TRC Environmental Corporation

EMISSIONS TESTING OF A PRESS REGENERATIVE THERMAL OXIDIZER

Presented to

Louisiana-Pacific Corporation
Houlton, Maine

Prepared by

TRC Environmental Corporation
Windsor, Connecticut

Raymond Potter
Manager, Emissions Measurement Group

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TRC Environmental Corporation
5 Waterside Crossing
Windsor, CT 06095
Telephone: (860) 289-8631
Facsimile: (860) 298-6399

Table of Contents

List of Figures

List of Tables

Appendices

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) was retained by Louisiana-Pacific Corporation to conduct an emissions measurement program on the regenerative thermal oxidizer (RTO) at the Louisiana-Pacific facility in New Limerick, Maine. The purpose of this program was to measure emissions of formaldehyde, oxides of nitrogen (NO_x), and carbon monoxide (CO) at the inlet and outlet of the RTO. Emissions measurements for NO_x, and CO were conducted in accordance with accepted USEPA test methodologies. Formaldehyde testing was conducted using the NCASI Acetylacetone Method for measuring formaldehyde in water.

The test program was conducted on December 14, 1995 and was supervised by Mr. Raul Baez of TRC. Ms. Sue Somers and Mr. Mark Stile, both of Louisiana-Pacific, provided the process and logistical support during the program.

Section 2.0 of this test report presents a summary and discussion of the test results. Section 3.0 describes the process and associated control equipment and the parameters that were monitored during testing. Section 4.0 details the test methods to be used, and Section 5.0 presents TRC's quality control plan for this program.

2.0 SUMMARY AND DISCUSSION OF RESULTS

The purpose of this program was to measure emissions of formaldehyde, oxides of nitrogen (NO_x), and carbon monoxide (CO) at the inlet and outlet of the regenerative thermal oxidizer (RTO). Emissions measurements for NO_x, and CO were conducted in accordance with accepted USEPA test methodologies. Formaldehyde testing was conducted using the NCASI Acetylacetone Method for measuring formaldehyde in water. The following sections provide the results for each pollutant.

2.1 Regenerative Thermal Oxidizer Emissions

Emissions measurements were conducted at the inlet and outlet of the regenerative thermal oxidizer (RTO) to determine inlet and outlet concentrations of formaldehyde, NO_x, and CO. Triplicate 60-minute formaldehyde tests were conducted at each location in accordance with the NCASI Acetylacetone Method for measurement of formaldehyde in water. Triplicate 20-minute NO_x and CO tests were conducted at each location in accordance with EPA Methods 7E and 10, respectively. In addition, TRC measured the volumetric flowrate, concentration of oxygen, and moisture content of the exhaust gases at each location in accordance with EPA Methods 1-4. The results of the inlet and outlet tests are presented in **Tables 2-1 and 2-2**, respectively. All associated field data are presented in **Appendix A**.

2.1.1 Formaldehyde Emissions

The results of the formaldehyde testing indicate that the average inlet concentration was 6.6 parts per million (ppm) and that the average inlet loading rate was 2.25 lb/hr. The average outlet concentration was 0.3 ppm and the average outlet emission rate was 0.10 lb/hr. The average removal efficiency of formaldehyde was 95.5 %.

2.1.2 NO_x and CO Emissions

The results of the continuous emissions monitoring for NO_x and CO at the inlet of the RTO indicate that the average NO_x concentration was 1.6 ppm and the average inlet loading rate was 0.83 lb/hr. The average CO concentration was 9.8 ppm and the average inlet loading rate was 3.10 lb/hr.

Table 2-1

Summary of Formaldehyde, NOx, and CO Loading at the RTO Inlet

Louisiana-Pacific Corporation
New Limerick, Maine
December 14, 1995

Test Number Time Location	In-1 1035-1135 RTO -Inlet	In-2 1200-1300 RTO -Inlet	In-3 1338-1438 RTO -Inlet	Average
Stack Conditions				
Stack Temperature (°F)	102	104	104	103
CO_2 (%)	0.00	0.00	0.00	0.00
O_2 (%)	20.8	20.9	20.8	20.8
Moisture (%)	1.33	1.37	1.40	1.36
Volumetric Flowrate, Actual (ACFM)	78432	79065	79364	78954
Volumetric Flowrate, Standard (SCFM)[a]	73109	73420	73688	73406
Volumetric Flowrate, Dry Std. (DSCFM)[b]	72137	72415	72660	72404
Formaldehyde Emissions				
Concentration (ppm)	5.9	6.5	7.6	6.6
Mass Emission Rate (lb/hr)[c]	1.98	2.20	2.57	2.25
NOx Emissions				
Concentration (ppm)	1.8	2.1	0.9	1.6
Mass Emission Rate (lb/hr)[c]	0.93	1.09	0.47	0.83
CO Emissions				
Concentration (ppm)	16.3	7.1	6.1	9.8
Mass Emission Rate (lb/hr)[c]	5.13	2.24	1.93	3.10

a - ACFM Actual Cubic Feet per Minute.
b - DSCFM Dry Standard Cubic Feet per Minute at 68°F and 29.92 in. Hg.
c - lb/hr = conc(ppm) x MW x flow(DSCFM) x 15.58E-08
MW Formaldehyde = 30
MW NOx = 46
MW CO = 28

Table 2-2

Summary of Formaldehyde, NOx, and CO Emissions at the RTO Outlet

Louisiana-Pacific Corporation
New Limerick, Maine
December 14, 1995

Test Number Time Location	out-1 1035-1135 RTO-outlet	out-2 1200-1300 RTO-outlet	out-3 1338-1438 RTO-outlet	Average
Stack Conditions				
Stack Temperature (°F)	232	234	235	233
CO_2 (%)	0.00	0.00	0.00	0.00
O_2 (%)	20.3	20.4	20.4	20.4
Moisture (%)	2.11	2.04	2.42	2.19
Volumetric Flowrate, Actual (ACFM)	95318	94835	96425	95526
Volumetric Flowrate, Standard (SCFM)[a]	72896	72370	73477	72914
Volumetric Flowrate, Dry Std. (DSCFM)[b]	71357	70891	71700	71316
Formaldehyde Emissions				
Concentration (ppm)	0.3	0.3	0.3	0.3
Mass Emission Rate (lb/hr)[c]	0.10	0.10	0.11	0.10
NOx Emissions				
Concentration (ppm)	15.9	16.0	15.6	15.8
Mass Emission Rate (lb/hr)[c]	8.13	8.13	8.02	8.09
CO Emissions				
Concentration (ppm)	16.5	15.8	16.6	16.3
Mass Emission Rate (lb/hr)[c]	5.14	4.89	5.19	5.07

a - ACFM Actual Cubic Feet per Minute.

b - DSCFM Dry Standard Cubic Feet per Minute at 68$_o$F and 29.92 in. Hg.

c - lb/hr = conc(ppm) x MW x flow(DSCFM) x 15.58E-08
    MW Formaldehyde = 30
    MW NOx = 46
    MW CO = 28

The results of the continuous emissions monitoring for NO_x and CO at the outlet of the RTO indicate that the average NO_x concentration was 15.8 ppm and the average emission rate was 8.09 lb/hr. The average CO concentration was 16.3 ppm and the average inlet loading rate was 5.07 lb/hr.

2.1.3 Volumetric Flowrate

Volumetric flowrate measurements were conducted at the inlet and outlet of the RTO in accordance with EPA Method 2. The results indicated that the inlet flowrate was approximately 1000 DSCFM greater than the outlet flowrate. However, the outlet flowrate should have been greater than the inlet flowrate due to the addition of combustion air. This error can be partially explained by the accuracy of the EPA Method 2. EPA Method 2 has an accuracy of +/- 10%. It is possible that the inlet measurement was biased high and the outlet may have been biased low.

3.0 PROCESS DESCRIPTION

The Houlton, Maine facility operates one oriented strandboard line including two wafer dryers, a press, and two thermal oil heaters.

3.1 Regenerative Thermal Oxidizer

The regenerative thermal oxidizer (RTO) is used to control emissions of volatile organic compounds and particulate matter from the press operation. The RTO is fired on natural gas. During testing the plant operated at approximately 90% of the daily production rate of 440 tons per day. Plant personnel monitored and recorded the following data:

Panels/Hour
Panel Weight
Press Temp.
Tons/Hour

Copies of the recorded process data are presented in **Appendix C**.

4.0 SAMPLING AND ANALYTICAL METHODS

Emissions measurements were conducted at the inlet and outlet of the RTO in accordance with the following methods.

4.1 NO_x and CO Emissions Measurements - EPA Methods 7E and 10

Triplicate 20-minute tests were conducted at the inlet and outlet of the RTO to measure concentrations of NO_x and CO. Testing was conducted in accordance with EPA Methods 7E and 10, respectively. Diluent concentrations of oxygen were measured in accordance with EPA Method 3A. A schematic of the measurement system is presented in **Figure 4-1.** A single CEMS was used to evaluate inlet and outlet concentrations. A three way valve was placed in line prior to the conditioning system, which allowed the operator to switch from the inlet to the outlet location and vice versa. Each sampling location had a dedicated sampling probe and heated sample line prior to the three way valve and conditioning system.

All CEM data was recorded by a Yokogawa Model 2300 strip chart/data logger which is capable of integrating 5-minute and 20-minute averages. The CEM system was housed in the TRC Mobile Environmental Laboratory (MEL) which was parked at the base of the RTO.

4.1.1 Sample Conditioning System

An in-stack Alundum thimble filter with a stainless steel nozzle facing away from the stack gas flow was used to remove any PM from the sample gas stream. The thimble filter was mounted on the end of a stainless steel sampling probe. The sample was then drawn through 100 feet of heated (325°F ± 25°F) Teflon sample line through a condenser system to remove the moisture from the gas stream. The sample was drawn through the tubing by a leak-free Teflon double-diaphragm pump to a stainless steel sample manifold with an atmospheric bypass rotameter. The analyzers then drew their samples from the manifold.

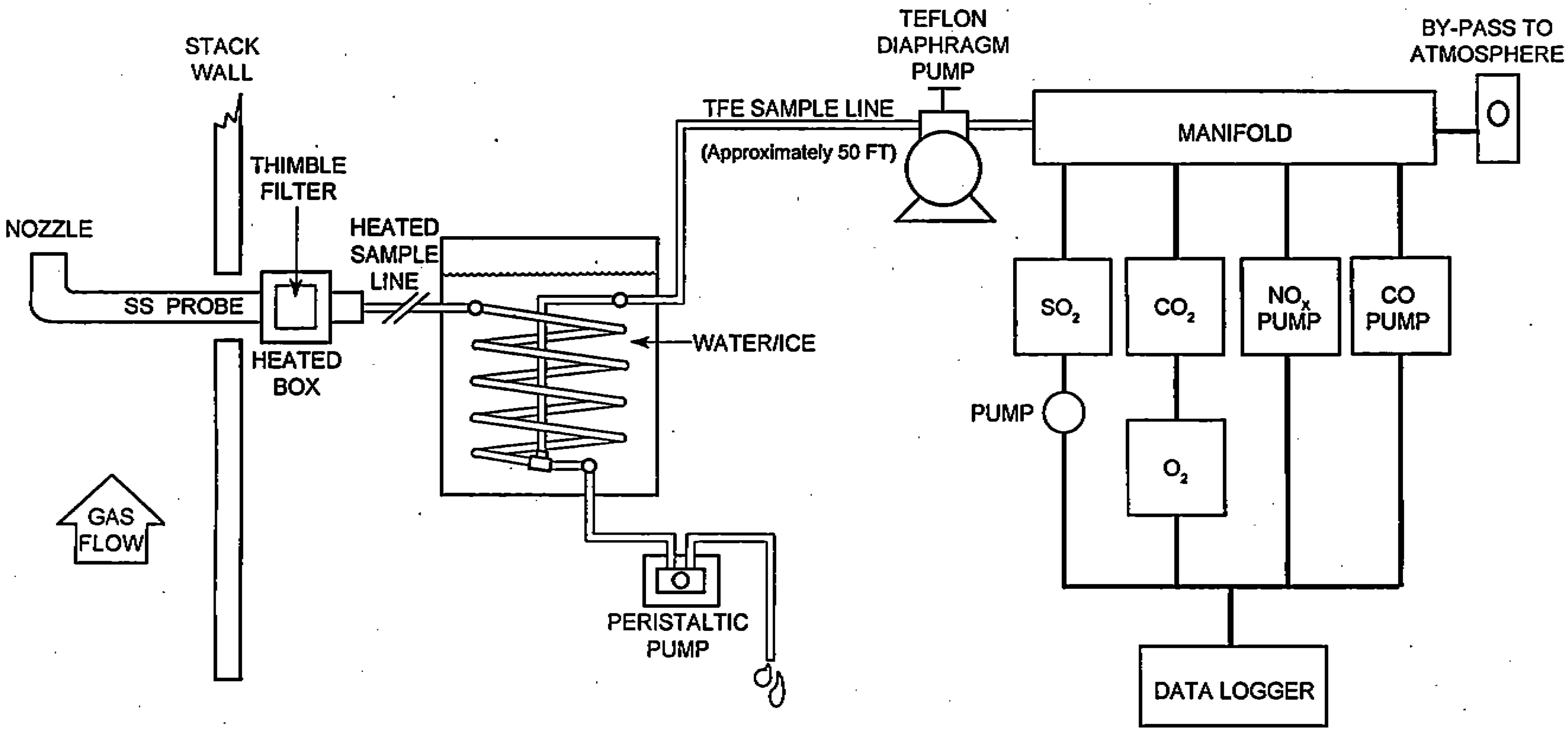

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FIGURE 4-1.

CONTINUOUS EMISSION MONITORING SYSTEM SCHEMATIC

EMISSN-3

4.1.2 NO_x Analyzer

A Thermo-Electron Corporation Model 10A Chemiluminescent NO/NO_x analyzer was used to determine NO_x concentrations. The chemiluminescent reaction of NO and O_3 (ozone) provides the basis for the analytical method ($NO + O_3 \rightarrow NO_2 + O_2$ + light). A photomultiplier-electrometer-amplifier produces a current proportional to the NO concentration. The output of the amplifier provides a signal for direct readout on a meter indicator, or for outputs to a recorder or computer.

4.1.3 CO Analyzer

A TECO Model 48 nondispersive infrared gas analyzer was used to measure CO concentrations. The analyzer contains an infrared detector that uses the signal nondispersive beam technique with alternate modulations of the sample and reference cells. Radiation absorbed by CO in the sample cell results in a capacitance change in the detector which is proportional to the CO concentration.

4.1.4 O_2 Analyzer

A Horiba Model PMA-200 O_2 analyzer was used to determine the concentration of O_2 in the stack gas. This instrument uses the paramagnetic principle, whereby the magnetic susceptibility of the gas volume is measured by the force acting on a nonmagnetic test body suspended in a magnetic field. The force is converted to an output current proportional to the O_2 concentration.

4.1.5 Data Acquisition and Handling

All CEM data was monitored by a Yokagawa Model 2400 automatic data logger. Emissions data was "viewed" by the data logger every six seconds, averaged, and printed at 5-minute intervals and 20-minute intervals.

4.1.6 CEM Calibrations

Calibrations (zero, low, mid, and high of span) of each analyzer were performed using EPA Protocol 1 gases at the beginning and end of each test period. Calibration gases were introduced to the system through a three-way valve at the back of the sample probe. The gas concentrations used were approximately 30%, 60%, and 90% of each analyzer's range. Each analyzer was multi-point calibrated at the beginning of the test program to establish linearity of each instrument.

4.2 Formaldehyde Measurements - NCASI Method

Triplicate 60-minute tests were conducted at the inlet and outlet of the RTO to measure concentrations of formaldehyde. Testing was conducted in accordance with the NCASI Acetylacetone Method (Determination of Formaldehyde in Water), with inlet and outlet testing conducted simultaneously. The sampling system describe in the NCASI method was modified by TRC. TRC's modification was to use a standard EPA Method 5 train with standard impingers instead of mini-impingers. This modification allowed for more accurate measurement of sample volume and the use of heated probes and filters.

4.2.1 Sample Collection

Formaldehyde sampling was accomplished by use of an EPA Method 5 train. The sample train is shown schematically in **Figure 4-2** and consisted of a nozzle, probe, filter, four impingers, a vacuum pump, dry-gas meter, and an orifice flow meter.

A stainless steel nozzle was attached to a glass-lined stainless steel probe which was heated to prevent condensation. Teflon mat filter papers supported in 4½-inch glass filter holders were used to remove particulate matter from the gas stream. The filter assembly was enclosed in a heated box to maintain temperatures at 248 °F ± 25 °F. A thermocouple located inside the back half of the filter holder monitored the gas stream temperature and verified that the temperature was kept at 248 °F ± 25 °F.

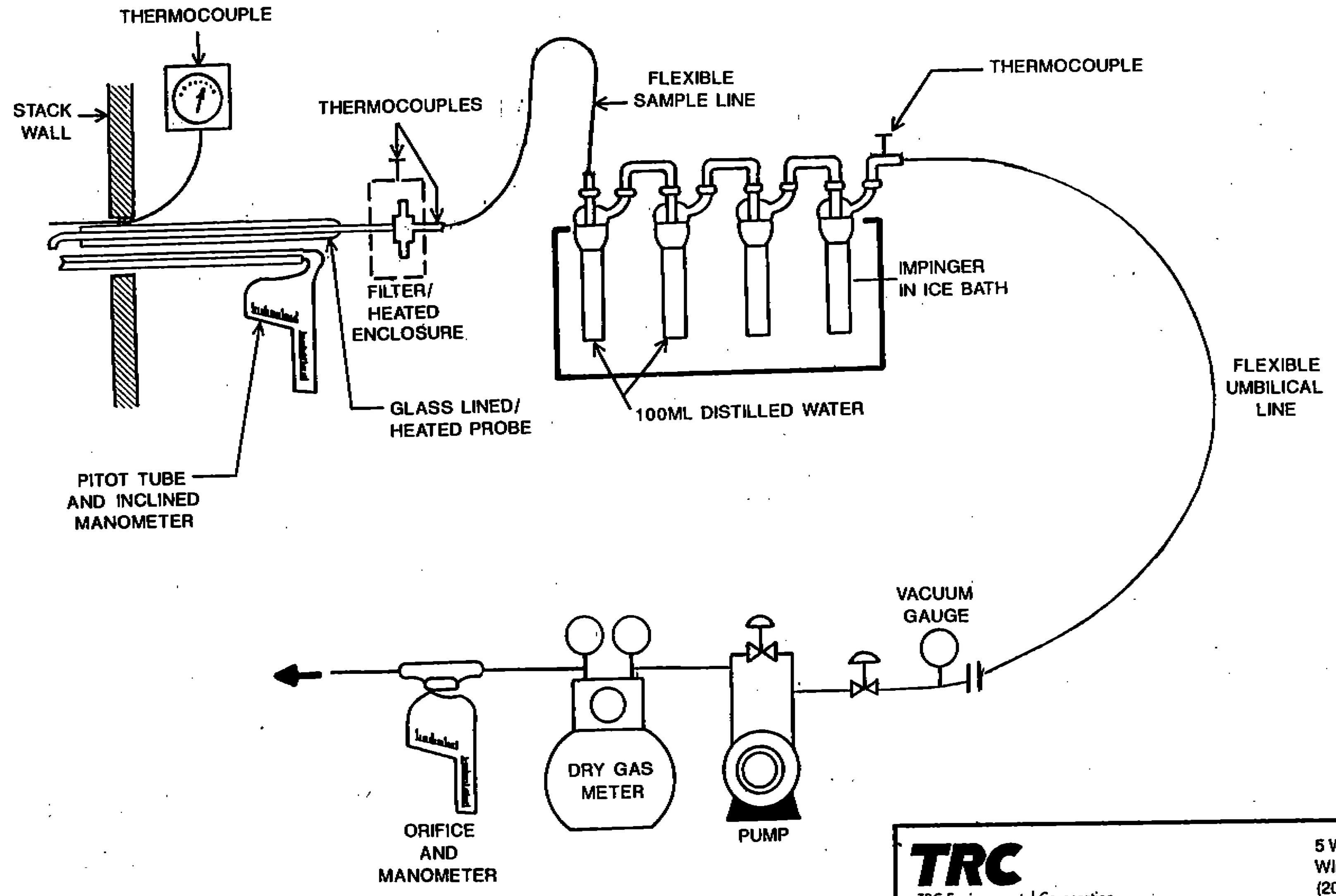

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Figure 4-2

NCASI Formaldehyde Train

An ice bath containing four impingers was attached to the back end of the filter. The first and second impingers contained 100 milliliters (mℓ) each of HPLC grade deionized water. The third impinger was empty, and the fourth impinger contained silica gel to remove any remaining moisture. Flexible tubing, a vacuum gauge, a needle valve, a leakless vacuum pump, a bypass valve, a dry-gas meter calibration orifice, and an inclined manometer completed the sampling train. The stack velocity pressure and temperature were monitored by an S-type pitot and a thermocouple connected to a potentiometer. A check valve was not used in the TRC sampling train.

Sampling flow was adjusted by means of the bypass valve. Before and after each particulate test run, the sampling train was leak checked to meet the 0.02 cfm limit. All pertinent test data were recorded on the appropriate field data sheets.

4.2.2 Sample Recovery

Two sample containers were used, as follows:

Container No. 1:	The impinger contents were measured volumetrically to the nearest milliliter.and deposited into a sample jar. Each impinger was rinsed three times with HPLC grade deionized water. The water rinses were also deposited into the sample jar.
Container No. 2:	Silica gel from the fourth impinger was transferred to its original container and weighed to the nearest 0.5 milligram (mg).

4.2.3 Sample Analysis

The samples were transported to TRC's laboratory, where the following analyses were performed:

Container No. 1:	The impinger contents were analyzed in accordance with the NCASI Acetylacetone Method.

Container No. 2: Silica gel was weighed to the nearest 0.5 mg. The weight of the moisture entrapped in the silica gel, along with the impingers, was used to calculate the moisture content of the stack gas.

4.3 Flowrate and Moisture Measurements

Flowrate measurements were conducted according to EPA Method 2. An S-type pitot and an inclined manometer were used to measure the velocity pressure head, and a thermocouple was used to monitor gas stream temperature.

4.4 Sampling Locations

Sampling points for isokinetic and/or flowrate measurements at each location were determined in accordance with EPA Method 1.

4.4.1 Regenerative Thermal Oxidizer Inlet and Outlet

Inlet sampling was conducted from two ports in the 54-inch diameter stack. The ports were located 2.8 diameters downstream from any flow disturbances and 5.4 diameters upstream from any flow disturbances. Twenty four traverse points were sampled with each flowrate measurement. The inlet sampling point locations are presented in **Figure 4-3**.

Outlet sampling was conducted from two ports in the 76-inch diameter stack. The ports were located 10.4 diameters downstream from any flow disturbances and 6.9 diameters upstream from the stack exhaust. Twelve traverse points were sampled with each flowrate measurement. The outlet sampling point locations are presented in **Figure 4-4**.

Figure 4-3

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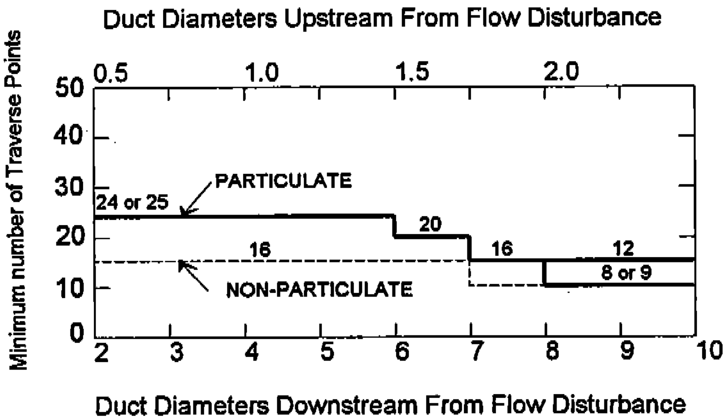
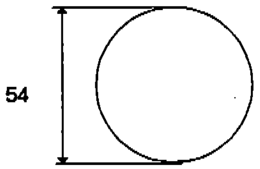
EPA Method 1 Data Sheet

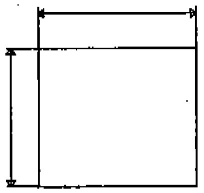
Firm	Louisiana-Pacific
Location	RTO Inlet
Diameters Upstream	5.4
Diameters Downstream	2.8
Nipple Size (in.)	6

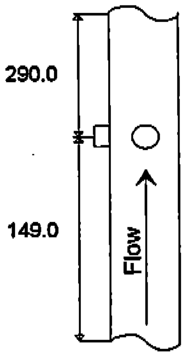
Total Traverse Points Required	24
Number of Ports	2
Points Per Port	12
Traverse (Horizontal or Vertical)	Horizontal/Vertical

Minimum Number of Traverse Points For Particulate and Non-Particulate Traverses









Cross-Sectional Layout For Rectangular Stacks	
Total Traverse Points	Matrix
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5

Location of Points on a Circular Stack

Point Number On a Diameter	(Percent of Stack Diameter from Inside Wall to Traverse Point) No. of Traverse Points on a Diameter) 4	8	10	12
1	6.7	3.2	2.6	2.1
2	25.0	10.5	8.2	6.7
3	75.0	19.4	14.6	11.8
4	93.3	32.3	22.6	17.7
5		67.7	34.2	25.0
6		80.6	65.8	35.6
7		89.5	77.4	64.4
8		96.8	85.4	75.0
9			91.8	82.3
10			97.4	88.2
11				93.3
12				97.9

Traverse Point Location

Point Number	Distance From Wall	Total Distance
1	1.1	7.1
2	3.6	9.6
3	6.4	12.4
4	9.6	15.6
5	13.5	19.5
6	19.2	25.2
7	34.8	40.8
8	40.5	46.5
9	44.4	50.4
10	47.6	53.6
11	50.4	56.4
12	52.9	58.9

Figure 4-4

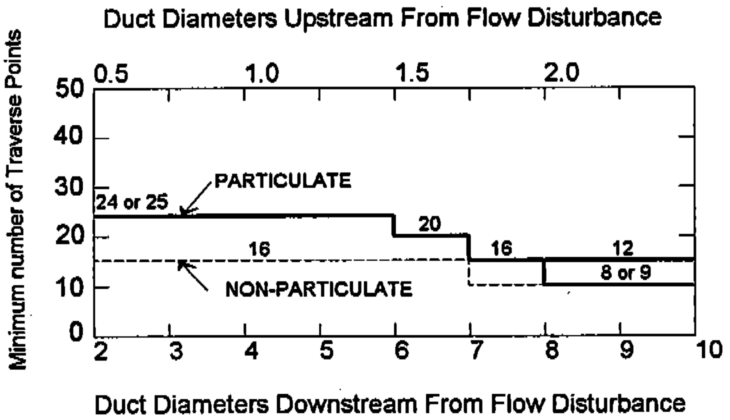
TRC Environmental Corporation

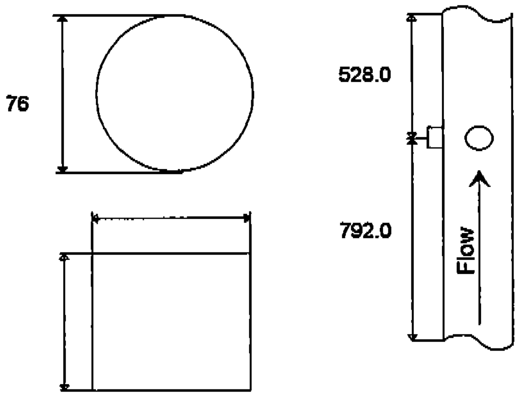
EPA Method 1 Data Sheet

Firm	Louisiana-Pacific
Location	RTO Outlet
Diameters Upstream	6.9
Diameters Downstream	10.4
Nipple Size (in.)	6

Total Traverse Points Required	12
Number of Ports	2
Points Per Port	6
Traverse (Horizontal or Vertical)	Horizontal

Minimum Number of Traverse Points For Particulate
and Non-Particulate Traverses





Cross-Sectional Layout For Rectangular Stacks Total Traverse Points	Matrix
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5

Location of Points on a Circular Stack

Point Number On a Diameter	(Percent of Stack Diameter from Inside Wall to Traverse Point) No. of Traverse Points on a Diameter) 4	8	10	12
1	6.7	3.2	2.6	2.1
2	25.0	10.5	8.2	6.7
3	75.0	19.4	14.6	11.8
4	93.3	32.3	22.6	17.7
5		67.7	34.2	25.0
6		80.6	65.8	35.6
7		89.5	77.4	64.4
8		96.8	85.4	75.0
9			91.8	82.3
10			97.4	88.2
11				93.3
12				97.9

Traverse Point Location

Point Number	Distance From Wall	Total Distance
1	3.3	9.3
2	11.1	17.1
3	22.5	28.5
4	53.5	59.5
5	64.9	70.9
6	72.7	78.7
7		
8		
9		
10		
11		
12		

5.0 QUALITY ASSURANCE

The project manager was responsible for implementating the TRC quality assurance (QA) program as applied to this project. The program was designed to ensure that emission measurement work was performed by qualified people using proper equipment following written procedures in order to provide accurate, defensible data.

At the beginning of the test day, a meeting was held to orient TRC and Louisiana-Pacific personnel to the activities scheduled for that day and to determine if any special considerations were appropriate for the day's work.

5.1 Sampling Quality Assurance

The TRC quality assurance program for source measurements was designed so that the work was done by competent, trained individuals experienced on the specific methodologies being used; using properly calibrated equipment; and using approved procedures for sample handling and documentation.

TRC's measurement devices, pitot tubes, dry-gas meters, thermocouples, and portable gas analyzers were uniquely identified and calibrated with documented procedures and acceptance criteria before and after each field effort. Records of all calibration data are maintained in TRC files.

Data were recorded on standard forms. Bound field notebooks were used to record observations and miscellaneous elements affecting data, calculations, or evaluation.

Specific details of TRC's QA program for stationary air pollution sources may be found in *Quality Assurance Handbook for Air Pollution Measurement Systems,* Volume III (EPA-600/4-77-027b).

In the mobile laboratory, analysts recorded calibration and analysis data in notebooks and summarized specific data on prepared data sheets. Notebooks, data sheets, and calculations were reviewed by the project manager.

5.2 Analytical Quality Control

Compressed gases used as fuels and carriers were purchased at specific purities, according to application. Compressed gases used as calibration standards are always National Institute for Standards and Technology (NIST) traceable, either directly or indirectly.

In the TRC and subcontract laboratories, all QC samples including field blank samples, reagent and filter blanks, and any audit samples were analyzed with the actual test samples. Each laboratory maintains a continuous QC program to monitor instrument response and analyst proficiency and to ensure the precision and accuracy of all analytical results. These programs were developed in consultation with EPA, NIOSH, and various state departments of health.

TRC used some or all of the following quality control procedures during the field and laboratory sampling program:

> *Field Blanks*—For each set of samples taken, a field blank was also be collected. Field blanks included filter materials and solutions used for sample collection and recovery.
>
> *Replicates*—When the analytical procedure permitted, a prescribed number of the analyses were duplicated to indicate the precision of the method used.

Appendix A

Field Data

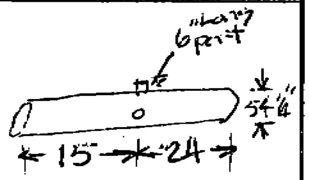
ISOKINETIC SAMPLING DATA

PLANT NAME, CITY, STATE	SAMPLING LOCATION	Method No.	RUN NUMBER	TEST DATE
L.P. Houlton ME	inlet		in # 1	12-14-95

OPERATORS	Barometric (In Hg)	Static P. (In H2O)	Ambient T. (°F)	Filter Type & Filter Number(s)	Stack I.D. (In.)	Pitot Tube Cp	Probe Length and Liner Type	Nozzel Number	Nozzel Diameter
S.B RB	30.02	-4.5	15		54 1/2	.84	NA	NA	NA

PITOT LEAK CHECK	DGM No.	DGM ΔH@	DGM CAL 'Y'	Assumed Moist. %	Pitot No.	Stack Therm. No.	Impinger Therm. No.	Leak Check (Inl.) (In Hg)	Leak Check (Inl.) cfm	Leak Check (Fin.) (In Hg)	Leak Check (Fin.) cfm	K Factor
OK	80823	1.88	1.00	2	C-7			12	.002	3	.000	NA

Notes



POINT NUMBER	CLOCK TIME (24-hour)	ELAPSED TEST TIME (min)	DRY GAS METER READING (Cubic Feet)	ΔP Velocity (In H2O)	ΔH Orifice (In H2O)	Stack Temp. (°F)	Probe Temp. (°F)	Filter Oven Temp. (°F)	Impinger Temp. (°F)	AUX Temp. (°F)	DGM Temp. (°F) DGM In	DGM Temp. (°F) DGM Out	Sample Train Vacuum (In Hg)	XAD Trap Temp. (°F)
1	10:35	0	11.000		1.88	100	240	235	25	NA	33	30	3	
		5	14.700		1.88	100	244	240	24		36	31	3	
		10	18.300		1.88	100	242	245	30		38	32	3	
		15	23.900		1.88	100	244	246	34		39	33	3	
		20	25.600		1.88	100	238	250	36		43	34	3	
		25	29.200		1.88	100	240	254	38		45	36	3	
		30	32.800		1.88	100	235	255	40		47	37	3	
		35	36.300		1.88	100	230	255	40		48	38	3	
		40	39.800		1.88	100	235	257	40		49	39	3	
		45	43.300		1.88	100	235	257	42		49	40	3	
		50	46.900		1.88	100	230	258	45		49	40	3	
		55	50.300		1.88	100	230	257	48		49	41	3	
STOP	11:35	60	53.663											

Total Run Time	DGM Volume	Ave. SQRT ΔP	Average ΔH	Stack Temp
60	42.663			

Ave. DGM Temp.
40

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ISOKINETIC SAMPLING DATA

PLANT NAME, CITY, STATE	SAMPLING LOCATION	Method No.	RUN NUMBER	TEST DATE	Notes
Acisinna Pacific	Inlet		In# 2	12/14/95	Formaldehyde

OPERATORS	Barometric (in Hg)	Static P. (in H2O)	Ambient T. (°F)	Filter Type & Filter Number(s)	Stack I.D. (in.)	Pitot Tube Cp	Probe Length and Liner Type	Nozzel Number	Nozzel Diameter
Gevko/Baez	30.02	-4.5	10		54	0.84	5/8 TEFLON 4/MANTLE	NA	NA

PITOT LEAK CHECK	DGM No.	DGM ΔH@	DGM CAL Y	Assumed Moist. %	Pitot No.	Stack Therm. No.	Impinger Therm. No.	Leak Check (Ini.) (in Hg)	Leak Check (Ini.) cfm	Leak Check (Fin.) (in Hg)	Leak Check (Fin.) cfm	K Factor
OK	P0523	1.88	1.00	2	C-7			10	0.001	5	0.000	NA

POINT NUMBER	CLOCK TIME (24-hour)	ELAPSED TEST TIME (min)	DRY GAS METER READING (Cubic Feet)	ΔP Velocity (in H20)	ΔH Orifice (in H20)	Stack Temp. (°F)	Probe Temp. (°F)	Filter Oven Temp. (°F)	Impinger Temp. (°F)	AUX Temp. (°F)	DGM Temp. (°F) DGM In	DGM Temp. (°F) DGM Out	Sample Train Vacuum (in Hg)	XAD Trap Temp. (°F)
1	12:00	0	53.800		1.88	100	225	230	36	NA	39	38	3	NA
		5	57.400		1.88	100	225	230	35		39	38	3	
		10	60.900		1.88	100	236	240	35		41	37	3	
		15	64.400		1.88	100	236	240	36		42	37	3	
		30	67.900		1.88	100	240	238	40		44	37	3	
		35	71.400		1.88	100	240	237	40		44	37	3	
		30	74.800		1.88	100	242	243	39		45	37	3	
		35	77.200		1.88	100	240	247	39		46	38	3	
		40	81.600		1.88	100	238	252	38		46	38	3	
		45	85.100		1.88	100	236	254	37		46	38	3	
		50	88.500		1.88	100	248	256	37		47	39	3	
		55	91.900		1.88	100	249	257	37		47	39	3	
STOP	13:00	60	95.312											

Total Run Time	DGM Volume	Ave. SQRT ΔP	Average ΔH	Stack Temp.
60	41.512			

Ave. DGM Temp.
41

TRC

ISOKINETIC SAMPLING DATA

PLANT NAME, CITY, STATE	SAMPLING LOCATION	Method No.	RUN NUMBER	TEST DATE	Notes
L.P. Houlton ME.	Inlet		In# 3	12/4/95	

OPERATORS	Barometric (in Hg)	Static P. (in H2O)	Ambient T. (°F)	Filter Type & Filter Number(s)	Stack I.D. (in.)	Pitot Tube Cp	Probe Length and Liner Type	Nozzel Number	Nozzel Diameter
Boyko BAEZ	29.99	-4.5	10		54	.84	5' Teflon/Nozzle	NA	NA

PITOT LEAK CHECK	DGM No.	DGM ΔH@	DGM CAL Y	Assumed Moist. %	Pitot No.	Stack Therm. No.	Impinger Therm. No.	Leak Check (Ini.) (in Hg)	Leak Check (Ini.) cfm	Leak Check (Fin.) (in Hg)	Leak Check (Fin.) cfm	K Factor
ok	80823	1.88	1.00	2	C-7			10	.001	3	000	NA

POINT NUMBER	CLOCK TIME (24-hour)	ELAPSED TEST TIME (min)	DRY GAS METER READING (Cubic Feet)	ΔP Velocity (in H2O)	ΔH Orifice (in H2O)	Stack Temp. (°F)	Probe Temp. (°F)	Filter Oven Temp. (°F)	Impinger Temp. (°F)	AUX Temp. (°F)	DGM Temp. (°F) DGM In	DGM Temp. (°F) DGM Out	Sample Train Vacuum (in Hg)	XAD Trap Temp. (°F)
	13:38	0	95.400		1.88	100	236	240	35	NA	35	35	3	NA
		5	99.200		1.88	100	238	241	39		36	35	3	
		10	102.900		1.88	100	242	241	40		38	35	3	
		15	106.600		1.88	100	241	239	43		40	35	3	
		20	110.300		1.88	100	242	244	45		42	35	3	
		25	114.000		1.88	100	238	248	47		43	35	3	
		30	117.700		1.88	100	240	251	48		44	36	3	
		35	121.800		1.88	100	239	256	50		45	36	3	
		40	125.000		1.88	100	238	257	50		45	36	3	
		45	128.500		1.88	100	236	259	52		46	37	3	
		50	132.100		1.88	100	241	260	53		46	37	3	
		55	135.700		1.88	100	238	262	54		46	37	3	
STOP	14:38	60	139.067											

Total Run Time	DGM Volume	Ave. SQRT ΔP	Average ΔH	Stack Temp
	43.667			

Ave. DGM Temp.
39

TRC

ISOKINETIC SAMPLING DATA

PLANT NAME, CITY, STATE	SAMPLING LOCATION	Method No.	RUN NUMBER	TEST DATE	Notes
Louisiana Pacific	OUTLET - PRESS		1-OUT	12/13/95	Formaldehyde

OPERATORS	Barometric (in Hg)	Static P. (in H20)	Ambient T. (°F)	Filter Type & Filter Number(s)	Stack I.D. (in.)	Pitot Tube Cp	Probe Length and Liner Type	Nozzel Number	Nozzel Diameter
F. Baez/Arroyo	30.02	-.42	15	—	77				

PITOT LEAK CHECK	DGM No.	DGM ΔH@	DGM CAL Y	Assumed Moist. %	Pitot No.	Stack Therm. No.	Impinger Therm. No.	Leak Check (Ini.) (in Hg)	Leak Check (Ini.) cfm	Leak Check (Fin.) (in Hg)	Leak Check (Fin.) cfm	K Factor
	50136	1.75	1.00					0.001	8	0.000	5	

POINT NUMBER	CLOCK TIME (24-hour)	ELAPSED TEST TIME (min)	DRY GAS METER READING (Cubic Feet)	ΔP Velocity (in H20)	ΔH Orifice (in H20)	Stack Temp. (°F)	Probe Temp. (°F)	Filter Oven Temp. (°F)	Impinger Temp. (°F)	AUX Temp. (°F)	DGM Temp. (°F) DGM In	DGM Temp. (°F) DGM Out	Sample Train Vacuum (in Hg)	XAD Trap Temp. (°F)
1	1035	0	742.953		1.75	230	240	245	32		41	38	5	
	1040	5	746.091		↓	236	250	250	33		41	38	5	
	1045	10	749.46			236	250	250	34		41	38	5	
	1050	15	752.41			236	250	250	36		41	38	5	
	1055	20	754.41			236	250	250	38		43	39	5	
	1100	25	759.62			236	250	250	39		48	41	5	
	1105	30	763.19			236	250	250	40		50	42	5	
	1110	35	766.69			236	250	250	41		51	43	5	
	1115	40	770.32			236	251	242	42		53	45	5	
	1120	45	774.07			236	251	237	45		53	45	5	
	1125	50	777.36			236	251	237	48		53	46	5	
	1130	55	780.84			236	250	234	51		53	46	5	
	1135	60	784.300											

Total Run Time	DGM Volume	Ave. SQRT ΔP	Average ΔH	Stack Temp
	41.347			

Ave. DGM Temp.
44

TRC

ISOKINETIC SAMPLING DATA

PLANT NAME, CITY, STATE	SAMPLING LOCATION	Method No.	RUN NUMBER	TEST DATE	Notes
Louisiana Pacific	outlet		2	12/14/95	

OPERATORS	Barometric (In Hg)	Static P. (In H20)	Ambient T. (°F)	Filter Type & Filter Number(s)	Stack I.D. (In.)	Pitot Tube Cp	Probe Length and Liner Type	Nozzel Number	Nozzel Diameter
Carl / Burke	30.02	-0.42	10		77	0.99	1/2 heated teflon		

PITOT LEAK CHECK	DGM No.	DGM ΔH@	DGM CAL Y	Assumed Moist. %	Pitot No.	Stack Therm. No.	Impinger Therm. No.	Leak Check (Ini.) (In Hg)	Leak Check (Ini.) cfm	Leak Check (Fin.) (In Hg)	Leak Check (Fin.) cfm	K Factor
	80036	1.75	1.0	5				10	0.000	5	0.000	

POINT NUMBER	CLOCK TIME (24-hour)	ELAPSED TEST TIME (min)	DRY GAS METER READING (Cubic Feet)	ΔP Velocity (In H20)	ΔH Orifice (In H20)	Stack Temp. (°F)	Probe Temp. (°F)	Filter Oven Temp. (°F)	Impinger Temp. (°F)	AUX Temp. (°F)	DGM Temp. (°F) DGM In	DGM Temp. (°F) DGM Out	Sample Train Vacuum (In Hg)	XAD Trap Temp. (°F)
1	1200	0	784.45		1.75	230	240	233	33		46	45	3	
	1205	5	788.31		1.75	230	246	238	33		46	45	3	
	1210	10	791.65		1.71	230	246	235	33		46	41	3	
	1215	15	795.40		1.75	230	244	240	33		49	44	3	
	1220	20	798.30		1.75	230	249	243	33		49	45	3	
	1225	25	801.72		1.75	230	250	242	34		50	45	3	
	1230	30	805.22		1.75	230	250	243	37		51	45	3	
	1235	35	808.77		1.75	230	250	242	38		51	45	3	
	1240	40	812.30		1.75	230	249	242	40		52	46	3	
	1245	45	815.81		1.75	230	249	242	40		52	46	3	
	1250	50	819.42		1.75	230	250	243	43		52	46	3	
	1255	55	823.0		1.75	230	250	242	45		52	46	3	
	1300	60	827.45											

Total Run Time	DGM Volume	Ave. SQRT ΔP	Average ΔH	Stack Temp
	43.00			

Ave. DGM Temp.
47

TRC

ISOKINETIC SAMPLING DATA

PLANT NAME, CITY, STATE	SAMPLING LOCATION	Method No.	RUN NUMBER	TEST DATE	Notes
Lousiana Pacific	Outlet		#3	12/14/95	Formaldehyde

OPERATORS	Barometric (In Hg)	Static P. (In H20)	Ambient T. (°F)	Filter Type & Filter Number(s)	Stack I.D. (In.)	Pitot Tube Cp	Probe Length and Liner Type	Nozzel Number	Nozzel Diameter
Craez/Pavlo	29.94	-0.42	10		77	0.84			

PITOT LEAK CHECK	DGM No.	DGM ΔH@	DGM CAL Y	Assumed Moist. %	Pitot No.	Stack Therm. No.	Impinger Therm. No.	Leak Check (Ini.) (In Hg)	Leak Check (Ini.) cfm	Leak Check (Fin.) (In Hg)	Leak Check (Fin.) cfm	K Factor
✓	8836	1.77	1.0	3				0.001	10	5	0.000	

POINT NUMBER	CLOCK TIME (24-hour)	ELAPSED TEST TIME (min)	DRY GAS METER READING (Cubic Feet)	ΔP Velocity (In H20)	ΔH Orifice (In H20)	Stack Temp. (°F)	Probe Temp. (°F)	Filter Oven Temp. (°F)	Impinger Temp. (°F)	AUX Temp. (°F)	DGM Temp. (°F) DGM In	DGM Temp. (°F) DGM Out	Sample Train Vacuum (In Hg)	XAD Trap Temp. (°F)
1	1338	0	826.600		1.75	230	215	200	29		44	43	2	
	1343	5	830.10		1.75	230	245	238	32		44	43	2	
	1348	10	833.45		1.75	230	249	240	34		44	43	2	
	1353	15	836.89		1.75	230	249	242	35		45	43	2	
	1358	20	840.23		1.75	230	250	242	36		47	43	2	
	1403	25	843.68		1.75	230	250	240	38		47	43	2	
	1408	30	847.07		1.75	220	250	243	40		48	43	2	
	1413	35	850.46		1.75	230	250	242	43		49	43	2	
	1418	40	853.93		1.75	230	251	242	43		50	43	2	
	1423	45	857.45		1.75	230	250	243	48		50	44	2	
	1428	50	860.96		1.75	230	250	242	50		51	44	2	
	1433	55	864.51		1.75	230	250	245	50		52	45	2	
	1438	60	868.044											

Total Run Time	DGM Volume	Ave. SQRT ΔP	Average ΔH	Stack Temp
	41.444			

Ave. DGM Temp.
45

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EPA METHOD 2
VELOCITY TRAVERSE AND FLOWRATE DETERMINATION

PAGE ____ OF ____

PLANT LP
DATE 12-14-95 9 30AM
LOCATION Press - Inlet - stack
STACK DIMENSIONS 54.5" AREA ______ ft^2
BAROMETRIC PRESSURE, Pb = 30.04 in. Hg
STACK STATIC PRESSURE, Pg = ± - 4.5 in. H_2O
STACK GAS MOLECULAR WEIGHT (Wet), M_W 28.9
STACK GAS MOISTURE CONTENT, % H_2O = 10%
PITOT NO. ______ Cp= 0.99
TESTER ______

SCHEMATIC OF TRAVERSE POINT LOCATION

Cyclonic Flow Angle
+ θ Clockwise
- θ Counterclockwise

PORT	POINT	ΔP Inch H_2O	$\sqrt{\Delta P}$	T_s (°F)	± θ	Pitots reversed for Negative Flow?	$\sqrt{\Delta P} \cdot \cos\theta$
4	1	1.5		90			
	2	1.7		100			
	3	1.9		100			
	4	2.0		100			
	5	2.2		105			
	6	2.2		105			
	7	2.3		105			
	8	2.4		105			
B	1	1.3		100			
	2	1.4		102			
	3	2.2		100			
	4	2.2		100			
	5	1.9		100			
	6	1.9		100			
	7	1.8		100			
	8	1.7		103			
		Average	2.756	T_s = 101°F	*		
				T_{sr} = 561 °R			

*Avg. of absolute values including zeroes

Absolute Gas Temperature, $T_{sr} = T_s + 460°$ 29.709

Absolute Gas Pressure, $P_s = P_b + P_g/13.6$ = ~~30.01~~

Gas Velocity, $V_s = (85.49)\ C_p\ (\sqrt{\Delta P} \cdot \cos\theta)\ avg\ \sqrt{\frac{T_{sr}\ avg}{P_s\ M_w}}$ = ~~159.6~~ ft/sec 79.98 159.97

Actual Gas Flowrate, $Q_a = (V_s)(60)(A)$ = ~~3259~~ 32729 ACFM 16780

Standard Gas Flowrate, $Q_{std} = Q_a \left(\frac{528°R}{T_{sr}}\right)\left(\frac{P_s}{29.92}\right)\left(\frac{100 - \%\ H_2O}{100}\right)$ = ~~30464~~ DSCFM 15003

Rev. 3 3/22/82

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EPA METHOD 2
VELOCITY TRAVERSE AND FLOWRATE DETERMINATION

PAGE ____ OF ____

PLANT LP
DATE 12 14-95 1200
LOCATION Inlet
STACK DIMENSIONS 54.5 AREA ____ ft^2
BAROMETRIC PRESSURE, Pb = 30.01 in. Hg
STACK STATIC PRESSURE, Pg = ± −4.6 in. H_2O
STACK GAS MOLECULAR WEIGHT (Wet), M_W 25.9
STACK GAS MOISTURE CONTENT, % H_2O = ____
PITOT NO. ____ Cp= 0.84
TESTER ____

SCHEMATIC OF TRAVERSE POINT LOCATION

Cyclonic Flow Angle
+ θ Clockwise
- θ Counterclockwise

PORT	POINT	ΔP Inch H_2O	$\sqrt{\Delta P}$	T_s (°F)	± θ	Pitots reversed for Negative Flow?	$\sqrt{\Delta P} \cdot \cos\theta$
A	1	1.6		100			
	2	1.7		100			
	3	1.9		100			
	4	2.1		100			
	5	2.2		105			
	6	2.2		103			
	7	2.3		106			
	8	2.4		107			
B	1	1.4		100			
	2	1.4		100			
	3	2.2		102			
	4	2.2		103			
	5	1.9		101			
	6	1.9		105			
	7	1.8		107			
	8	1.7		104			
		Average	1.385	T_s = 103°F	*		
				T_{sr} = 563°R			

*Avg. of absolute values including zeroes

Absolute Gas Temperature, $T_{sr} = T_s + 460^\circ$

Absolute Gas Pressure, $P_s = P_b + P_g/13.6$ = 29.70

Gas Velocity, $V_s = (85.49)\ C_p\ (\sqrt{\Delta P} \cdot \cos\theta)\ \text{avg} \sqrt{\frac{T_{sr}\ \text{avg}}{P_s\ M_w}}$ = 80.57 ft/sec

Actual Gas Flowrate, $Q_a = (V_s)(60)(A)$ = 16502 ACFM

Standard Gas Flowrate, $Q_{std} = Q_a \left(\frac{528^\circ R}{T_{sr}}\right)\left(\frac{P_s}{29.92}\right)\left(\frac{100 - \%\ H_2O}{100}\right)$ = 15053 DSCFM

TRC Environmental Consultants, Inc.

TRC
EPA METHOD 2
VELOCITY TRAVERSE AND FLOWRATE DETERMINATION

PAGE ____ OF ____

PLANT LP
DATE 121491 1300
LOCATION Inlet
STACK DIMENSIONS 54.5 AREA ____ ft^2
BAROMETRIC PRESSURE, Pb = 30.01 in. Hg
STACK STATIC PRESSURE, Pg = ± -4.7 in. H_2O
STACK GAS MOLECULAR WEIGHT (Wet), M_w 28.9
STACK GAS MOISTURE CONTENT, % H_2O = ____
PITOT NO. ____ Cp= 0.84
TESTER ____

SCHEMATIC OF TRAVERSE POINT LOCATION

Cyclonic Flow Angle + θ Clockwise
- θ Counterclockwise

PORT	POINT	ΔP Inch H_2O	$\sqrt{\Delta P}$	T_s (°F)	± θ	Pitots reversed for Negative Flow?	$\sqrt{\Delta P} \cdot \cos\theta$
A	1	1.6		100			
	2	1.7		102			
	3	1.8		102			
	4	1.7		103			
	5	2.2		102			
	6	2.2		105			
	7	2.3		105			
	8	2.4		106			
B	1	1.5		107			
	2	1.5		108			
	3	2.2		109			
	4	2.2		108			
	5	2.2		106			
	6	1.9		108			
	7	1.9		108			
	8	1.8		108			
		Average		T_s = °F	*		
				T_{sr} = °R			

*Avg. of absolute values including zeroes

Absolute Gas Temperature, $T_{sr} = T_s + 460°$

Absolute Gas Pressure, $P_s = P_b + P_g/13.6$ = ____

Gas Velocity, $V_s = (85.49)\ C_p\ (\sqrt{\Delta P} \cdot \cos\theta)\ \text{avg} \sqrt{\frac{T_{sr}\ \text{avg}}{P_s\ M_w}}$ = ____ ft/sec

Actual Gas Flowrate, $Q_a = (V_s)(60)(A)$ = ____ ACFM

Standard Gas Flowrate, $Q_{std} = Q_a \left(\frac{528°R}{T_{sr}}\right)\left(\frac{P_s}{29.92}\right)\left(\frac{100 - \%\ H_2O}{100}\right)$ = ____ DSCFM

Rev. 3 3/22/82

TRC Environmental Consultants, Inc.

TRC
EPA METHOD 2
VELOCITY TRAVERSE AND FLOWRATE DETERMINATION

PAGE ____ OF ____

PLANT LP
DATE 12/4/95
LOCATION Inlet 1400
STACK DIMENSIONS ________ AREA ________ ft^2
BAROMETRIC PRESSURE, Pb = ________ in. Hg
STACK STATIC PRESSURE, Pg = ± ________ in. H_2O
STACK GAS MOLECULAR WEIGHT (Wet), M_w ________
STACK GAS MOISTURE CONTENT, % H_2O = ________
PITOT NO. ________ Cp= ________
TESTER ________

SCHEMATIC OF TRAVERSE POINT LOCATION
Cyclonic Flow Angle + θ Clockwise
− θ Counterclockwise

PORT	POINT	ΔP Inch H_2O	$\sqrt{\Delta P}$	T_s (°F)	± θ	Pitots reversed for Negative Flow?	$\sqrt{\Delta P}\cdot\cos\theta$
	1	1.6		100			
	2	1.8		101			
	3	1.9		102			
	4	1.8		103			
	5	1.9		104			
	6	2.0		105			
	7	2 1		105			
	8	2.2		105			
	1	1.6		100			
	2	2.15		101			
	3	2.3		103			
	4	2,3		104			
	5	2.2		104			
	6	20		105			
	7	1.7		105			
	8	1.7		105			
		Average		T_s = °F	*		
				T_{sr} = °R			

*Avg. of absolute values including zeroes

Absolute Gas Temperature, $T_{sr} = T_s + 460^\circ$

Absolute Gas Pressure, $P_s = P_b + P_g/13.6$ = ________

Gas Velocity, $V_s = (85.49)\ C_p\ (\sqrt{\Delta P}\cdot\cos\theta)\ \text{avg}\ \sqrt{\frac{T_{sr}\ \text{avg}}{P_s\ M_w}}$ = ________ ft/sec

Actual Gas Flowrate, $Q_a = (V_s)(60)(A)$ = ________ ACFM

Standard Gas Flowrate, $Q_{std} = Q_a \left(\frac{528^\circ R}{T_{sr}}\right)\left(\frac{P_s}{29.92}\right)\left(\frac{100 - \%\ H_2O}{100}\right)$ = ________ DSCFM

TRC Environmental Consultants, Inc.

TRC
EPA METHOD 2
VELOCITY TRAVERSE AND FLOWRATE DETERMINATION

PAGE ____ OF ____

PLANT LP
DATE 12-14-95 1000
LOCATION OUTLET
STACK DIMENSIONS 77 1/4 AREA ______ ft^2
BAROMETRIC PRESSURE, Pb = 30.02 in. Hg
STACK STATIC PRESSURE, Pg = ± -0.42 in. H_2O
STACK GAS MOLECULAR WEIGHT (Wet), M_w ______
STACK GAS MOISTURE CONTENT, % H_2O = ______
PITOT NO. ______ Cp= 0.99
TESTER ______

SCHEMATIC OF TRAVERSE POINT LOCATION

Cyclonic Flow Angle
+ θ Clockwise
- θ Counterclockwise

PORT	POINT	ΔP Inch H_2O	$\sqrt{\Delta P}$	T_s (°F)	± θ	Pitots reversed for Negative Flow?	$\sqrt{\Delta P} \cdot \cos\theta$
A	1	0.46		226			
	2	0.55		233			
	3	0.55		233			
	4	0.60		234			
B	5	0.60		236			
	6	0.60		236			
	7	0.61		236			
	8	0.65		236			
	1	0.42		[illegible]			
	2	0.45		[illegible]			
	3	0.47		226			
	4	0.59		226			
	5	[illegible]		224			
	6	0.62		230			
	7	0.67		233			
	8	0.65		233			
		Average	1.518	T_s = 232°F	*		
				T_{sr} = 692°R			

*Avg. of absolute values including zeroes

Absolute Gas Temperature, $T_{sr} = T_s + 460^{\circ}$

Absolute Gas Pressure, $P_s = P_b + P_g/13.6$ = 30.01

Gas Velocity, $V_s = (85.49)\ C_p\ (\sqrt{\Delta P} \cdot \cos\theta)\ \text{avg} \sqrt{\frac{T_{sr}\ \text{avg}}{P_s\ M_w}}$ = ~~47.77~~ 48.69 ft/sec

Actual Gas Flowrate, $Q_a = (V_s)(60)(A)$ = ~~14943~~ ACFM 9971

Standard Gas Flowrate, $Q_{std} = Q_a \left(\frac{528^{\circ}R}{T_{sr}}\right)\left(\frac{P_s}{29.92}\right)\left(\frac{100 - \%\ H_2O}{100}\right)$ = ~~15111~~ 7555 DSCFM

Rev. 3 3/22/82

TRC Environmental Consultants, Inc.

TRC
EPA METHOD 2
VELOCITY TRAVERSE AND FLOWRATE DETERMINATION

PAGE ____ OF ____

PLANT LP
DATE 121495 1200
LOCATION OUTLET
STACK DIMENSIONS 77 1/4 AREA ____ ft^2
BAROMETRIC PRESSURE, Pb = 30.02 in. Hg
STACK STATIC PRESSURE, Pg = ± -0.42 in. H_2O
STACK GAS MOLECULAR WEIGHT (Wet), M_w 28.9
STACK GAS MOISTURE CONTENT, % H_2O = 10
PITOT NO. ____ Cp= 0.99
TESTER ____

SCHEMATIC OF TRAVERSE POINT LOCATION

Cyclonic Flow Angle
+ θ Clockwise
- θ Counterclockwise

PORT	POINT	ΔP Inch H_2O	$\sqrt{\Delta P}$	T_s (°F)	± θ	Pitots reversed for Negative Flow?	$\sqrt{\Delta P} \cdot \cos\theta$
A	1	0.46		230			
	2	0.55		231			
	3	0.55		232			
	4	0.60		230			
	5	0.60		231			
	6	0.61		235			
	7	0.61		236			
	8	0.65		237			
B	1	0.42		230			
	2	0,93		231			
	3	0.48		232			
	4	0.57		234			
	5	0.59		235			
	6	0.61		235			
	7	0.67		235			
	8	0.66		235			
		Average		T_s = °F	*		
				T_{sr} = °R			

*Avg. of absolute values including zeroes

Absolute Gas Temperature, $T_{sr} = T_s + 460^\circ$

Absolute Gas Pressure, $P_s = P_b + P_g/13.6$ = 30.01

Gas Velocity, $V_s = (85.49)\ C_p\ (\sqrt{\Delta P} \cdot \cos\theta)\ \text{avg} \sqrt{\frac{T_{sr}\ \text{avg}}{P_s\ M_w}}$ = 48.25 ft/sec

Actual Gas Flowrate, $Q_a = (V_s)(60)(A)$ = 9,882 ACFM

Standard Gas Flowrate, $Q_{std} = Q_a \left(\frac{528^\circ R}{T_{sr}}\right)\left(\frac{P_s}{29.92}\right)\left(\frac{100 - \%\ H_2O}{100}\right)$ = 7513 DSCFM

Rev. 3 3/22/82

TRC Environmental Consultants, Inc.

TRC
EPA METHOD 2
VELOCITY TRAVERSE AND FLOWRATE DETERMINATION

PAGE ____ OF ____

PLANT LF
DATE 12/4/95 1300
LOCATION OUTLET
STACK DIMENSIONS 77 1/4 AREA ____ ft^2
BAROMETRIC PRESSURE, Pb = 30.02 in. Hg
STACK STATIC PRESSURE, Pg = ± -0.42 in. H_2O
STACK GAS MOLECULAR WEIGHT (Wet), M_w 28.9
STACK GAS MOISTURE CONTENT, % H_2O = 10
PITOT NO. ____ Cp= .84
TESTER ____

SCHEMATIC OF TRAVERSE POINT LOCATION
Cyclonic Flow Angle + θ Clockwise
- θ Counterclockwise

PORT	POINT	ΔP Inch H_2O	$\sqrt{\Delta P}$	T_s (°F)	± θ	Pitots reversed for Negative Flow?	$\sqrt{\Delta P} \cdot \cos\theta$
A	1	0.47		230			
	2	0.54		231			
	3	0.54		231			
	4	0.59		231			
	5	0.60		231			
	6	0.61		232			
	7	0.62		233			
	8	0.61		233			
B	1	0.42		233			
	2	0.49		236			
	3	0.49		236			
	4	0.56		236			
	5	0.60		236			
	6	0.61		237			
	7	0.66		237			
	8	0.66		235			
		Average		T_s = °F	*		
				T_{sr}= °R			

*Avg. of absolute values including zeroes

Absolute Gas Temperature, $T_{sr} = T_s + 460^\circ$
Absolute Gas Pressure, $P_s = P_b + P_g/13.6$ = ____
Gas Velocity, $V_s = (85.49)\ C_p\ (\sqrt{\Delta P} \cdot \cos\theta)\ \text{avg} \sqrt{\frac{T_{sr}\ \text{avg}}{P_s\ M_w}}$ = ____ ft/sec
Actual Gas Flowrate, $Q_a = (V_s)(60)(A)$ = ____ ACFM
Standard Gas Flowrate, $Q_{std} = Q_a \left(\frac{528^\circ R}{T_{sr}}\right)\left(\frac{P_s}{29.92}\right)\left(\frac{100 - \%\ H_2O}{100}\right)$ = ____ DSCFM

Rev. 3 3/22/82

PAGE ____ OF ____

TRC Environmental Consultants, Inc.

TRC
EPA METHOD 2
VELOCITY TRAVERSE AND FLOWRATE DETERMINATION

PLANT LP
DATE 121495 1400
LOCATION outlet
STACK DIMENSIONS ____ AREA ____ ft^2
BAROMETRIC PRESSURE, Pb = ____ in. Hg
STACK STATIC PRESSURE, Pg = ± ____ in. H_2O
STACK GAS MOLECULAR WEIGHT (Wet), M_w ____
STACK GAS MOISTURE CONTENT, % H_2O = ____
PITOT NO. ____ Cp= ____
TESTER ____

SCHEMATIC OF TRAVERSE POINT LOCATION

Cyclonic Flow Angle
+ θ Clockwise
- θ Counterclockwise

PORT	POINT	ΔP Inch H_2O	$\sqrt{\Delta P}$	T_s (°F)	± θ	Pitots reversed for Negative Flow?	$\sqrt{\Delta P} \cdot \cos\theta$
	1	0.45		232			
	2	0.47		230			
	3	0.66		230			
	4	0.66		233			
	5	0.67		230			
	6	0.67		233			
	7	0.67		237			
	8	0.7		230			
	9	0.60		232			
	2	0.52		232			
	3	0.63		240			
	4	0.69		241			
	5	0.66		241			
	6	0.62		241			
	7	0.59		241			
	8	0.60		241			
		Average		T_s = °F T_{sr} = °R	*		

*Avg. of absolute values including zeroes

Absolute Gas Temperature, $T_{sr} = T_s + 460^o$
Absolute Gas Pressure, $P_s = P_b + P_g/13.6$ = ____
Gas Velocity, $V_s = (85.49)\ C_p\ (\sqrt{\Delta P} \cdot \cos\theta)\ avg \sqrt{\frac{T_{sr}\ avg}{P_s\ M_w}}$ = ____ ft/sec

Actual Gas Flowrate, $Q_a = (V_s)(60)(A)$ = ____ ACFM
Standard Gas Flowrate, $Q_{std} = Q_a \left(\frac{528^oR}{T_{sr}}\right)\left(\frac{P_s}{29.92}\right)\left(\frac{100 - \%\ H_2O}{100}\right)$ = ____ DSCFM

Rev. 3 3/22/82

Imp - weight

T-1	Inlet	Outlet
Before	3171	3187
after	3184 / 13	3207 / 20

T-2	Inlet	outlet
Before	3126	3185
after	3139 / 13	3205 / 20

T-3	Inlet	outlet
Before	3109	3113
after	3123 / 14	3136 / 23

TRC Environmental Consultants, Inc.

TRC
EPA METHOD 2
VELOCITY TRAVERSE AND FLOWRATE DETERMINATION

PAGE ____ OF ____

PLANT LP
DATE 121495 1300
LOCATION OUTLET
STACK DIMENSIONS 7'7 1/4 AREA ____ ft^2
BAROMETRIC PRESSURE, Pb = 30.02 in. Hg
STACK STATIC PRESSURE, Pg = ± -0.42 in. H_2O
STACK GAS MOLECULAR WEIGHT (Wet), M_w 28.9
STACK GAS MOISTURE CONTENT, % H_2O = 10
PITOT NO. ____ Cp= 0.84
TESTER ____

SCHEMATIC OF TRAVERSE POINT LOCATION

Cyclonic Flow Angle
+ θ Clockwise
- θ Counterclockwise

PORT	POINT	ΔP Inch H_2O	$\sqrt{\Delta P}$	T_s (°F)	± θ	Pitots reversed for Negative Flow?	$\sqrt{\Delta P} \cdot \cos\theta$
A	1	0.47		230			
	2	0.54		231			
	3	0.54		231			
	4	0.59		231			
	5	0.60		231			
	6	0.61		232			
	7	0.62		233			
	8	0.65		233			
B	1	0.42		233			
	2	0.49		236			
	3	0.49		236			
	4	0.56		236			
	5	0.60		236			
	6	0.61		237			
	7	0.66		237			
	8	0.66		235			
		Average		T_s = °F	*		
				T_{sr} = °R			

*Avg. of absolute values including zeroes

Absolute Gas Temperature, $T_{sr} = T_s + 460^\circ$

Absolute Gas Pressure, $P_s = P_b + P_g/13.6$ = ____

Gas Velocity, $V_s = (85.49)\ C_p\ (\sqrt{\Delta P} \cdot \cos\theta)\ \text{avg} \sqrt{\frac{T_{sr}\ \text{avg}}{P_s\ M_w}}$ = ____ ft/sec

Actual Gas Flowrate, $Q_a = (V_s)(60)(A)$ = ____ ACFM

Standard Gas Flowrate, $Q_{std} = Q_a \left(\frac{528^\circ R}{T_{sr}}\right)\left(\frac{P_s}{29.92}\right)\left(\frac{100 - \%\ H_2O}{100}\right)$ = ____ DSCFM

Rev. 3 3/22/82

TRC
EPA METHOD 2
VELOCITY TRAVERSE AND FLOWRATE DETERMINATION

PAGE ____ OF ____

PLANT LP
DATE 121495
LOCATION outlet 1400
STACK DIMENSIONS ________ AREA ________ ft^2
BAROMETRIC PRESSURE, Pb = ________ in. Hg
STACK STATIC PRESSURE, Pg = ± ________ in. H_2O
STACK GAS MOLECULAR WEIGHT (Wet), M_w ________
STACK GAS MOISTURE CONTENT, % H_2O = ________
PITOT NO. ________ Cp= ________
TESTER ________

SCHEMATIC OF TRAVERSE POINT LOCATION

Cyclonic Flow Angle
+ θ Clockwise
- θ Counterclockwise

PORT	POINT	ΔP Inch H_2O	$\sqrt{\Delta P}$	T_s (°F)	± θ	Pitots reversed for Negative Flow?	$\sqrt{\Delta P} \cdot \cos\theta$
	1	0.45		232			
	2	0.47		230			
	3	0.66		230			
	4	0.66		233			
	5	0.67		230			
	6	0.67		233			
	7	0.67		237			
	8	0.7		230			
	9	0.60		232			
	2	0.52		232			
	3	0.63		240			
	4	0.69		241			
	5	0.66		241			
	6	0.62		241			
	7	0.59		241			
	8	0.60		241			
		Average		T_s = °F	*		
				T_{sr}= °R			

*Avg. of absolute values including zeroes

Absolute Gas Temperature, $T_{sr} = T_s + 460^{\circ}$
Absolute Gas Pressure, $P_s = P_b + P_g/13.6$ = ________
Gas Velocity, $V_s = (85.49)\ C_p\ (\sqrt{\Delta P}\cdot\cos\theta)\ \text{avg}\ \sqrt{\frac{T_{sr}\ \text{avg}}{P_s\ M_w}}$ = ________ ft/sec

Actual Gas Flowrate, $Q_a = (V_s)(60)(A)$ = ________ ACFM
Standard Gas Flowrate, $Q_{std} = Q_a \left(\frac{528^{\circ}R}{T_{sr}}\right)\left(\frac{P_s}{29.92}\right)\left(\frac{100 - \%\ H_2O}{100}\right)$ = ________ DSCFM

Imp - weight

T-1	Inlet	Outlet
Before	3171	3187
after	3184 / 13	3207 / 20

T-2	Inlet	Outlet
Before	3126	3185
after	3139 / 13	3205 / 20

T-3	Inlet	Outlet
Before	3109	3113
after	3123 / 14	3136 / 23

TRC Environmental Corporation
CEM Data Sheet

Firm L Pacific
Location Houlton, ME
Tester S. Paterson
Test No. Inlet-1
Sample Loc. RTO Inlet Duct
Date December 14, 1995
TIME 1035-1055

Ambient Temp, deg. F = 10
MEL Temp, deg. F = 70
Bar. Pressure, in Hg = 30.28
Vacuum Gauge = 10
Pressure Gauge =
% Moisture =

	Calibration Gases			
	Mid Cal	High Cal	Tank ID Mid	Tank ID High
O_2	9.1	20.8	ALM037884	ALM057653
CO_2				
CO	142	451	ALM010642	AAL 20965
SO_2				
NOx	49.5	88.6	ALM43797	ALM43127
THC				

		Calibration Data							Emissions Summary	
			Initial Values		Final Values					
		(Rack) Analyzer Cal. Response	System Cal. Response	System Cal. Bias % of Span	System Cal. Response	System Cal. Bias % of Span	Drift % of Span	Analyzer Units & Range	Measured Average Gas Conc.	Corrected Effluent Gas Conc.
O_2	Zero	0.1	0.1	0.0	0.14	0.3	0.3	%	-	-
	Upscale	20.9	20.8	-0.6	20.78	-0.5	0.1	25	20.8	20.8
CO_2	Zero			0.0		0.0	0.0	%	-	-
	Upscale			0.0		0.0	0.0	20		ERR
CO	Zero	0.3	0.6	0.1	-5.5	-1.2	-1.2	ppm	-	-
	Upscale	451.8	448.3	-0.7	437.3	-2.9	-2.2	500	13.6	16.3
SO_2	Zero			0.0		0.0	0.0	ppm	-	-
	Upscale			0.0		0.0	0.0	1000		ERR
NOx	Zero	0.2	0.9	0.7	1.5	1.3	0.6	ppm	-	-
	Upscale	89.2	89.2	0.0	90.8	1.6	1.6	100	3.0	1.8
THC	Zero			0		0	0	ppm	-	-
	Upscale			0		0	0	100		ERR
			LIMITS	+/- 5%		+/- 5%	+/- 3%			

Comments:
NOx (lb/hr) = K x ppm x MW x Flow

NOx (lb/hr) = **0.19**

CO (lb/hr) = K x ppm x MW x Flow

CO (lb/hr) = **0.76**

K = 2.59E-09
MW for NOx = 46.01 g/gmol
Flow (dscfm)= 15,028
MW for CO= 20.00 g/gmol

	ZERO Cal. Gas Analyzer Response	Analyzer Calib. Error	MID Cal. Gas Analyzer Response	Analyzer Calib. Error	HIGH Cal. Gas Analyzer Response	Analyzer Calib. Error
O_2	0.1	0.2	9.1	0.2	20.9	0.4
CO_2		0.0		0.0		0.0
CO	0.3	0.1	140.7	-0.3	451.8	0.2
SO_2		0.0		0.0		0.0
NOx	0.2	0.2	47.6	-1.9	89.2	0.6
THC		0.0		0.0		0.0
	LIMIT	+/- 2%		+/- 2%		+/- 2%

TRC Environmental Corporation
CEM Data Sheet

Firm	L Pacific	Ambient Temp, deg. F =	10
Location	Houlton, ME	MEL Temp, deg. F =	70
Tester	S. Paterson	Bar. Pressure, in Hg =	30.28
Test No.	Inlet-3	Vacuum Gauge =	10
Sample Loc.	RTO Inlet Duct	Pressure Gauge =	
Date	December 14, 1995	% Moisture =	
TIME	13:38 - 13:58		

	Calibration Gases			
	Mid Cal	High Cal	Tank ID Mid	Tank ID High
O_2	9.1	20.8	ALM037884	ALM057653
CO_2				
CO	142	451	ALM010642	AAL 20965
SO_2				
NOx	49.5	88.6	ALM43797	ALM43127
THC				

		Calibration Data							Emissions Summary	
			Initial Values		Final Values					
		(Rack) Analyzer Cal. Response	System Cal. Response	System Cal. Bias % of Span	System Cal. Response	System Cal. Bias % of Span	Drift % of Span	Analyzer Units & Range	Measured Average Gas Conc.	Corrected Effluent Gas Conc.
O_2	Zero	0.1	0.2	0.4	0.13	0.3	-0.1	%	-	-
	Upscale	20.9	20.7	-0.7	20.68	-0.9	-0.2	25	20.7	20.8
CO_2	Zero			0.0		0.0	0.0	%	-	-
	Upscale			0.0		0.0	0.0	20		ERR
CO	Zero	0.3	1.4	0.2	-1.7	-0.4	-0.6	ppm	-	-
	Upscale	450.7	448.3	-0.5	442.3	-1.7	-1.2	500	5.9	6.1
SO_2	Zero			0.0		0.0	0.0	ppm	-	-
	Upscale			0.0		0.0	0.0	1000		ERR
NOx	Zero	0.2	2.2	2.0	2.2	2.0	0.0	ppm	-	-
	Upscale	89.2	91.9	2.7	91.8	2.6	-0.1	100	3.1	0.9
THC	Zero			0		0	0	ppm	-	-
	Upscale			0		0	0	100		ERR
			LIMITS	+/- 5%		+/- 5%	+/- 3%			

	ZERO Cal. Gas Analyzer Response	Analyzer Calib. Error	MID Cal. Gas Analyzer Response	Analyzer Calib. Error	HIGH Cal. Gas Analyzer Response	Analyzer Calib. Error
O_2	0.1	0.2	9.1	0.2	20.9	0.4
CO_2		0.0		0.0		0.0
CO	0.3	0.1	140.6	-0.3	450.7	-0.1
SO_2		0.0		0.0		0.0
NOx	0.2	0.2	47.6	-1.9	89.2	0.6
THC		0.0		0.0		0.0
LIMIT		+/- 2%		+/- 2%		+/- 2%

Comments:

NOx (lb/hr) = K x ppm x MW x Flow

NOx (lb/hr) = 0.10

CO (lb/hr) = K x ppm x MW x Flow

CO (lb/hr) = 0.29

= 2.59E-09
W for NOx = 46.01 g/gmol
low (dscfm)= 15,143
W for CO= 20.00 g/gmol