13.44	43.61
18 May 94	13.45	43.68
18 May 94	13.46	43.31
18 May 94	13.47	43.38
18 May 94	13.48	43.29
18 May 94	13.49	43.28
18 May 94	13.50	43.48
18 May 94	13.51	43.63
18 May 94	13.52	43.30
18 May 94	13.53	43.39
18 May 94	13.54	43.31
18 May 94	13.55	42.99
18 May 94	13.56	43.48
18 May 94	13.57	43.15
18 May 94	13.58	43.23
18 May 94	13.59	43.37
18 May 94	14.00	43.31
18 May 94	14.01	42.92
18 May 94	14.02	43.13
18 May 94	14.03	43.30
18 May 94	14.04	43.35
18 May 94	14.05	43.09
Average		43.46

LIQUID CARBONIC
CYLINDER GAS PRODUCTS
EAST COAST REGION
145 SHIMERSVILLE RD., BETHLEHEM, PA 18015
610-691-2474
FAX # 610-758-8384

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

CUSTOMER ROY F. WESTON P.O NUMBER 43045

REFERENCE STANDARD

COMPONENT	NIST SRM NO.	CYLINDER NO.	CONCENTRATION
CARBON DIOXIDE 14.38% GMIS VS.	1675B	FF28127	14.04%
OXYGEN 21.09% GMIS VS.	2659A	FF-27650	20.71%

ANALYZER READINGS

R=REFERENCE STANDARD Z=ZERO GAS C=GAS CANDIDATE

1. COMPONENT CARBON DIOXIDE 14.38% GMIS ANALYZER MAKE-MODEL-S/N SIEMENS ULTRAMAT 5E C7-228
ANALYTICAL PRINCIPLE NDIR LAST CALIBRATION DATE 01/31/95
FIRST ANALYSIS DATE 02/14/95 SECOND ANALYSIS DATE

Z	0.00	R	14.38	C	4.96	CONC.	4.96	Z		R		C		CONC.	
R	14.38	Z	0.00	C	4.96	CONC.	4.96	R		Z		C		CONC.	
Z	0.00	C	4.96	R	14.38	CONC.	4.96	Z		C		R		CONC.	
U/M	%			MEAN TEST ASSAY			4.96	U/M		%		MEAN TEST ASSAY			

2. COMPONENT OXYGEN 21.09% GMIS VS. ANALYZER MAKE-MODEL-S/N SYBRON SERVOMEX 244A 244/701/953
ANALYTICAL PRINCIPLE PARAMAGNETIC LAST CALIBRATION DATE 01/31/95
FIRST ANALYSIS DATE 02/14/95 SECOND ANALYSIS DATE

Z	0.00	R	21.09	C	20.37	CONC.	20.37	Z		R		C		CONC.	
R	21.11	Z	0.00	C	20.36	CONC.	20.34	R		Z		C		CONC.	
Z	0.00	C	20.35	R	21.12	CONC.	20.32	Z		C		R		CONC.	
U/M	VOLTS			MEAN TEST ASSAY			20.34	U/M		VOLTS		MEAN TEST ASSAY			

THIS CYLINDER NO. SA 13437
HAS BEEN CERTIFIED ACCORDING TO SECTION EPA-600/R93/224
OF TRACEABILITY PROTOCOL NO. REV. 9/93
PROCEDURE G1
CERTIFIED ACCURACY ± 1 % NIST TRACEABLE
CYLINDER PRESSURE 2000 PSIG
CERTIFICATION DATE 2/14/95
EXPIRATION DATE 2/14/98

CERTIFIED CONCENTRATION

CARBON DIOXIDE	4.96%
OXYGEN	20.34%
NITROGEN	BALANCE

ANALYZED BY *Stan Leck*
STAN LECK

CERTIFIED BY *Bill Reightler*
BILL REIGHTLER

LIQUID CARBONIC

INDUSTRIES CORPORATION

145 SHIMERSVILLE RD., BETHLEHEM, PA 18015

610-691-2474
FAX # 610-758-8384

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

CUSTOMER ROY F. WESTON   P.O NUMBER 59093

REFERENCE STANDARD

COMPONENT	NIST SRM NO.	CYLINDER NO.	CONCENTRATION
CARBON DIOXIDE 14.38% GMIS VS.	1675B	FF-28116	14.04 %
OXYGEN 9.88% GMIS VS.	2658A	FF-27536	9.72%

ANALYZER READINGS

R=REFERENCE STANDARD   *Z=ZERO GAS*   *C=GAS CANDIDATE*

1. COMPONENT CARBON DIOXIDE 14.38% GMIS   ANALYZER MAKE-MODEL-S/N SIEMENS ULTRAMAT

ANALYTICAL PRINCIPLE NDIR   LAST CALIBRATION DATE 06/31/95

FIRST ANALYSIS DATE 07-05-95   SECOND ANALYSIS DATE

Z	0.00	R	14.38	C	17.54	CONC.	17.54	Z		R		C	CONC.
R	14.38	Z	0.00	C	17.58	CONC.	17.58	R		Z		C	CONC.
Z	0.00	C	17.58	R	14.38	CONC.	17.58	Z		C		R	CONC.

U/M %   MEAN TEST ASSAY 17.57   U/M %   MEAN TEST ASSAY

2. COMPONENT OXYGEN 9.88% GMIS VS.   ANALYZER MAKE-MODEL-S/N SYBRON SERVOMEX 244A 244/701/953

ANALYTICAL PRINCIPLE PARAMAGNETIC   LAST CALIBRATION DATE 06/31/95

FIRST ANALYSIS DATE 08/03/95   SECOND ANALYSIS DATE

Z	0	R	9.9	C	6.7	CONC.	6.69	Z		R		C	CONC.
R	9.8	Z	0.0	C	6.8	CONC.	6.79	R		Z		C	CONC.
Z	0	C	6.8	R	9.8	CONC.	6.79	Z		C		R	CONC.

U/M VOLTS   MEAN TEST ASSAY 6.76   U/M VOLTS   MEAN TEST ASSAY

THIS CYLINDER NO. SA 18885
HAS BEEN CERTIFIED ACCORDING TO SECTION EPA-600/R93/224
OF TRACEABILITY PROTOCOL NO. REV. 9/93
PROCEDURE G1
CERTIFIED ACCURACY ± 1 % NIST TRACEABLE
CYLINDER PRESSURE 2000 PSIG
CERTIFICATION DATE 8/ 3/95
EXPIRATION DATE 8/ 3/98

CERTIFIED CONCENTRATION

CARBON DIOXIDE	17.57%
OXYGEN	6.76%
NITROGEN	BALANCE

ANALYZED BY Karina Beck
KARINA BECK

CERTIFIED BY Stan Leck
STAN LECK

LIQUID CARBONIC

CYLINDER GAS PRODUCTS

EAST COAST REGION
145 SHIMERSVILLE RD., BETHLEHEM, PA 18015

610-691-2474
FAX # 610-758-8384

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

CUSTOMER ROY F. WESTON **P.O NUMBER** 59093

REFERENCE STANDARD

COMPONENT	NIST SRM NO.	CYLINDER NO.	CONCENTRATION
CARBON DIOXIDE 14.38% GMIS VS.	1675B	FF28127	14.04%
OXYGEN 9.85% GMIS VS.	2658A	FF-27638	9.72%

ANALYZER READINGS

R=REFERENCE STANDARD *Z=ZERO GAS* *C=GAS CANDIDATE*

1. **COMPONENT** CARBON DIOXIDE 14.38% GMIS **ANALYZER MAKE-MODEL-S/N** SIEMENS ULTRAMAT 5E C7-228

ANALYTICAL PRINCIPLE NDIR **LAST CALIBRATION DATE** 05/31/95

FIRST ANALYSIS DATE 06/30/95 **SECOND ANALYSIS DATE**

Z	0.00	R	14.14	C	9.80	CONC.	9.97	Z		R		C		CONC.	
R	14.12	Z	0.00	C	9.86	CONC.	10.04	R		Z		C		CONC.	
Z	0.00	C	9.86	R	14.14	CONC.	10.03	Z		C		R		CONC.	
U/M	%			MEAN TEST ASSAY			10.01	U/M	%			MEAN TEST ASSAY			

2. **COMPONENT** OXYGEN 9.85% GMIS VS. **ANALYZER MAKE-MODEL-S/N** SYBRON SERVOMEX 244A 244/701/953

ANALYTICAL PRINCIPLE PARAMAGNETIC **LAST CALIBRATION DATE** 05/31/95

FIRST ANALYSIS DATE 06/30/95 **SECOND ANALYSIS DATE**

Z	0.0	R	9.9	C	12.4	CONC.	12.34	Z		R		C		CONC.	
R	9.9	Z	0.0	C	12.4	CONC.	12.34	R		Z		C		CONC.	
Z	0.0	C	12.4	R	9.9	CONC.	12.34	Z		C		R		CONC.	
U/M	VOLTS			MEAN TEST ASSAY			12.34	U/M	VOLTS			MEAN TEST ASSAY			

THIS CYLINDER NO. SA 19012
HAS BEEN CERTIFIED ACCORDING TO SECTION EPA-600/R93/224
OF TRACEABILITY PROTOCOL NO. REV. 9/93
PROCEDURE G1
CERTIFIED ACCURACY ± 1 % **NIST TRACEABLE**
CYLINDER PRESSURE 2000 PSIG
CERTIFICATION DATE 6/30/95
EXPIRATION DATE 6/30/98

CERTIFIED CONCENTRATION	
CARBON DIOXIDE	10.01%
OXYGEN	12.34%
NITROGEN	BALANCE

ANALYZED BY Stan Leck
STAN LECK

CERTIFIED BY Steve Bogar
STEVE BOGAR

213-585-2154
FAX# 213-585-0582

LIQUID CARBONIC

CYLINDER GAS PRODUCTS

5700 SOUTH ALAMEDA STREET • LOS ANGELES, CA 90058

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

CUSTOMER E.I.D. P.O NUMBER SG145824 RE:112095-1

REFERENCE STANDARD

COMPONENT		NIST SRM NO.	CYLINDER NO.	CONCENTRATION
NITRIC OXIDE	GMIS	vs 2629a	SGAL 929	25.6 ppm

ANALYZER READINGS

R=REFERENCE STANDARD Z=ZERO GAS C=GAS CANDIDATE

COMPONENT NITRIC OXIDE GMIS ANALYZER MAKE-MODEL-S/N Beckman 951A S/N 0101354
ANALYTICAL PRINCIPLE Chemiluminescence LAST CALIBRATION DATE 11/29/95
FIRST ANALYSIS DATE 12/13/95 SECOND ANALYSIS DATE 12/20/95

Z 0	R 921	C 971	CONC.	27.0 ppm	Z 0	R 915	C 967	CONC.	27.1 ppm
R 922	Z 0	C 977	CONC.	27.1 ppm	R 915	Z 0	C 972	CONC.	27.2 ppm
Z 0	C 977	R 922	CONC.	27.1 ppm	Z 0	C 972	R 915	CONC.	27.2 ppm
U/M mV			MEAN TEST ASSAY	27.1 ppm	U/M mV			MEAN TEST ASSAY	27.2 ppm

Values not valid below 150 psig

THIS CYLINDER NO. SA 10523
HAS BEEN CERTIFIED ACCORDING TO SECTION EPA-600/R93/224
OF TRACEABILITY PROTOCOL NO. Rev. 9/93
PROCEDURE G1
CERTIFIED ACCURACY ± 1 % NIST TRACEABLE
CYLINDER PRESSURE 2000 PSIG
CERTIFICATION DATE 12/20/95
EXPIRATION DATE 12/20/97 TERM 24 MONTHS

CERTIFIED CONCENTRATION	
NITRIC OXIDE	27.2 ppm
NITROGEN	BALANCE
NOx	28.0 ppm

ANALYZED BY Eliza Zabala
ELIZA ZABALA

CERTIFIED BY
KWAN T. YOUNG

LIQUID CARBONIC

CYLINDER GAS PRODUCTS

610-691-2474
FAX # 610-758-8384

EAST COAST REGION
145 SHIMERSVILLE RD., BETHLEHEM, PA 18015

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

CUSTOMER R.F WESTON

P.O NUMBER

REFERENCE STANDARD

COMPONENT		NIST SRM NO.	CYLINDER NO.	CONCENTRATION
NITRIC OXIDE	100.3 PPM GMIS VS.	1684B	CLM-008395	96.8 PPM

ANALYZER READINGS

R=REFERENCE STANDARD Z=ZERO GAS C=GAS CANDIDATE

1. COMPONENT NITRIC OXIDE 100.3 PPM GMIS ANALYZER MAKE-MODEL-S/N THERMO ENVIRON. 14A 14A-35387-250

ANALYTICAL PRINCIPLE CHEMILUMINESCENCE LAST CALIBRATION DATE 04/30/95

FIRST ANALYSIS DATE 05/11/95 SECOND ANALYSIS DATE 05/22/95

Z	0.00	R	0.95	C	0.56	CONC.	59.1	Z	0.00	R	0.64	C	0.38	CONC.	59.6
R	0.95	Z	0.00	C	0.56	CONC.	59.1	R	0.64	Z	0.00	C	0.38	CONC.	59.6
Z	0.00	C	0.56	R	0.95	CONC.	59.1	Z	0.00	C	0.38	R	0.64	CONC.	59.6
U/M	mV			MEAN TEST ASSAY			59.1	U/M	mV			MEAN TEST ASSAY			59.6

SHOULD NOT BE USED BELOW 150 PSIG

THIS CYLINDER NO. SA 16325
HAS BEEN CERTIFIED ACCORDING TO SECTION EPA-600/R93/224
OF TRACEABILITY PROTOCOL NO. REV. 9/93
PROCEDURE G1
CERTIFIED ACCURACY ± 1.0 % NIST TRACEABLE
CYLINDER PRESSURE 2000 PSIG
CERTIFICATION DATE 05/22/95
EXPIRATION DATE 05/22/97 TERM 24 MONTHS

CERTIFIED CONCENTRATION	
NITRIC OXIDE	59.4 ppm
NITROGEN	BALANCE

ANALYZED BY KEVIN BRADY

CERTIFIED BY BOB [illegible]ARD

213-585-2154
FAX# 213-588-0582

LIQUID CARBONIC

CYLINDER GAS PRODUCTS

5700 SOUTH ALAMEDA STREET • LOS ANGELES, CA 90058

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

CUSTOMER E.I.D. P.O NUMBER SG145824 RE:112095-1

REFERENCE STANDARD

COMPONENT		NIST SRM NO.	CYLINDER NO.	CONCENTRATION
NITRIC OXIDE	GMIS	vs. 1684b	SA 13760	98.5 ppm

ANALYZER READINGS

R=REFERENCE STANDARD *Z=ZERO GAS* *C=GAS CANDIDATE*

1. COMPONENT NITRIC OXIDE GMIS ANALYZER MAKE-MODEL-S/N Beckman 951A S/N 0101354

ANALYTICAL PRINCIPLE Chemiluminescence LAST CALIBRATION DATE 11/29/95

FIRST ANALYSIS DATE 12/04/95 SECOND ANALYSIS DATE 12/11/95

Z 0	R 865	C 732	CONC.	83.4 ppm	Z 0	R 853	C 720	CONC.	83.1 ppm
R 865	Z 0	C 732	CONC.	83.4 ppm	R 853	Z 0	C 719	CONC.	83.0 ppm
Z 0	C 734	R 868	CONC.	83.3 ppm	Z 0	C 720	R 857	CONC.	82.8 ppm
U/M mV			MEAN TEST ASSAY	83.4 ppm	U/M mV			MEAN TEST ASSAY	83.0 ppm

Values not valid below 150 psig
NOx values for reference only

THIS CYLINDER NO. SA 14127
HAS BEEN CERTIFIED ACCORDING TO SECTION EPA-600/R93/224
OF TRACEABILITY PROTOCOL NO. Rev. 9/93
PROCEDURE G1
CERTIFIED ACCURACY ± 1 % NIST TRACEABLE
CYLINDER PRESSURE 2000 PSIG
CERTIFICATION DATE 12/11/95
EXPIRATION DATE 12/11/97 TERM 24 MONTHS

CERTIFIED CONCENTRATION	
NITRIC OXIDE	83.2 ppm
NITROGEN	BALANCE
NOx	85.4 ppm

ANALYZED BY ELIZA ZABALA *CERTIFIED BY* TY TRIPLETT

PITOT TUBE IDENTIFICATION NUMBER: P - 110

TYPE S PITOT TUBE INSPECTION DATA FORM

PITOT TUBE ASSEMBLY LEVEL? ✓ (YES) ______ (NO)

PITOT TUBE OPENINGS DAMAGED? ______ (YES-EXPLAIN BELOW) ✓ (NO)

α_1 = 2 ° (<10°) α_2 = 2 ° (<10°)

β_1 = 2 ° (< 5°) β_2 = 1 ° (< 5°)

Υ = 0 ° θ = 0 ° A = 85 cm (in.)

$z = A \sin \Upsilon$ = 0 cm (in.); <0.32 cm (<1/8 in.),

$w = A \sin \theta$ = 0 cm (in.); <0.32 cm (<1/8 in.),

P_a .46 cm (in.) P_b .46 cm (in.)

D_t .38 cm (in.)

COMMENTS ______

CALIBRATION REQUIRED? ______ (YES) ✓ (NO)

INSPECTOR Walter Peters DATE 3/7/95

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WESTON

LONG/PRE DRY GAS METER CALIBRATION DATA FORM

Calibrator P. Mack

Date 8/03/95 Meter Box Number 15 Plant

Barometric pressure, P_b = 29.74 in. Hg Dry Gas Meter Number 138735 Comments

Setting	Gas volume		Temperatures						
Orifice manometer	Wet test meter	Dry gas meter	Wet test meter	Dry gas meter					
(Δ H) in. H_2O	(V_w) ft^3	(V_d) ft^3	(t_w) °F	Inlet (td_i) °F	Outlet (td_o) °F	Avg (t_d) °F	Time (Θ), min	Y_i	$\Delta H@_i$ in. H_2O
0.5	5	474.636 469.539	71	79,79,80	76,76,77	78	12.8	.9926	1.830
1.0	5	480.731 475.648	71	78,78,79	76,76,77	77.5	9.2	.9932	1.893
1.5	10	491.914 481.745	71	80,82,83	77,77,78	79.5	15.6	.9954	2.034
2.0	10	502.115 492.425	71.5	83,85,86	78,78,79	81.5	13.6	.9948	2.057
3.0	10	514.310 504.130	71.5	88,89,91	79,80,80	84.5	11.0	.9989	2.007
							Avg	Y .9950	Δ H @ 1.964

If there is only one thermometer on the dry gas meter, record the temperature under td_o.

(ΔH) in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$	$\Delta H@i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\Theta}{V_w}\right]^2$
0.5	0.0368	$\frac{(5)(29.74)(78+460)}{(5.097)(29.74+.0368)(71+460)}$	$\frac{(.0317)(.5)}{(29.74)(78+460)}\left[\frac{(71+460)(12.8)}{5}\right]^2$
1.0	0.0735	$\frac{(5)(29.74)(77.5+460)}{(5.083)(29.74+.0735)(71+460)}$	$\frac{(.0317)(1.0)}{(29.74)(77.5+460)}\left[\frac{(71+460)(9.2)}{5}\right]^2$
1.5	0.110	$\frac{(10)(29.74)(79.5+460)}{(10.169)(29.74+.110)(71+460)}$	$\frac{(.0317)(1.5)}{(29.74)(79.5+460)}\left[\frac{(71+460)(15.6)}{10}\right]^2$
2.0	0.147	$\frac{(10)(29.74)(81.5+460)}{(10.190)(29.74+.147)(71.5+460)}$	$\frac{(.0317)(2.0)}{(29.74)(81.5+460)}\left[\frac{(71.5+460)(13.6)}{10}\right]^2$
3.0	0.221	$\frac{(10)(29.74)(84.5+460)}{(10.180)(29.74+.221)(71.5+460)}$	$\frac{(.0317)(3.0)}{(29.74)(84.5+460)}\left[\frac{(71.5+460)(11.0)}{10}\right]^2$

WESTON

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

DATE 8/02/95
AMBIENT TEMPERATURE 74
CALIBRATION [illegible]

POTENTIOMETER NUMBER 2010 #15
BAROMETRIC PRESSURE 29.64
REFERENCE: THERMOCOUPLE SIMULATOR (ACCURACY ± 1°F)

REFERENCE TEMPERATURE °C	REFERENCE TEMPERATURE °F	TEMPERATURE READING FROM THERMOCOUPLE CHANNEL INPUT NUMBER 1	2	3	4	5	AVERAGE TEMPERATURE READING ⓐ	TEMPERATURE DIFFERENCE ⓑ (%)
0	32	31	31	31	31	31	31	1° - .2%
100	212	213	213	213	213	213	213	1° - .14%
500	932	932	932	932	932	932	932	0° - 0%
1000	1832	1830	1830	1830	1830	1830	1830	2° - .08%

COMMENTS

ⓐ AVERAGE TEMPERATURE READING = MEAN OF THE TEMPERATURE READINGS FOR THE THERMOCOUPLE CHANNELS

ⓑ THE CHANNEL READINGS MUST AGREE WITHIN ± 5°F OR 3°C

ACCEPTABLE TEMPERATURE DIFFERNCE ≤ 1.5 = $\left(\frac{(\text{REF TEMP}^\circ F + 460) - (\text{TEST TEMP}^\circ F + 460)}{(\text{REF TEMP}^\circ F + 460)}\right) \times 100$

POTCAL-AT

alibrator P. Mack

POSTTEST DRY GAS METER CALIBRATION DATA FORM

ate 1/24/94 Meter box number 15 Plant Scott Paper

arometric pressure, P_b = 29.11 in. Hg Dry gas meter number 138735 Pretest Y .9904

Setting: Orifice Manometer (ΔH) in. H_2O	Gas Volume: Wet test meter (V_w) ft^3	Gas Volume: Dry gas meter (V_d) ft^3	Temperature: Wet test meter (t_w) °F	Temperature: Dry gas meter Inlet (td_i) °F	Temperature: Dry gas meter Outlet (td_o) °F	Temperature: Dry gas meter Average (t_d) °F	Time (θ), min.	Vacuum Setting, in. Hg.	Y_i	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
1.5	10	243.087 232.899	67	75,77,78	70,70,71	73.5	15.9	3	.9897	
1.5	10	253.305 243.087	67	78,79,80	71,72,73	75.5	15.9	3	.9909	
1.5	10	263.573 253.305	67	79,80,81	73,74,74	77	15.9	3	.9886	
									Y = .9897	

there is only one thermometer on the dry gas meter, record the temperature under td_o.

= Gas volume passing through the wet test meter, ft^3.
= Gas volume passing through the dry gas meter, ft^3.
= Temperature of the gas in the wet test meter, °F.
= Temperature of the inlet gas of the dry gas meter, °F.
= Temperature of the outlet gas of the dry gas meter, °F.
= Average temperature of the gas in the dry gas meter, $\frac{td_i + td_o}{2}$.

$$\Delta H@_i = \frac{0.0317\Delta H}{P_b(t_d+460)}\left[\frac{(t_w+460)\theta}{V_w}\right]^2$$

H = Pressure differential across orifice, in. H_2O.
= Ratio of accuracy of wet test meter to dry gas meter for each run.
= Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y ± 0.05Y.
= Barometric pressure, in. Hg.
= Time of calibration run, min.

ong calibration required? Yes ✓ No ______

WESTON

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

DATE 1/24/96
AMBIENT TEMPERATURE 67
CALIBRATION O/C, Pollack

POTENTIOMETER NUMBER 2010 #15
BAROMETRIC PRESSURE 27.11
REFERENCE: THERMOCOUPLE SIMULATOR (ACCURACY ± 1°F)

REFERENCE TEMPERATURE °C	REFERENCE TEMPERATURE °F	TEMPERATURE READING FROM THERMOCOUPLE CHANNEL INPUT NUMBER 1	2	3	4	5	AVERAGE TEMPERATURE READING ⓐ	TEMPERATURE DIFFERENCE ⓑ (%)
0	32	33, 32	34, 32	34, 32	33, 32	33, 32	33.4, 32	0° - 0%
100	212	214, 213	215, 213	215, 213	214, 213	214, 213	214.4, 213	1° - .15%
500	932	933, 932	934, 932	934, 932	933, 932	933, 932	933.4, 932	0° - 0%
1000	1832	1828, 1826	1828, 1826	1828, 1826	1828 1826	1828, 1826	1828, 1826	6° - .26%

COMMENTS adjusted to range

ⓐ AVERAGE TEMPERATURE READING = MEAN OF THE TEMPERATURE READINGS FOR THE THERMOCOUPLE CHANNELS

ⓑ THE CHANNEL READINGS MUST AGREE WITHIN ± 5°F OR 3°C

ACCEPTABLE TEMPERATURE DIFFERNCE ≤ 1.5 = $\left(\frac{(\text{REF TEMP}\,^\circ F + 460) - (\text{TEST TEMP}\,^\circ F + 460)}{(\text{REF TEMP}\,^\circ F + 460)}\right) \times 100$

POTCAL.67

APPENDIX E

LIST OF PROJECT PARTICIPANTS

WESTON
MANAGERS DESIGNERS/CONSULTANTS

WESTON PROJECT PARTICIPANTS

Roy Rakiewicz Project Manager	Environmental Sciences and Health Division
Thomas Bernstiel Principal Project Scientist	Environmental Sciences and Health Division
Stephen DiCarlo Assistant Engineer	Environmental Sciences and Health Division
Brian Houghton Assistant Project Scientist	Environmental Sciences and Health Division