Project No. 1331

[redacted]

Emission Compliance Test Program

Prepared for:

Mr. Steve Hirsch

[redacted]

January 1991

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1.0 Introduction

AirNova, Inc. conducted an emission test program at the [redacted] facility located in [redacted] on November 30, 1990. The purpose of this test program was to demonstrate compliance with applicable State of New Jersey Department of Environmental Protection regulations governing the operation of a thermal oxidizer. The oxidizer is operated for the purpose of controlling VOC emissions resulting from coating/laminating operations. The specific parameters determined as part of this test program included the following:

Inlet Test Locations	Outlet Test Location
Total Hydrocarbons	Total Hydrocarbons
Specific VOCs	Specific VOCs
Moisture	Carbon Monoxide
Flow Rate	Carbon Dioxide/Oxygen
	Moisture
	Flow Rate

Determinations of those parameters listed above allowed for the additional calculation of the destruction efficiency for volatile organic compounds.

Presented in this report are the complete results of the test program.

2.0 Site Information

The emission control device under evaluation is a Huntington Energy Systems regenerative thermal oxidizer. The fume afterburner operates at a combustion chamber temperature of 1500° F with a residence time of 0.50 seconds. The Huntington Energy oxidizer system controls the emissions emanating from three coating/laminating lines. The lines are operated for the purpose of surface coating of adhesive backed films. Solvent vapors emanating from each process enclosure are exhausted by negative draft capture hooding and vented to a common section of exhaust ducting. The vapors are subsequently routed to the Huntington Energy thermal oxidizer.

Outlet emission sampling was conducted in a vertical section of 40 inch ID exhaust ducting with sample ports situated at 90° apart and located approximately 4 duct diameters downstream and 1 duct diameters upstream from the nearest flow disturbance.

Inlet sampling was conducted in a common section of horizontal ducting located at the termination of the inlet ducts for presses one, three and five. Inlet flow measurement was made at the common inlet of coaters one and three with three ports located along one side of the rectangular ductwork. The ports are located 2 equivalent diameters upstream and 5 equivalent diameters downstream from any flow disturbance. Additional flow measurement for the calculation of total inlet flow was made at coater five. Three ports located along one axis of the horizontal duct were used for all sampling. The ports are located 5 equivalent diameters upstream and 30 equivalent diameters downstream from any flow disturbance.

3.0 Test Results

Presented in this section are the results of the test program. The data are presented on individual tables according to emission parameter to facilitate comparison and analysis. These tables , their parameters and page numbers are as follows:

The results of the test program indicate that the Huntington Energy Systems thermal oxidizer exceeds the mandated New Jersey Department of Environmental Protection requirement for VOC destruction. The demonstrated VOC removal efficiency averaged 96.8%. Emissions of carbon monoxide averaged a concentration of 29 ppm and an emission rate of 2.45 lbs/hr. Total hydrocarbons were emitted at an average concentration of 100 ppm with a corresponding mass emission rate of 4.80 lbs/hr.

An additional concern during the compliance test program was the verification of complete fume capture for the total permanent enclosures encompassing the three coating lines. The procedures used in evaluation of the enclosures included ensuring inward air flow, adequate draft velocity, and leaktight integrity. The criteria for acceptance were met and 100% VOC capture can be assumed.

Table 3-1
Flow Rate Data

	Test No. 1			Test No. 2			Test No. 3		
	Inlet	Inlet	Outlet	Inlet	Inlet	Outlet	Inlet	Inlet	Outlet
Stack Area (ft^2)	1.11	2.50	8.72	1.11	2.50	8.72	1.11	2.50	8.72
Stack Gas Temp. (°F)	113	140	296	113	135	283	113	138	294
Moisture Content (%)	1.6	1.6	0.5	1.5	1.5	0.8	1.0	1.0	0.7
Molecular Wt. (lbs.mole)	28.65	28.65	28.86	28.67	28.67	28.83	28.72	28.72	28.84
Stack Gas Velocity (FPM)	8,086	3,495	3,144	8,622	3,509	3,256	7,740	3,528	2,921
Volumetric Flow Rate (DSCFM)	8,210	7,628	19,324	8,757	7,724	20,284	7,903	7,766	17,948

Standard Conditions: 70°F, 29.92 in. Hg.

Table 3-2
Isopropanol Emission Summary

Run		Concentration (ppmV/dry)	Emission Rate (lbs/hr)
1	Inlet	<2.0	<0.30
	Outlet	<2.0	<0.36
2	Inlet	<2.0	<0.31
	Outlet	<2.0	<0.38
3	Inlet	11.1	1.62
	Outlet	<2.0	<0.34

Standard Conditions: 70°F/29.92 inches Hg

Table 3-3
Methyl ethyl ketone Emission Summary

Run		Concentration (ppmV/dry)	Emission Rate (lbs/hr)
1	Inlet	742	131
	Outlet	26.9	5.81
2	Inlet	732	135
	Outlet	25.9	5.87
3	Inlet	881	154
	Outlet	9.5	1.91

Standard Conditions - 70°F/29.92 inches Hg

Table 3-4
Ethyl Acetate Emission Summary

Run		Concentration (ppmV/dry)	Emission Rate (lbs/hr)
1	Inlet	35.2	7.62
	Outlet	<1.0	<0.26
2	Inlet	32.6	7.34
	Outlet	<1.0	<0.28
3	Inlet	<1.0	<0.21
	Outlet	<1.0	<0.25

Standard Conditions - 70°F/29.92 inches Hg

Table 3-5
Toluene Emission Summary

Run		Concentration (ppmV/dry)	Emission Rate (lbs/hr)
1	Inlet	60.0	13.6
	Outlet	2.5	0.69
2	Inlet	59.3	14.0
	Outlet	2.5	0.73
3	Inlet	18.8	4.21
	Outlet	1.0	0.26

Standard Conditions - 70°F/29.92 inches Hg

Table 3-6
Carbon Monoxide Emissions

	Concentration (ppmV dry)	Emission Rate (lbs/hr)
Test No. 1	30	2.52
Test No. 2	30	2.64
Test No. 3	28	2.18
Average	29	2.45

Standard Conditions: 70°F, 29.92 in. Hg

Table 3-7
Total Hydrocarbon Emissions
(as Methane C_1)

	Concentration (ppmV dry)	Emission Rate (lbs/hr)
Test No. 1	112	5.38
Test No. 2	109	5.50
Test No. 3	79	3.53
Average	100	4.80

Standard Conditions: 70°F, 29.92 in. Hg

Table 3-8
Destruction Efficiency Determinations
(as Methane C_1)

	Incinerator Inlet		Incinerator Outlet		
Test No.	Concentration (ppmV)	Emission Rate (lbs/hr)	Concentration (ppmV)	Emission Rate (lbs/hr)	Destruction Efficiency (%)
1	3813	150.2	112	5.38	96.4
2	3664	150.2	109	5.50	96.3
3	3722	145.0	79	3.53	97.6
Average	3733	148.5	100	4.80	96.8

Standard conditions: 70°F, 29.92 in. Hg

4.0 Sampling and Analytical Procedures

The sample collection and analysis techniques utilized in the completion of this test program were performed in accordance with current NJDEP and EPA reference test methods. Published Federal Register and New Jersey Administrative Code methods employed in characterization of the inlet and outlet test locations included the following:

EPA Method 1 - Sample and Velocity Traverse for Stationary Sources

EPA Method 2 - Determination of Stack Gas Velocity and Volumetric Flow Rate

EPA Method 3 - Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight

EPA Method 3A - Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources

EPA Method 10 - Determination of Carbon Monoxide Emissions from Stationary Sources

NJ Air Test Method 3-7 - Procedures for the Direct Measurement of VOS Using a Flame Ionization Detector

NJ Air Test Method 3-9 - Procedures for the Sampling and Remote Analysis of Known Organic Substances using a Gas Chromatograph with a Flame Ionization Detector

The methodologies employed in the determination of the specific emission of interest are fully described below.

4.1 Exhaust Analysis System and Instrumentation

The exhaust emission analysis system was housed in AirNova's mobile laboratory which was parked adjacent to the Huntington Energy Systems thermal oxidizer. The inlet and exhaust samples were transported from the filter probe assemblies to the analysis trailer by a heated Teflon lined diaphragm

pump through 100 feet of 1/4" heated Teflon sample line. This portion of the system was heated to 375° F to prevent the condensation of water and high molecular weight hydrocarbons. A heated filter at the inlet to the sample line and a second filter at the inlet to the pump prevented particulate matter from entering the analysis system. The analytical system was configured in 5 parallel legs. The first two sample paths were maintained at 375°F up to the total hydrocarbon analyzers. The sample in the other three legs was refrigerator dried before analysis. Two ice-bath refrigerator coils removed the water of combustion before supplying the samples to the CO CO_2 and O_2 analyzers. A selector valve in each leg admitted sample, zero, or span gas to each analyzer . Zero and span gases were connected directly to the hydrocarbon analyzer and selected by analyzer front panel controls. A system of flow control valves in each leg and a system bypass valve combined to permit precise flow control at each point in the system. Flow meters in each leg were used to set and monitor the sample flows.

Carbon Monoxide (CO) - Carbon monoxide was continuously monitored using a Beckman Model 865 nondispersive infrared analyzer in the range of 0-100 ppm. The analyzer relies on the selective absorption of infrared light at the wavelength particular to carbon monoxide. It then makes a comparison in signals between a reference and sample cell. The instrument was spanned with NBS traceable standards of 7 ppm, 53 ppm CO, 92 ppm, and zeroed with zero-grade nitrogen.

Total Hydrocarbons (THC) - The determination of total hydrocarbon concentrations at the inlet and outlet test locations was accomplished by employing New Jersey Air Test Method 3, "Sampling and Analytical Procedures for the Determination of Volatile Organic Substances from Source Operations".

This method involved the continuous analysis of source gas concentrations by utilizing a high temperature flame ionization detector (FID).

Sampling involved withdrawing exhaust gas directly from the emission source through a heated Teflon sample line and filter for immediate analysis by the FID. This provided a continuous determination of hydrocarbon concentrations for the entire sample period.

Total hydrocarbons were measured using two Ratfisch Model RS55 heated total hydrocarbon analyzers. These instruments use a flame ionization detector, with a heated sample path maintained at 350°F to prevent the condensation of high molecular weight hydrocarbons. The detector was fueled with hydrogen and used blended air as the oxidant. The analyzers operate on the principle that a small electric current is detected when a gas containing carbon atoms is oxidized to carbon dioxide in a hydrogen flame; measurement of this current provides an indication of concentration for organic compounds present in the gas sample. The instruments were spanned using certified span gases containing 30 ppm, 189 ppm, 260 ppm, 1112 ppm, 1887 ppm, and 2990 ppm methane (CH_4) with a balance of air. The instruments were zeroed with hydrocarbon free air.

Specific Hydrocarbons - The determination of Volatile Organic Compound (VOC) concentration at the inlet and outlet sampling locations was accomplished utilizing New Jersey Air Test Method 3-9. This method involves gas chromatography techniques providing for the identification and measurement of the solvent compounds in gaseous samples.

Sampling was conducted using the procedures outlined in section three where an integrated sample was collected in a tedlar bag by evacuating its rigid air-tight container. This method allows for the direct collection of a

sample minimizing the chance of dilution or contamination. A flow rate of 1.0 liters/min was maintained during the test run. Following sample collection the tedlar bags were returned to AirNova's laboratory for immediate analysis.

A Varian 3400 gas chromatograph with a flame ionization detector was used for the analysis of Volatile Organic Compounds. The FID was fired with a mixture of pure hydrogen and hydrocarbon free combustion air. Gas chromatography provides for the separation of constituents in a gaseous mixture based on their differences in relative affinity for a given packing material in a column. The continuous process of repeated adsorption and desorption steps results in their passing thorough the column at different rates. The gases are analyzed separately at the column exit by the flame ionization detector which as an affinity for organic material. The analysis was referenced to prepared laboratory standards.

Carbon Dioxide - Carbon dioxide levels in the oxidizer exhaust were determined by a Horiba PIR-2000 infrared analyzer. Most molecules absorb infrared radiation of a specific wavelength and the degree of absorption is proportional to the concentration at constant pressure. The Horiba Model PIR-2000 continuously determines the concentration change of a given component by measuring the infrared absorption specific to the component of interest.

The infrared radiation emitted by the light source passes through the sample and reference cells to the rotating chopper where it is modulated. If a portion of the infrared radiation passing through the sample cell is absorbed by the sample gas, a decrease in the amount of radiation reaching the sampling side of the detector cell will result. This difference causes a membrane between the sample and reference cells in the detector to produce an electrical output which is amplified and directed to a meter and recording

device.

Because the component gas of interest is sealed in the detector cell it absorbs radiation of the wavelength specific to that component and does not respond to any other wavelength, so that the concentration change of that component alone can be determined.

In the case of a component that partially overlaps the absorption wavelength of the component of interest, a solid filter is provided to remove the infrared radiation of the overlapping wavelength, eliminating the effect of the interferent.

The span gases used for carbon dioxide comparison were 2.17%, 4.60% and 9.12% mixtures in nitrogen with a component blend accuracy of ±2%.

Enclosure Verification

As part of the emission compliance test program, the verification of 100% VOC fume capture was demonstrated. The measurements performed in evaluation of the total permanent enclosures for fume containment effectiveness are as follows:

The airflow direction inward into the enclosures through the natural draft openings was verified by the use of tel tru smoke sticks. The leaktight integrity of the enclosure was measured with the same smoke source

The airflow velocity through the natural draft openings was measured using a vane anemometer. At all three locations the airflow velocity exceeded 200

ft/min

The VOC fume pickup hoods were at least four equivalent diameters away from the nearest natural draft opening

Measurement of the natural draft opening dimensions to ensure the total surface area does not exceed 5% of the total combined surface area of the enclosure

Data Reduction

The response of each instrument was continuously recorded on a strip chart recorder. All instruments were zeroed and spanned before each run and the response to zero gas and span gas was checked at the end of each run. A run consisted of sampling for one hour during normal press operation. At the beginning and conclusion of sampling the strip chart was marked with the test number.

The average instrument response during each test was manually read from the strip charts and tabulated in chart units. Sample concentrations were calculated based on the instrument response relative to the zero and spans using the appropriate instrument response characteristic as determined from the pre-test instrument calibration curves.

Appendix A

Calculations

METHOD 2- Velocity Traverse

Proj. No. 1331
Test Date 11/30/90 [redacted]
Barometer 30.19 Oxidizer Inlet
Pitot Cp 0.99

Traverse Point	Traverse 1 Delta-P (in. H2O)	Traverse 1 Temp. (Deg.F)	Traverse 2 Delta-P (in. H2O)	Traverse 2 Temp. (Deg.F)	Traverse 3 Delta-P (in. H2O)	Traverse 3 Temp. (Deg.F)
A-1	4.5	112	6.2	112	2.5	113
A-2	6.1	112	6.3	112	2.3	113
A-3	5.5	113	5.5	113	3.8	112
A-4	4.9	114	5.0	114	4.2	114
A-5	4.0	112	5.8	113	6.2	113
A-6	2.5	112	5.3	114	5.9	113
A-7						
A-8						
A-9						
A-10						
A-11						
A-12						
B-1	2.5	113	4.3	112	4.7	112
B-2	5.0	114	3.4	113	4.5	112
B-3	4.8	113	3.6	115	3.5	113
B-4	2.5	112	3.4	114	2.1	113
B-5	1.9	112	2.1	113	1.8	114
B-6	3.0	112	2.5	112	2.2	113
B-7						
B-8						
B-9						
B-10						
B-11						
B-12						
Mol.Wt. (lb/mole)	28.65		28.67		28.72	
Moisture (%)	1.6		1.5		1.0	
Temperature (F)	113		113		113	
Velocity (FPM)	8086		8622		7740	
Flow Rate (DSCFM)	8210		8757		7903	
# Points	12	# Points	12	# Points	12	
Ps(inH2O)	-1.9	Ps(inH2O)	-1.9	Ps(inH2O)	-1.9	
CO2 (%)	0	CO2 (%)	0	CO2 (%)	0	
CO (%)	0	CO (%)	0	CO (%)	0	
O2 (%)	20.8	O2 (%)	20.8	O2 (%)	20.8	
Moisture%	1.6	Moisture%	1.5	Moisture%	1.0	
Area(ft2)	1.11	Area(ft2)	1.11	Area(ft2)	1.11	
Std.Temp.	70	Std.Temp.	70	Std.Temp.	70	

METHOD 2- Velocity Traverse

Proj. No. 1331
Test Date 11/30/90
Barometer 30.19
Pitot Cp 0.99

[redacted]
Oxidizer Inlet #5

Traverse Point	Traverse 1 Delta-P (in. H2O)	Traverse 1 Temp. (Deg.F)	Traverse 2 Delta-P (in. H2O)	Traverse 2 Temp. (Deg.F)	Traverse 3 Delta-P (in. H2O)	Traverse 3 Temp. (Deg.F)
A-1	0.65	140	0.64	134	0.68	136
A-2	0.73	140	0.79	135	0.75	136
A-3	0.63	139	0.80	133	0.71	138
A-4	0.62	140	0.68	136	0.63	137
A-5	0.88	138	0.65	133	0.65	139
A-6	0.88	139	0.75	134	0.88	137
A-7						
A-8						
A-9						
A-10						
A-11						
A-12						
B-1	0.67	140	0.61	136	0.90	139
B-2	0.64	140	0.59	136	0.80	139
B-3	0.55	140	0.56	136	0.64	138
B-4	0.64	140	0.79	135	0.72	138
B-5	0.73	139	0.81	136	0.55	139
B-6	0.58	140	0.65	136	0.50	140
B-7						
B-8						
B-9						
B-10						
B-11						
B-12						

Mol.Wt. (lb/mole)	28.65	28.67	28.72
Moisture (%)	1.6	1.5	1.0
Temperature (F)	140	135	138
Velocity (FPM)	3495	3509	3528
Flow Rate (DSCFM)	7628	7724	7766

# Points	12	# Points	12	# Points	12
Ps(inH2O)	-2.2	Ps(inH2O)	-2.2	Ps(inH2O)	-2.3
CO2 (%)	0	CO2 (%)	0	CO2 (%)	0
CO (%)	0	CO (%)	0	CO (%)	0
O2 (%)	20.8	O2 (%)	20.8	O2 (%)	20.8
Moisture%	1.6	Moisture%	1.5	Moisture%	1.0
Area(ft2)	2.5	Area(ft2)	2.5	Area(ft2)	2.5
Std.Temp.	70	Std.Temp.	70	Std.Temp.	70

METHOD 2- Velocity Traverse

Proj. No. 1331
Test Date 11/30/90
Barometer 30.19
Pitot Cp 0.99

[redacted]
Oxidizer Outlet

Traverse Point	Traverse 1 Delta-P (in. H2O)	Traverse 1 Temp. (Deg.F)	Traverse 2 Delta-P (in. H2O)	Traverse 2 Temp. (Deg.F)	Traverse 3 Delta-P (in. H2O)	Traverse 3 Temp. (Deg.F)
A-1	0.44	333	0.35	281	0.38	285
A-2	0.51	303	0.41	283	0.41	285
A-3	0.55	266	0.42	283	0.42	287
A-4	0.38	301	0.53	286	0.45	290
A-5	0.33	315	0.54	288	0.44	292
A-6	0.35	290	0.43	295	0.34	303
A-7						
A-8						
A-9						
A-10						
A-11						
A-12						
B-1	0.44	323	0.39	289	0.30	299
B-2	0.46	306	0.47	276	0.32	308
B-3	0.46	297	0.48	279	0.24	308
B-4	0.35	283	0.54	274	0.39	291
B-5	0.55	259	0.63	279	0.42	286
B-6	0.53	270	0.64	284	0.52	295
B-7						
B-8						
B-9						
B-10						
B-11						
B-12						
Mol.Wt. (lb/mole)		28.86		28.83		28.84
Moisture (%)		0.5		0.8		0.7
Temperature (F)		296		283		294
Velocity (FPM)		3144		3256		2921
Flow Rate (DSCFM)		19324		20284		17948
# Points		12	# Points	12	# Points	12
Ps(inH2O)		0.27	Ps(inH2O)	0.27	Ps(inH2O)	0.27
CO2 (%)		0.7	CO2 (%)	0.7	CO2 (%)	0.7
CO (%)		0	CO (%)	0	CO (%)	0
O2 (%)		20.2	O2 (%)	20.1	O2 (%)	20.1
Moisture%		0.5	Moisture%	0.8	Moisture%	0.7
Area(ft2)		8.72	Area(ft2)	8.72	Area(ft2)	8.72
Std.Temp.		70	Std.Temp.	70	Std.Temp.	70

[redacted]

METHOD 4- Moisture Determination

Proj. No. 1331
Test Date 11/30/90
Barometer 30.19

	Inlet			Outlet		
Run No.	1	2	3	1	2	3
Meter Vol. (DCF)	45.822	45.262	43.38	43.163	42.824	44.501
Moisture Gain (g)	16.0	14.4	9.1	4.3	7.8	7.4
Avg Meter Temp(F)	67.0	79.0	66.3	58.5	54.0	52.3
Std. Temp. (F)	70	70	70	70	70	70
Meter Coeff. (Y)	1.004	1.004	1.004	0.999	0.999	0.999
Meter Vol. (DSCF)	46.685	45.087	44.256	44.474	44.511	46.408
Water Vapor (SCF)	0.7572	0.6815	0.4307	0.2035	0.3692	0.3502
Stack Moisture(%)	1.6	1.5	1.0	0.5	0.8	0.7

[redacted]

NJDEP Compliance Test

Inlet Flow	Press 1/3	Press 5	Total
1	8210	7628	15838
2	8757	7724	16481
3	7903	7766	15669

[redacted]

Emission Rate Calculations
Total Hydrocarbons

Inlet (3813 ppm)(15838 DSCFM)(16.04 MW)(60min/hr)
387×10⁶
150.18 lbs CH_4/hr

Outlet (112 ppm)(19324 DSCFM)(16.04 MW)(60min/hr)
387×10⁶
5.38 lbs CH_4/hr

Inlet (3664 ppm)(16481 DSCFM)(16.04 MW)(60min/hr)
387×10⁶
150.17 lbs CH_4/hr

Outlet (109 ppm)(20284 DSCFM)(16.04 MW)(60min/hr)
387×10⁶
5.50 lbs CH_4/hr

Inlet (3722 ppm)(15669 DSCFM)(16.04 MW)(60min/hr)
387×10⁶
145.03 lbs CH_4/hr

Outlet (79 ppm)(17948 DSCFM)(16.04 MW)(60min/hr)
387×10⁶
3.53 lbs CH_4/hr

[redacted]

Emission Rate Calculations
Carbon monoxide

$$\frac{(30\ ppm)(19324\ DSCFM)(28.01\ MW)(60\ min/hr)}{387 \times 10^6}$$

2.52 lbs CO/hr

$$\frac{(30\ ppm)(20284\ DSCFM)(28.01\ MW)(60\ min/hr)}{387 \times 10^6}$$

2.64 lbs CO/hr

$$\frac{(28\ ppm)(17942\ DSCFM)(28.01\ MW)(60\ min/hr)}{387 \times 10^6}$$

2.18 lbs CO/hr

A7

[redacted]

Specific VOC Emission Rate

Molecular Weights

IPA - 60.10
MEK - 72.11
Ethyl acetate - 88.11
Toluene 92.14

Volumetric Flow Rates

Run	Inlet	Outlet
1	15838 DSCFM	19324 DSCFM
2	16481 DSCFM	20284 DSCFM
3	15669 DSCFM	17948 DSCFM

Emission Rates

	IPA		MEK		ETAC		Toluene	
Run	In	Out	In	Out	In	Out	In	Out
1	<0.30	<0.36	131.44	5.81	7.62	<0.26	13.58	0.69
2	<0.31	<0.38	134.86	5.87	7.34	<0.28	13.96	0.73
3	1.62	<0.34	154.33	1.91	0.21	<0.25	4.21	0.26

Appendix B

Coating Formulations and Usage

Attachment
Surface Coating Data

	Machine #1	Machine #3	Machine # 5
Material Being Coated	Polyester for Sail Cloth	Polyester for Sail Cloth	Silicon Release Coated Paper
Type of Coating	Polyester Thermalset Laminating Adhesive	Polyester Thermalset Laminating Adhesive	Acrylic Pressure Sensitive Adhesive
Coating Density (lb/gal)			
- Unthinned	7.8	7.8	7.3
- Thinned	7.6	7.6	7.3
Coating Rate (gal/hr)			
- Run #1	10.9	11.2	22.7
- Run #2	11.3	11.3	19.2
- Run #3	11.5	12.0	19.2
Coating Alteration	Addition of Solvent Thinner and Cross-Linking Agent (Catalyst)	Addition of Solvent Thinner and Cross Linking Agent (Catalyst)	Not Altered
Approximate Distance From Coating Head to Exhaust (ft)	6	6	10

Appendix C

Data Sheets and Calibrations

ELECTRONIC DEVELOPMENT CORPORATION

Calibrated 9/22/87 P-2128/87
Temperature 72 °F
Humidity 55 % RH

Certificate of Compliance

for

Model MV 106 J Serial Number 10497

referenced to

Primary Standard Cell, Serial Number 1596-3

certified by Test Number 223626

at the U.S. NATIONAL BUREAU OF STANDARDS,

Washington, D.C., U.S.A.

The EMF of this TRACEABLE STANDARD CELL is periodically checked and the test report is filed at ELECTRONIC DEVELOPMENT CORPORATION

1.0179877 Volts at 32.1 °C.

ELECTRONIC DEVELOPMENT CORPORATION certifies that this instrument conforms in all respects to applicable specifications and/or standards, and that physical and electrical test reports are on file and available for review. This certificate is valid for 1 year.

ELECTRONIC DEVELOPMENT CORPORATION

By: [signature]

Title: Quality Control Manager

Date: March 22, 1987

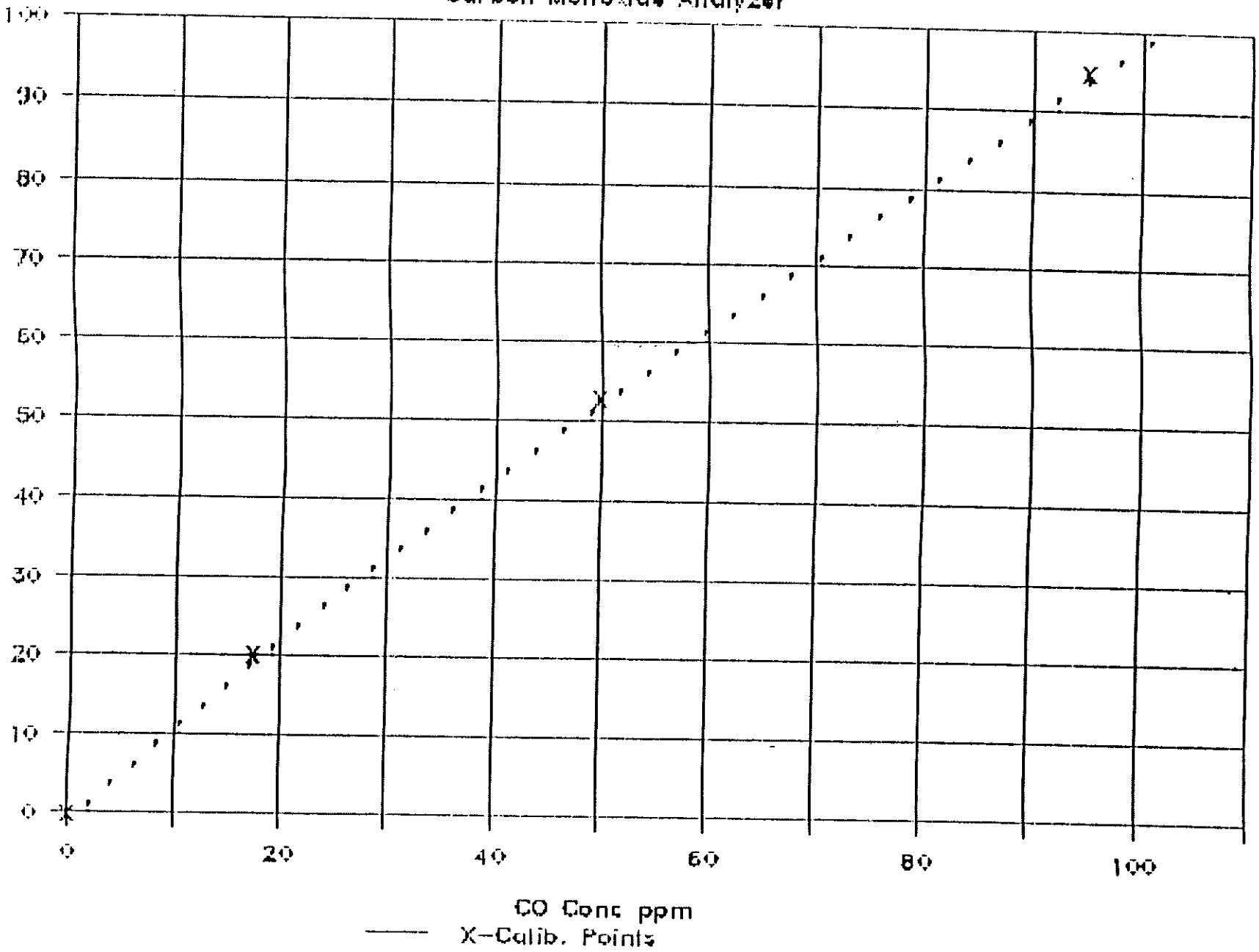
INSTRUMENT CALIBRATION REPORT

Instrument: Beckman 865 CO
S/N:
Range: 3 Gain: 4.5 Zero: 2.9 Tune: 32

Cyl. No.	CO CONC ppm	% FS	Coefficients for 3rd Order Polynomial Curve Fit
Zero	0.0	0.0	B0= 2.61300E-07
SX14266	17.4	20.5	B1= 7.82700E-01
BAL 1955	49.6	53.2	B2= 3.48120E-03
SX18064	95.0	95.0	B3= -1.25660E-05
SX19175			B4= 0.00000E+00

Beckman 865 R3

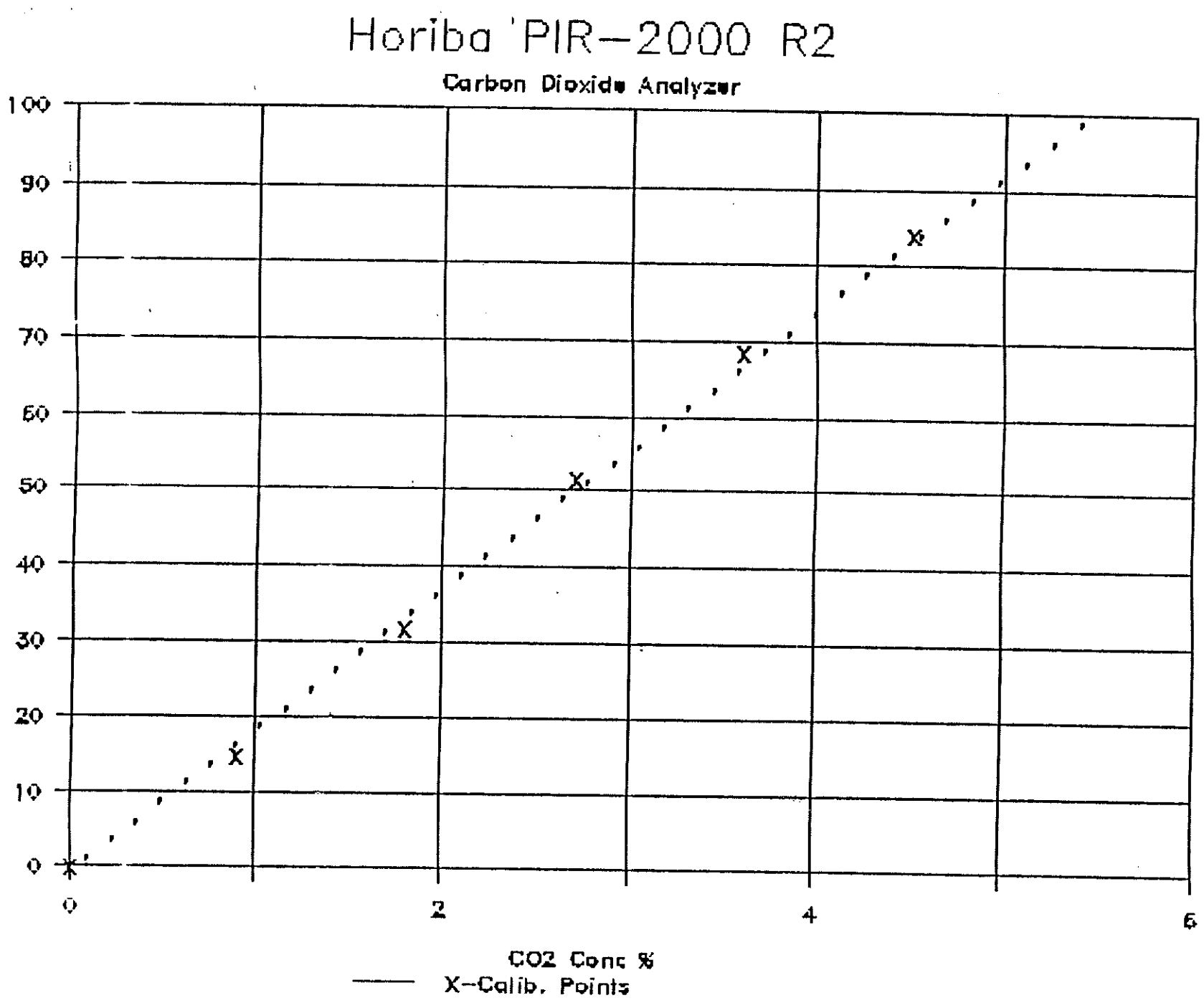
Carbon Monoxide Analyzer



INSTRUMENT CALIBRATION REPORT

Instrument: HORIBA PIR-2000 Calibration Date: Feb 8, 1989
S/N: 303011
Range: 3 Gain: 1.2 Zero: 5.2

Cyl. No.	CO2 CONC %	% FS	Coefficients for 4th Order Polynomial Curve Fit
Zero	0.000	0.0	B0= 2.00000E-04
CO2 in N2	1.824	26.0	B1= 7.46790E-02
	3.648	48.0	B2= -4.86810E-04
	5.472	65.0	B3= 1.33150E-05
	7.296	79.0	B4= -5.47520E-08
	9.120	91.5	
	4.600	59.2	


Horiba PIR-2000 R2
Carbon Dioxide Analyzer
100
90
80
70
60
50
40
30
20
10
0
0
2
4
6
CO2 Conc %
X-Calib. Points

INSTRUMENT CALIBRATION REPORT

Instrument: Oxymat 2 — Calibration Date: Mar 10, 1989
S/N:
Range: 25% Gain: Zero: Tune:

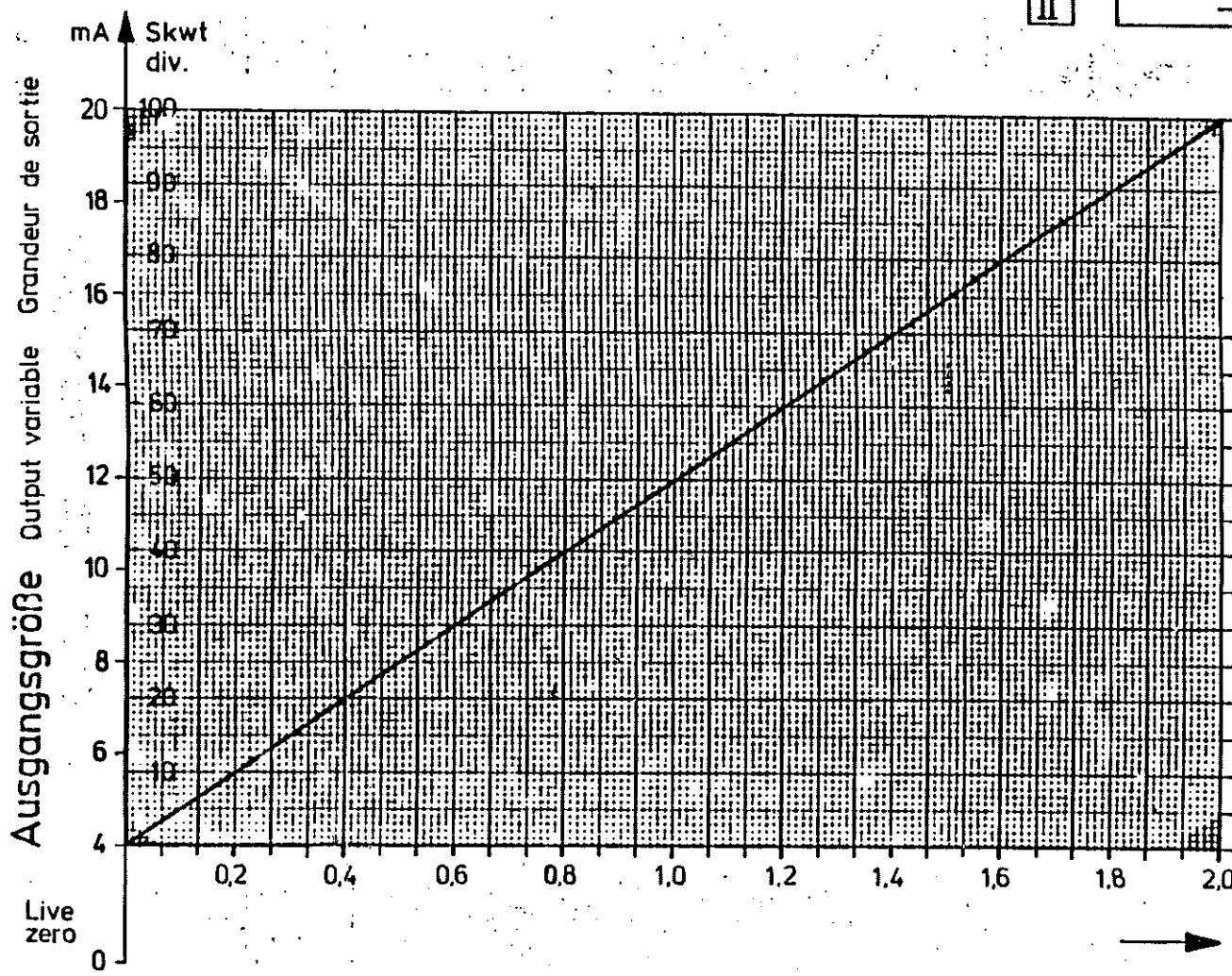
Cyl. No.	O2 CONC %	% FS	Coefficients for 4th Order Polynomial Curve Fit	
Zero	0.00	0.0	B0=	0.00000E+00
	6.87	26.3	B1=	2.54900E-01
	8.55	32.2	B2=	0.00000E+00
	16.10	63.5	B3=	0.00000E+00
	20.80	81.6	B4=	0.00000E+00

0 ~ 25% 4-20mA

Meßbereich Meas. range Etendue de mesure

I	0 ... 2 %O2
II	—

PR 2/14/89



Meßgas-konzentr. Analyzed gas concentr. Concentr. du gaz analysé		Geräteausgangsgröße Instr. output variable Grandeur de sortie de l'appareil	
[% O_2]		mA	V
I	II	I/II	I/II
0		4	2
0,25		6	3
0,5		8	4
0,75		10	5
1,0		12	6
1,25		14	7
1,5		16	8
1,75		18	9
2,0		20	10

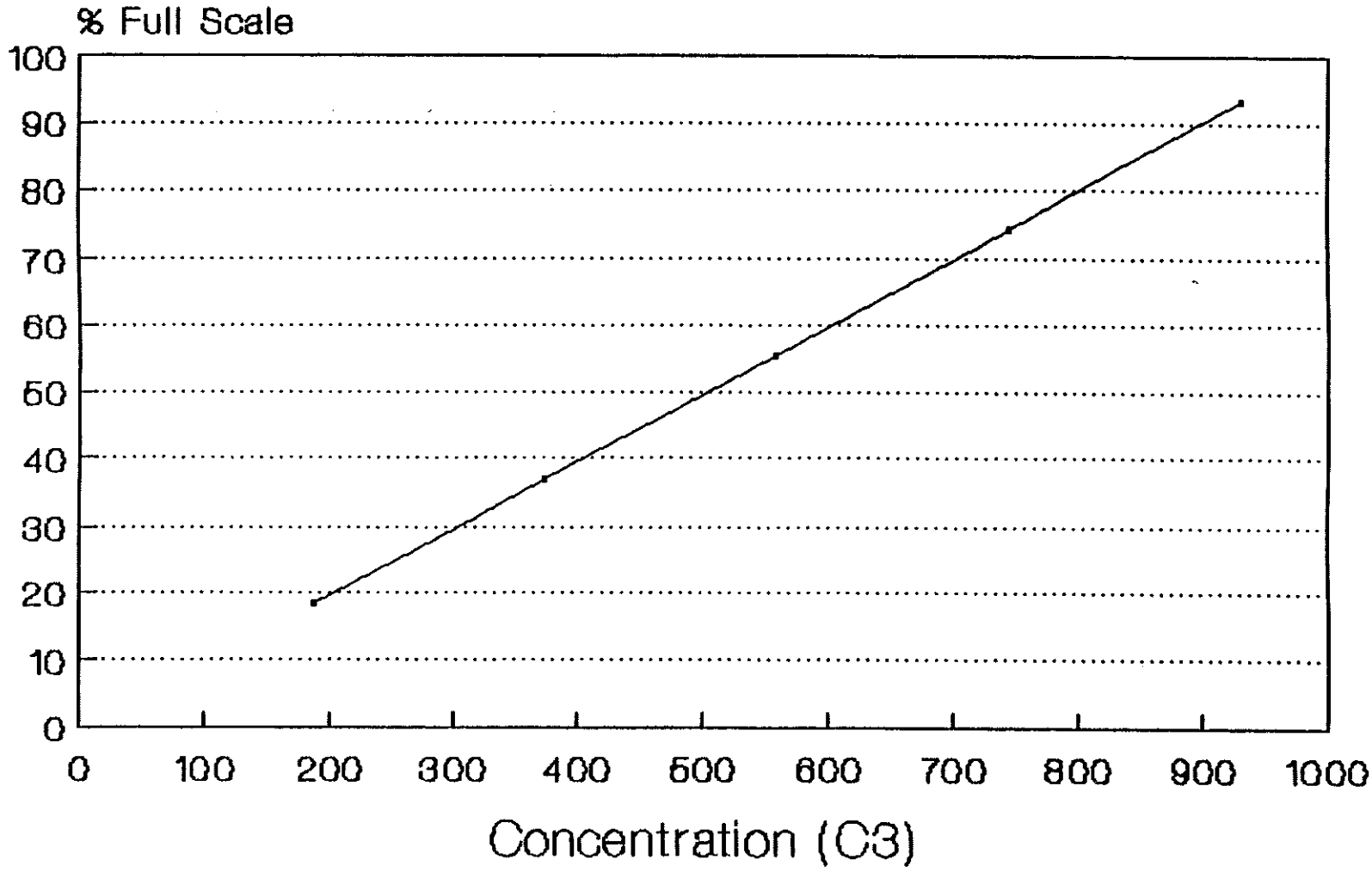
Meßgaskonzentration Analyzed gas concentr. Concentr. du gas analysé [% O_2]

F-Nr. Ser.No. N° de fabr.: U12-549

Typ Nr. Meas. point No. N° du point de mes.: M52017-B1142-B112

Ratfisch FID No. 1

Calibration Range= 0-1000 C3



01/27/87

INTER-LABORATORY STUDY RESULTS

DATE: 04/25/90

(JUNE 1989)

POLLUTANT - DGM

4011
. ROBERT MCKINNEY
RNOVA, INC.
1 HADDON AVE. / P.O. BOX 97
LLINGSWOOD, NJ 08108

UNITS - CUBIC METERS

ORIFICE NUMBER	REPORTED VALUE	EPA VALUE	PERCENT DIFFERENCE
185	.3085	.3075	.31
185	.3079	.3075	.12
185	.3081	.3075	.18

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
GAS METER SHOP

PROOF TEST RECORD

METER SIZE: CL175 DATE RECEIVED: 10/04/89 INSPECTOR: C. RIZZA

DATE TESTED: 10/05/89 MANUFACTURER: ROCKWELL

PROVER NO. 1264 TEMPERATURE: OIL : 73° F.

METER NUMBER: 6837018 PROVER AIR: 73° F.

175 C.F.H.

TEST # 1	2.0 CU. FT.	PERCENT PROOF	100.0
TEST # 2	2.0 CU. FT.		100.0
TEST # 3	2.0 CU. FT.		100.0

35 C.F.H

TEST # 1	2.0 CU. FT.	PERCENT PROOF	100.I
TEST # 2	2.0 CU. FT.		100.0
TEST # 3	2.0 CU. FT.		100.0

A calibration and accuracy test was performed on test meter number 6837018 for:

AirNova Inc
931 Haddon Avenue
Collingswood,N.J.
08108

METER REPAIR SUPERVISOR

CARMEN RIZZA

Carmen Rizza

CALIBRATION CALCULATIONS METER BOX Calibrated by Jay May Date 2/28/90 Box No. 4

$0.0317 \left(\frac{(T_w + 460)t}{P_b\ (T_{d\ avg.} + 460)}\right)\left(\frac{}{CF_w}\right)^2$	Man.	$\Delta H_@$	$\frac{CF_w\ P_b\ (T_{d\ avg.} + 460)}{CF_d\ (P_b + \frac{\text{Man. orifice}}{13.6})(T_w + 460)}$	Man.	Y
0.01585 (29 + 460) 5 / 30.35 (64 + 460) 1.990	.5	1.76	1.990 x 30.35 (64 + 460) / 1.965 (30.35 + 0.0368) (69 + 460)	.5	1.001
0.0317 (69 + 460) 5 / 30.36 (67.5 + 460) 2.756	1.0	1.82	2.756 x 30.36 (67.5 + 460) / 2.744 (30.36 + 0.0735) (69 + 460)	1.0	.999
0.0634 (69 + 460) 10 / 30.37 (71 + 460) 7.708	2.0	1.85	7.708 x 30.37 (71 + 460) / 7.684 (30.37 + 0.147) (69 + 460)	2.0	1.002
0.0951 (69 + 460) 10 / 30.34 (75 + 460) 9.413	3.0	1.85	9.413 x 30.34 (75 + 460) / 9.415 (30.34 + 0.221) (69 + 460)	3.0	1.003
0.1268 (69 + 460) 10 / 30.34 (78 + 460) 10.844	4.0	1.95	10.844 x 30.34 (78 + 460) / 10.876 (30.34 + 0.294) (69 + 460)	4.0	1.003
0.1585 (69 + 460) 10 / 30.34 (81.5 + 460) 12.073	5.0	1.95	12.073 x 30.34 (81.5 + 460) / 12.116 (30.34 + 0.368) (69 + 460)	5.0	1.005

CALIBRATION CALCULATIONS METER BOX Calibrated by JAY Date 8-29-90 Box No. 4

$0.0317 \text{ (Man. orifice)} \left(\frac{(T_w + 460)t}{P_b\ (T_{d\ avg.} + 460)}\right)^2 \frac{}{CF_w}$	Man.	$\Delta H_@$	$CF_w P_b (T_{d\ avg.} + 460) \Big/ CF_d \left(P_b + \frac{\text{Man. orifice}}{13.6}\right)(T_w + 460)$	Man.	Y
0.01585 ; (82 + 460) 15 ; 29.92 (87 + 460) ; 2.027	.5	1.75	2.027 x 29.92 (87 + 460) ; 2.015 (29.92 + 0.0368) (82 + 460)	.5	1.006
0.0317 ; (83 + 460) 15 ; 29.92 (85 + 460) ; 2.814	1.0	1.81	2.814 x 29.92 (85 + 460) ; 2.805 (29.92 + 0.0735) (83 + 460)	1.0	1.004
0.0634 ; (83 + 460) 10 ; 29.92 (87 + 460) ; 7.535	2.0	2.01	7.535 x 29.92 (87 + 460) ; 7.504 (29.92 + 0.147) (83 + 460)	2.0	1.006
0.0951 ; (83 + 460) 10 ; 29.92 (91 + 460) ; 9.705	3.0	1.81	9.705 x 29.92 (91 + 460) ; 9.692 (29.92 + 0.221) (83 + 460)	3.0	1.008
0.1268 ; (83 + 460) 10 ; 29.92 (92 + 460) ; 11.191	4.0	1.81	11.191 x 29.92 (92 + 460) ; 11.176 (29.92 + 0.294) (83 + 460)	4.0	1.01
0.1585 ; (84 + 460) 10 ; 29.92 (94 + 460) ; 12.442	5.0	1.83	12.442 x 29.92 (94 + 460) ; 12.427 (29.92 + 0.368) (84 + 460)	5.0	1.01

CALIBRATION CALCULATIONS METER BOX Calibrated by JAY Date 4-10-90 Box No. 5

$0.0317 \text{ (Man. orifice)} \left(\frac{(T_w + 460)t}{P_b\ (T_{d\ avg.} + 460)}\right)^2 \left(\frac{}{CF_w}\right)^2$	Man.	$\Delta H_@$	$CF_w\ P_b\ (T_{d\ avg.} + 460)$ / $CF_d\ (P_b + \frac{\text{Man. orifice}}{13.6})\ (T_w + 460)$	Man.	Y
0.01585 / 30.11 (70 + 460)	.5	1.74	1.985 x 30.11 (70 + 460) / 2.020 (30.11 + 0.0368) (66 + 460)	.5	.99
0.0317 / 30.11 (71 + 460)	1.0	1.80	2.758 x 30.11 (71 + 460) / 2.809 (30.11 + 0.0735) (67 + 460)	1.0	.99
0.0634 / 30.11 (76 + 460)	2.0	1.80	7.824 x 30.11 (76 + 460) / 7.899 (30.11 + 0.147) (69 + 460)	2.0	1.0
0.0951 / 30.11 (79.5 + 460)	3.0	1.78	9.616 x 30.11 (79.5 + 460) / 9.801 (30.11 + 0.221) (70 + 460)	3.0	.99
0.1268 / 30.11 (84.5 + 460)	4.0	1.76	11.155 x 30.11 (84.5 + 460) / 11.249 (30.11 + 0.294) (70 + 460)	4.0	1.00
0.1585 / 30.11 (85 + 460)	5.0	1.76	12.428 x 30.11 (85 + 460) / 12.537 (30.11 + 0.368) (70 + 460)	5.0	1.00

CALIBRATION CALCULATIONS METER BOX Calibrated by JAY Date 9-7-90 Box No. 5

0.0317 (Man. orifice) $\left(\frac{(T_w + 460)t}{P_b\ (T_{d\ avg.} + 460)}\right)^2 \left(\frac{}{CF_w}\right)$	Man.	$\Delta H_@$	$CF_w\ P_b\ (T_{d\ avg.} + 460)$ / $CF_d\ (P_b + \frac{\text{Man. orifice}}{13.6})\ (T_w + 460)$	Man.	Y
0.01585 ; $\left(\frac{(83 + 460)\ 5}{29.91\ (85 + 460)}\right)^2 \left(\frac{}{2.045}\right)$	.5	1.71	2.045 x 29.91 (85 + 460) / 2.062 (29.91 + 0.0368) (83 + 460)	.5	.99
0.0317 ; $\left(\frac{(84 + 460)\ 5}{29.91\ (87 + 460)}\right)^2 \left(\frac{}{2.826}\right)$	1.0	1.78	2.826 x 29.91 (87 + 460) / 2.843 (29.91 + 0.0735) (87 + 460)	1.0	.99
0.0634 ; $\left(\frac{(83 + 460)\ 10}{29.91\ (90 + 460)}\right)^2 \left(\frac{}{8.116}\right)$	2.0	1.73	8.116 x 29.91 (90 + 460) / 8.140 (29.91 + 0.147) (83 + 460)	2.0	1.004
0.0951 ; $\left(\frac{(84 + 460)\ 10}{29.91\ (92 + 460)}\right)^2 \left(\frac{}{9.886}\right)$	3.0	1.74	9.886 x 29.91 (92 + 460) / 9.889 (29.91 + 0.221) (84 + 460)	3.0	1.006
0.1268 ; $\left(\frac{(84 + 460)\ 10}{29.91\ (92 + 460)}\right)^2 \left(\frac{}{11.361}\right)$	4.0	1.76	11.361 x 29.91 (92 + 460) / 11.37 (29.91 + 0.294) (84 + 460)	4.0	1.008
0.1585 ; $\left(\frac{(84 + 460)\ 10}{29.91\ (94 + 460)}\right)^2 \left(\frac{}{12.741}\right)$	5.0	1.74	12.741 x 29.91 (94 + 460) / 12.725 (29.91 + 0.368) (84 + 460)	5.0	1.007

METTLER

Weight Traceability Certificate

To: AIR NOVA CORPORATION
5845-A CLAYTON AVE.
PENNSAUKEN, N.J. 08109

The balances listed below have been serviced by our representative on
Feb 21, 1990

This is to certify that the test weights used are traceable to the National Institute of Standards and Technology.

	Analytical	Precision
METTLER identification number of test weights used:	351	
METTLER calibration date of test weights used:	5-1-89	
National Institute of Standards and Technology test number:	737/C670 MET49	

Model and serial number of balances serviced:

HK 32146	

mark Kaminsky
METTLER Service Representative

Feb 21, 1990
Date of Issue

PITOT TUBE CALIBRATION DATA

Pitot Tube Identification Number: S ft Date: 3/14/90

Calibrated By: Robert McKinney

"A" SIDE CALIBRATION				
Run No.	ΔP_{std} cm H_2O (in. H_2O)	$\Delta P_{(s)}$ cm H_2O (in. H_2O)	$C_{p(S)}$	Dev.
1	.62	.85	.846	-0.002
2	.62	.85	.846	-0.002
3	.62	.84	.851	0.003
		Average	.848	

"B" SIDE CALIBRATION				
Run No.	ΔP_{std} cm H_2O (in. H_2O)	$\Delta P_{(s)}$ cm H_2O (in. H_2O)	$C_{p(S)}$	Dev.
1	.63	.86	.847	0.003
2	.63	.85	.852	0.002
3	.63	.85	.852	0.002
		Average	.850	

$$C_{p(s)} = .99\sqrt{\frac{\Delta P_{std.}}{\Delta P_{(s)}}}$$

Dev. = $C_{p(S)} - C_{p(S)(avg.)}$ = _____ (MUST BE ≤0.01)

C_p Difference = $A_{avg.} - B_{avg.}$ = 0.002 (MUST BE ≤0.01)

OK

DRY TEST METERS - LOW FLOW

Calibrated By MDD

Date 11/29/88 Meter No. 1

Thermometer — Leak Check OK

Flow Rate	V_w	V_d	T_w	IT_d	OT_d	$I_{d\ avg.}$	P_b	T
1 LPM/2 CFH	.583	.590	529.8			532.5	30.15	20
4 LPM/8 CFH								

$$\frac{V_w \times \left(P_b + \frac{D_m}{13.6}\right) \times \left(T_{d\ avg} + 460\right)}{V_d \times P_b \times (T_w + 460)}$$

	Flow	Y
$\frac{.583 \times (30.15 + 0) \times (532.5 + 460)}{.590 \times 30.15 \times (529.8 + 460)}$	1 LPM/ 2 CFH	.993
$\frac{\quad \times (\quad + \quad) \times (\quad + 460)}{\quad \times \quad \times (\quad + 460)}$	4 LPM/ 8 CFH	

V_w = Volume wet test meter

V_d = Volume dry test meter

T_w = Temperature wet test meter

IT_d = Inlet temperature dry test meter

OT_d = Outlet temperature dry test meter

T_d = Average temperature dry test meter

P_b = Barometric pressure, inches Hg

T = Time

D_m = Differential pressure wet test meter

Conversions:

1 CF = 28.32 ℓ

1 ℓ = 0.03532 CF

Run # 1

Dry Test Meter - Low Flow

Calibrated by JM

Date 6-14-89 Meter No. 2

Thermometer — Leak Check OK

Flow rate	V_w	V_d	T_w	$T_{d\,AVG}$	P_b	T
1LPM/2CFH	.363	.366	542	542	29.76	10

$$\frac{V_w \times P_b \times T_{d\,AVG}}{V_d \times P_b \times T_w}$$

	Flow	X
$\frac{.363 \times 29.76 \times 546}{.366 \times 29.76 \times 542}$	1LPM/ 2CFH	.999

V_w = Volume Test Meter
V_d = Volume Box meter
T_w = Temperature Test meter
T_d = Temperature Box meter
P_b = Barometric pressure, inches Hg
T = Time

Run # 2

Dry Test Meter - Low Flow

Calibrated by JM
Date 6-19-89 Meter No. 2
Thermometer — Leak Check OK

Flow rate	V_w	V_d	T_w	$T_{d\,AVG}$	P_b	T
1LPM/2CFH	.374	.379	543	547.5	29.74	10

$$\frac{V_w \times P_b \times T_{d\,AVG}}{V_d \times P_b \times T_w}$$

	Flow	X
$\frac{.374 \times 29.74 \times 547.5}{.379 \times 29.74 \times 543}$	1LPM/2CFH	.992

V_w = Volume Test Meter
V_d = Volume Box meter
T_w = Temperature Test meter
T_d = Temperature Box meter
P_b = Barometric Pressure, inches Hg
T = Time

Project Number _____ Test Number _____

Plant [redacted]

Date 11-30-90 Time _____

Sampling Location INLET

Sample Type _____

Run Number _____

Operators _____

Ambient Temperature 49

Barometer 30.19

Orsat Analysis

Sample Type (Bag, Integrated, Continuous) _____

GAS \ RUN	1		2		3	
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET
CO_2						
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)						
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)						
N_2 (NET IS 100 MINUS ACTUAL CO READING)						

Fyrite Analysis Pitot coefficient _____

CO_2	O_2	

Field Data - Moisture

Time _____

Final Meter Vol. 792.897

Initial Mtr. Vol. 746.075

Total Meter Vol. 45.822

Meter Temp. In 58 / 83

67 Out 58 / 73

Rotameter Setting 2

Final H_2O Vol. 502 ml

Init. H_2O Vol. 311 ml

Net Volume _____

Comments:

LEAK CK

.004 AT 10"

TRAVERSE POINT LOCATION & VELOCITY DATA BY

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=A x I.D. (D=)	C=B+NIPPLE (NIPPLE=)	VELOCITY HEAD (Δp_1), in. H_2O	STACK TEMPERATURE (T_s), °F
1				4.5	112
2				6.1	117
3			TUBE	5.5	3
4				4.9	114
5				4.0	112
6				2.5	112
7					
8				2.5	113
9				5.0	114
10				4.4	3
11				2.5	3
12				1.9	
13				3.0	
14					
15					
16			STATIC	-9.9	
17					
18					
19				.10	112
20				.13	3
21				.13	3
22				.11	3
23				.14	4
24				.11	3
25				.11	3
26				.11	3
27				.11	3
28				.69	3
29				.73	3
30				.71	3
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

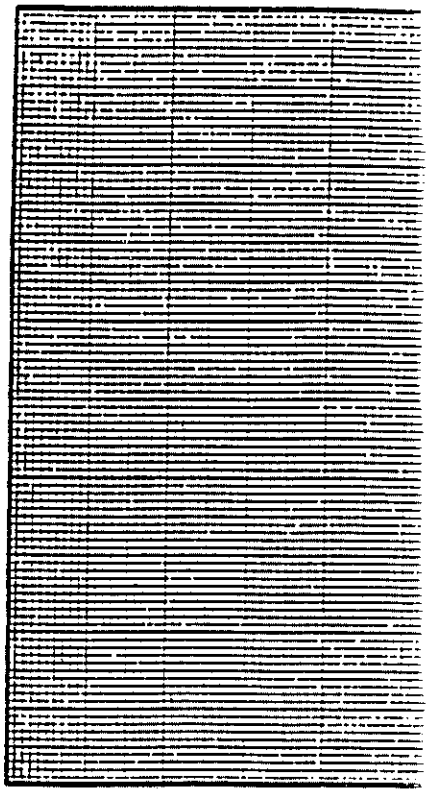


DIAGRAM OF STACK, PORTS, & TRAVERSE POINTS (indicate direction of flow)

INSIDE DIMENSIONS OF SAMPLE PLANE _____

STACK GAUGE PRESSURE in. H_2O _____

NEAREST UPSTREAM DISTURBANCE _____

NEAREST DOWNSTREAM DISTURBANCE _____

PROCESS & CONTROL EQUIPMENT DESCRIPTION _____

Project Number______ Test Number______

Plant [redacted]

Date [illegible] Time______

Sampling Location Inlet

Sample Type [illegible]

Run Number 2

Operators [illegible]

Ambient Temperature 51

Barometer 30.12

Orsat Analysis

Sample Type (Bag, Integrated, Continuous)______

GAS \ RUN	1 Actual Reading	1 Net	2 Actual Reading	2 Net	3 Actual Reading	3 Net
CO_2						
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)						
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)						
N_2 (NET IS 100 MINUS ACTUAL CO READING)						

Fyrite Analysis

Pitot coefficient .99

CO_2	O_2	

Field Data - Moisture

Time [illegible]

Final Meter Vol. 838.576

Initial Mtr. Vol. 793.314

Total Meter Vol. 45.262

Meter Temp. In 73 / 90

79 Out 73 / 80

Rotameter Setting 20

Final H_2O Vol. 201 ml

Init. H_2O Vol. 200 ml

Net Volume______

Comments:

Leak ck [illegible]

[illegible]

[illegible] .004 [illegible]

[illegible]

5"

TRAVERSE POINT LOCATION & VELOCITY DATA BY______

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=AxI.D. ID=	C=B+NIPPLE NIPPLE=	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	inlet	# 1		6.2	112
2				5.2	112
3				5.5	[illegible]
4				5.0	[illegible]
5				5.4	[illegible]
6				5.3	[illegible]
7					
8				4.3	112
9				3.4	113
10				3.6	[illegible]
11				3.4	[illegible]
12				2.1	[illegible]
13				2.5	[illegible]
14					
15			STATIC	- 1.9	
16					
17					
18					
19	inlet	# 2			
20					
21			A 1	.64	134
22			2	.79	135
23			3	.80	133
24			4	.68	136
25					
26			B 1	.65	133
27			2	.73	134
28			3	.81	136
29			4	.59	136
30					
31			1	.50	136
32			2	.79	135
33			3	.81	136
34			4	.65	136
35					
36			STATIC	[illegible]	
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

DIAGRAM OF STACK, PORTS, & TRAVERSE POINTS (indicate direction of flow)

INSIDE DIMENSIONS OF SAMPLE PLANE______

STACK GAUGE PRESSURE in. H_2O______

NEAREST UPSTREAM DISTURBANCE______

NEAREST DOWNSTREAM DISTURBANCE______

PROCESS & CONTROL EQUIPMENT DESCRIPTION______

Project Number _____ Test Number _____

Plant [redacted]

Date 11-30-90 Time _____

Sampling Location INLET

Sample Type Method 1-4

Run Number 3

Operators NC / JM

Ambient Temperature _____

Barometer 30.19

Orsat Analysis

Sample Type (Bag, Integrated, Continuous) _____

RUN	1		2		3	
GAS	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET
CO_2						
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)						
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)						
N_2 (NET IS 100 MINUS ACTUAL CO READING)						

Fyrite Analysis Pitot coefficient _____

CO_2	O_2	

Field Data - Moisture

Time _____

Final Meter Vol. 43,278

Initial Mtr. Vol. [illegible]

Total Meter Vol. 43.380

Meter Temp. In 72 / 70

663 Out [illegible] 70

Rotameter Setting _____

Final H_2O Vol. [illegible]

Init. H_2O Vol. [illegible]

Net Volume _____

Comments:

TRAVERSE POINT LOCATION & VELOCITY DATA BY _____

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=A x I.D. I.D.=	C=B+NIPPLE NIPPLE=	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1		INLET	[illegible]	2.5	116
2				2.3	115
3				3.8	115
4				4.2	114
5				[illegible]	[illegible]
6				5.9	[illegible]
7				4.7	[illegible]
8				4.5	[illegible]
9				3.5	[illegible]
10				[illegible]	[illegible]
11				[illegible]	[illegible]
12					
13					
14					
15					
16		[illegible]	[illegible]	.68	120
17				.75	[illegible]
18				.71	[illegible]
19				.63	[illegible]
20				.65	[illegible]
21				.85	[illegible]
22				.90	[illegible]
23				.80	[illegible]
24				.64	[illegible]
25				.72	[illegible]
26				.55	[illegible]
27				.50	[illegible]
28					
29			STATIC	-2.3	
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

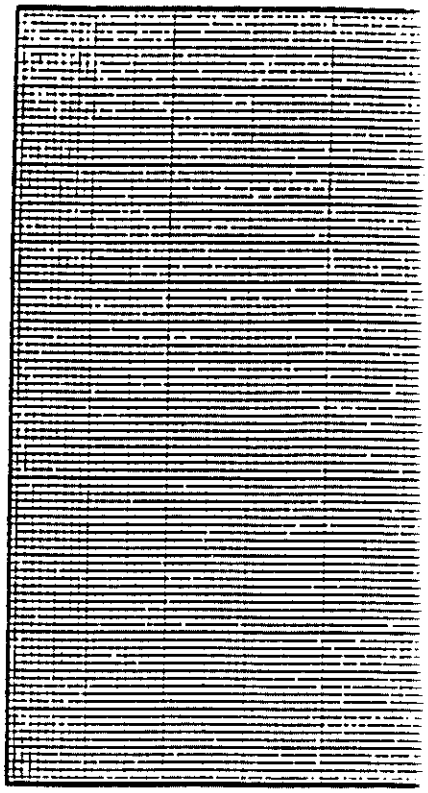


DIAGRAM OF STACK, PORTS, & TRAVERSE POINTS (indicate direction of flow)

INSIDE DIMENSIONS OF SAMPLE PLANE _____

STACK GAUGE PRESSURE in. H_2O _____

NEAREST UPSTREAM DISTURBANCE _____

NEAREST DOWNSTREAM DISTURBANCE _____

PROCESS & CONTROL EQUIPMENT DESCRIPTION _____

Project Number_____ Test Number_____

Plant [redacted]

Date 11-30-90 Time_____

Sampling Location outlet

Sample Type Run 1-4

Run Number 1

Operators JC-JM

Ambient Temperature_____

Barometer 30.19

Orsat Analysis

Sample Type (Bag, Integrated, Continuous)_____

RUN	1		2		3	
GAS	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET
CO_2						
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)						
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)						
N_2 (NET IS 100 MINUS ACTUAL CO READING)						

Fyrite Analysis Pitot coefficient .99

CO_2	O_2	

Field Data - Moisture

Time 11:00 - 12:00

Final Meter Vol. 43,163

Initial Mtr. Vol 38.725

Total Meter Vol. 43.725

Meter Temp. In 52 / 64

585 Out 72 / 66

Rotameter Setting 1.5

Final H_2O Vol. 200 ml

Init. H_2O Vol. 0 ml

Net Volume 0 ml

Comments:

5"

.29

.007

.0021

TRAVERSE POINT LOCATION & VELOCITY DATA BY_____

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=Axi I.D. ID=	C=B+NIPPLE NIPPLE=	VELOCITY HEAD (Δp_s), in.H_2O	STACK TEMPERATURE (T_s), °F
1				.44	332
2				.51	302
3				.55	312
4				.34	291
5				.33	315
6				.32	290
7				.44	324
8				.46	325
9				.46	327
10				.35	295
11				.52	251
12				.52	270
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

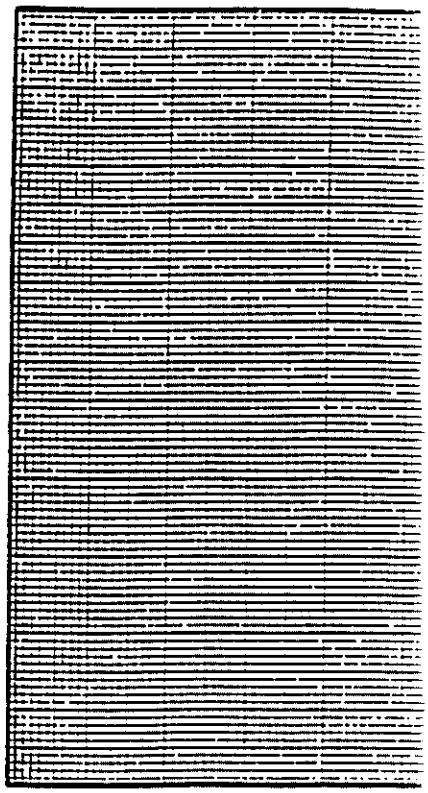


DIAGRAM OF STACK, PORTS, & TRAVE POINTS (indicate direction of fl

INSIDE DIMENSIONS OF SAMPLE PLAN

STACK GAUGE PRESSURE in. H_2O____

NEAREST UPSTREAM DISTURBANCE____

NEAREST DOWNSTREAM DISTURBANCE____

PROCESS & CONTROL EQUIPMENT DESCRIPTION_____

Project Number [redacted] Test Number _____

Plant [redacted]

Date 11-20-90 Time 13 [illegible]

Sampling Location OUTLET

Sample Type METHOD 1-4

Run Number _____

Operators [illegible]

Ambient Temperature [illegible]

Barometer [illegible]

Orsat Analysis

Sample Type (Bag, Integrated, Continuous) _____

RUN / GAS	1		2		3	
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET
CO_2						
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)						
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)						
N_2 (NET IS 100 MINUS ACTUAL CO READING)						

Fyrite Analysis Pitot coefficient .97

CO_2	O_2	

Field Data - Moisture

Time _____

Final Meter Vol. 550.399

Initial Mtr. Vol. 507.259

Total Meter Vol. 42.824

Meter Temp. In 56/54

SH_2O Out 54/51

Rotameter Setting _____

Final H_2O Vol. 220 [illegible]

Init. H_2O Vol. 200 [illegible]

Net Volume _____

Comments:

TRAVERSE POINT LOCATION & VELOCITY DATA BY _____

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=Axi.D. ID=	C=B+NIPPLE NIPPLE=	VELOCITY HEAD (Δp_s), in.H_2O	STACK TEMPERATURE (T_s), °F
1				.35	251
2				.44	252
3				.42	253
4				.53	[illegible]
5				.49	258
6				.[illegible]	255
7					
8				.39	[illegible]
9				.47	256
10				.45	[illegible]
11				.[illegible]	[illegible]
12				.[illegible]	[illegible]
13				.[illegible]	[illegible]
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

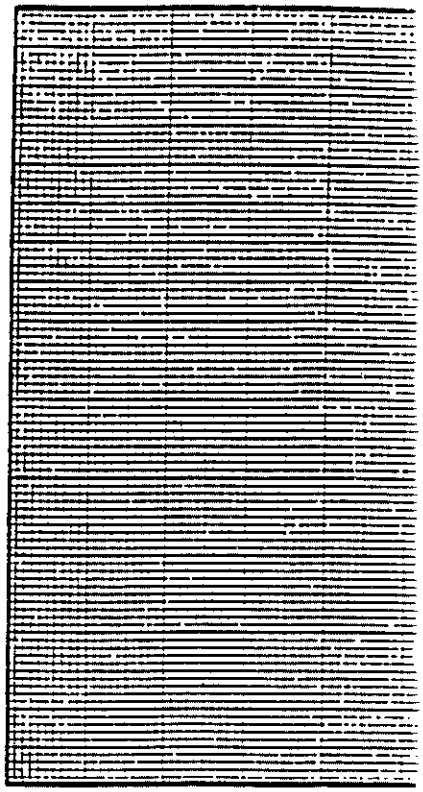


DIAGRAM OF STACK, PORTS, & TRAV POINTS (indicate direction of f

INSIDE DIMENSIONS OF SAMPLE PLA

STACK GAUGE PRESSURE in. H_2O +.2

NEAREST UPSTREAM DISTURBANCE

NEAREST DOWNSTREAM DISTURBANCE

PROCESS & CONTROL EQUIPMENT DESCRIPTION

[illegible]

Project Number _____ Test Number _____

Plant [redacted]

Date 10-[illegible]-[illegible] Time _____

Sampling Location [illegible]

Sample Type [illegible]

Run Number [illegible]

Operators [illegible]

Ambient Temperature 47

Barometer 30.[illegible]

Orsat Analysis

Sample Type (Bag, Integrated, Continuous) _____

RUN / GAS	1		2		3	
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET
CO_2						
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)						
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)						
N_2 (NET IS 100 MINUS ACTUAL CO READING)						

Fyrite Analysis Pitot coefficient .99

CO_2	O_2	

Field Data - Moisture

Time _____

Final Meter Vol. [illegible]

Initial Mtr. Vol. 570.459

Total Meter Vol. 44.501

Meter Temp. In 48 57

52.3 Out 47 57

Rotameter Setting 2.0

Final H_2O Vol. 198

Init. H_2O Vol. [illegible]

Net Volume _____

Comments:

TRAVERSE POINT LOCATION & VELOCITY DATA BY

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=A x I.D. ID=	C=B+NIPPLE NIPPLE=	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1			A 1	.38	285
2			2	.41	295
3			3	.42	297
4			4	.45	290
5			5	.44	292
6			6	.34	303
7					
8				.30	294
9				.32	295
10				.21	303
11				.32	[illegible]
12				.42	[illegible]
13			5	.62	295
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
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36					
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38					
39					
40					
41					
42					
43					
44					
45					
46					

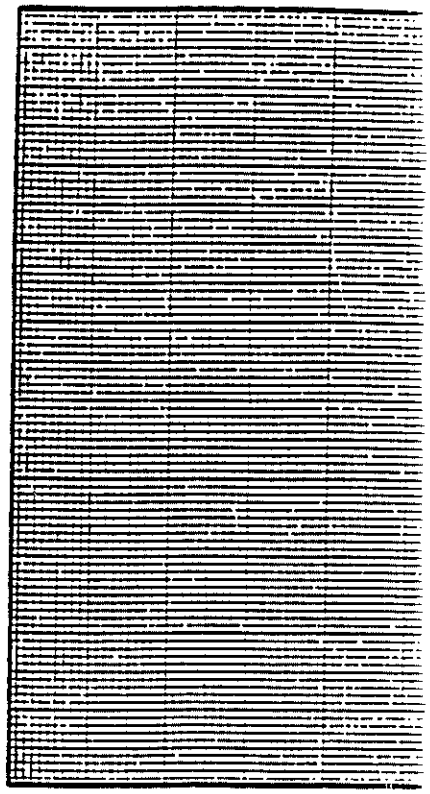

DIAGRAM OF STACK, PORTS, & TRAVERSE POINTS (indicate direction of flow)

INSIDE DIMENSIONS OF SAMPLE PLANE _____

STACK GAUGE PRESSURE in. H_2O [illegible]

NEAREST UPSTREAM DISTURBANCE _____

NEAREST DOWNSTREAM DISTURBANCE _____

PROCESS & CONTROL EQUIPMENT DESCRIPTION _____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF TECHNICAL SERVICES
VOS SAMPLING DATA SHEET

COMPANY [redacted]		ID #:
STACK: INLET	INLET or OUTLET	N.J. #: Hold 3
ADDITIONAL TEST:	RUN #: 3	DATE: 11/13/90
DILUTION FACTOR: DILUTION GAS:	Pst (H2O): .	Pb (Hg): .

IMPINGERS:	TEST TIMES	TEDLAR BAG ID #:
1 _____ _____	START: AM (PM)	ROTAMETER ID #:
2 _____ _____	STOP: AM (PM)	SAMPLING TIME (MIN): — 60
3 _____ _____		
4 _____ _____		

ROTAMETER							DRY GAS METER					
POINT	SET$_I$	SET$_F$	SET$_A$	T_R	VAC		$T_{m_{IN}}$	$T_{m_{OUT}}$	$T_{m_{AVG}}$	P_1	P_2	REMARKS
1	10	10	10			1						
2	10	10	10			2						
3						3						
4	10	10				4						
5						5						
6						6						
7	10	10			1	7				0		
8	10	10			1	8						
9	10	10	10			9						
10						10						
11						11						
12						12				0		
		AVG.					AVG.					
		FLOW RATE							AVG.			

LEAK CHECKS

FRONT HALF
- PRE.: _____ @ "Hg
- POST: _____ @ "Hg

METER DATA
- ID#: _____ Y = _____
- ORIFICE ID#: _____ ΔH@ = _____
- FINAL VOL.: 421.[illegible]
- INIT. VOL.: 424.[illegible]
- Vm : _____ * Y = _____

RIGID CONTAINER

APPROX. CONTAINER VOL.:

INIT
- T_I: _____ P_I: _____
- T_F: _____ P_F: _____
- LEAK RATE = _____%

FINAL
- T_I: _____ P_I: _____
- T_F: _____ P_F: _____
- LEAK RATE = _____%

TESTED BY: _____

_____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF TECHNICAL SERVICES
VOS SAMPLING DATA SHEET

COMPANY: [redacted]			ID #:
STACK: Inlet		JINLET or OUTLET	N.J. #: [illegible] 3
ADDITIONAL TEST:		RUN #: 2	DATE: [illegible]
DILUTION FACTOR:	DILUTION GAS:	Pst (H2O): .	Pb (Hg): 30 . 12

IMPINGERS:	TEST TIMES	TEDLAR BAG ID #:
1 _____ _____	START: 1336 AM PM	ROTAMETER ID #:
2 _____ _____		
3 _____ _____	STOP: AM PM	SAMPLING TIME (MIN): —
4 _____ _____		

ROTAMETER							DRY GAS METER					
POINT	SET$_1$	SET$_2$	SET$_3$	T_M	VAC		$T_{M_{IN}}$	$T_{M_{OUT}}$	$T_{M_{AVG}}$	P_1	P_2	REMARKS
1	11	12	12		1	1	64	60		0		
2	12	12	12		1	2	66	62		0		
3	12	12	12			3	69	63				
4	12	12	12			4	69	69				
5	12	12	12		1	5	70	66				
6	12	12	12		1	6	70	68				
7	11	10	10		1	7	71	70		0		
8	11	10	10		1	8	72	70		0		
9	12	12	12		1	9	76	77		0		
10	12	12	12		1	10	78	79		0		
11	12	12	12		1	11	79	80		0		
12						12						
		AVG.					AVG.					
		FLOW RATE							AVG.			

LEAK CHECKS

FRONT HALF

PRE.: 0.00 @ "Hg

POST: 2.00 @ "Hg

METER DATA

ID#: _____ Y = _____

ORIFICE ID#: _____ ΔH@ = _____

FINAL VOL.: 428.615

INIT. VOL.: 425.839

Vm : _____ * Y = _____

RIGID CONTAINER

APPROX. CONTAINER VOL.:

INIT

T_1: _____ P_1: _____

T_2: _____ P_2: _____

LEAK RATE = _____%

FINAL

T_1: _____ P_1: _____

T_2: _____ P_2: _____

LEAK RATE = _____%

TESTED BY: _____

_____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF TECHNICAL SERVICES
VOS SAMPLING DATA SHEET

45.72

COMPANY: [redacted]		ID #:
STACK:	INLET or OUTLET	N.J. #:
ADDITIONAL TEST:	RUN #: 1	DATE: 11/20/95
DILUTION FACTOR: DILUTION GAS:	Pst (H2O): .	Pb (Hg): 29.19

IMPINGERS:	TEST TIMES	TEDLAR BAG ID #:
1 _____ _____	START: AM PM	ROTAMETER ID #:
2 _____ _____		
3 _____ _____	STOP: AM PM	SAMPLING TIME (MIN): —
4 _____ _____		

	ROTAMETER						DRY GAS METER					
POINT	SET$_1$	SET$_F$	SET$_\Delta$	T_R	VAC		$T_{M_{IN}}$	$T_{M_{OUT}}$	$T_{M_{AVG}}$	P_1	P_2	REMARKS
1						1						
2						2						
3						3						
4						4						
5						5						
6						6						
7						7						
8						8						
9						9						
10						10						
11						11						
12						12						
		AVG.					AVG.					
		FLOW RATE							AVG.			

LEAK CHECKS

FRONT HALF
PRE.: _____ @ "Hg
POST: _____ @ "Hg

RIGID CONTAINER
APPROX. CONTAINER VOL.:

INIT
T_I: _____ P_I: _____
T_F: _____ P_F: _____
LEAK RATE = _____%

FINAL
T_I: _____ P_I: _____
T_F: _____ P_F: _____
LEAK RATE = _____%

METER DATA
ID#: _____ Y = _____
ORIFICE ID#: _____ ΔH@ = _____
FINAL VOL.: 977.345
INIT. VOL.: 970.372
Vm : _____ * Y = _____

TESTED BY: _____

_____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF TECHNICAL SERVICES
VOS SAMPLING DATA SHEET

COMPANY: [redacted]		ID #:
STACK: Inlet	INLET or OUTLET	N.J. #:
ADDITIONAL TEST:	RUN #: 1	DATE: 11/2/90
DILUTION FACTOR: DILUTION GAS:	Pst (H2O): .	Pb (Hg): 30.14

IMPINGERS:	TEST TIMES	TEDLAR BAG ID #:
1 ---------- ---------- 2 ---------- ---------- 3 ---------- ---------- 4 ---------- ----------	START: 11:00 AM PM	ROTAMETER ID #:
	STOP: 12:01 AM PM	SAMPLING TIME (MIN): —

ROTAMETER							DRY GAS METER					
POINT	SET$_I$	SET$_F$	SET$_A$	T_R	VAC		$T_{M_{IN}}$	$T_{M_{OUT}}$	$T_{M_{AVG}}$	P_1	P_2	REMARKS
1	1	1	1		1	1	52	50		0		
2	1	1	1		1	2	53	51		0		
3	1	1	1		1	3	54	52		0		
4	1	1	1		1	4	56	54		0		
5	1	1	1		1	5	57	56		0		
6	1	1	1		1	6	60	59		0		
7	1	1	1		1	7	61	60		0		
8	1	1	1		1	8	64	63		0		
9	1	1	1		1	9	67	67		0		
10	1	1	1		1	10	69	69		0		
11	1	1	1		1	11	71	70		0		
12	1	1	1		1	12	73	72				
		AVG.					AVG.					
		FLOW RATE							AVG.			

LEAK CHECKS

FRONT HALF

PRE.: 0.000 @ "Hg

POST: _____ @ "Hg

METER DATA

ID#: _____ Y = _____

ORIFICE ID#: _____ ΔH@ = _____

FINAL VOL.: 425.720

INIT. VOL.: 423.478

Vm : _____ * Y = _____

RIGID CONTAINER

APPROX. CONTAINER VOL.:

INIT

T_I: _____ P_I: _____

T_F: _____ P_F: _____

LEAK RATE = _____%

FINAL

T_I: _____ P_I: _____

T_F: _____ P_F: _____

LEAK RATE = _____%

TESTED BY: _____

_____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF TECHNICAL SERVICES
VOS SAMPLING DATA SHEET

COMPANY: [redacted]		ID #:
STACK: OUTLET	INLET or OUTLET	N.J. #:
ADDITIONAL TEST:	RUN #: 1	DATE:
DILUTION FACTOR: DILUTION GAS:	Pst (H2O): .	Pb (Hg): 30.12

IMPINGERS:	TEST TIMES	TEDLAR BAG ID #:
1 _____ _____	START: 13:36 AM PM	ROTAMETER ID #:
2 _____ _____	STOP: 14:36 AM PM	SAMPLING TIME (MIN): —
3 _____ _____		
4 _____ _____		

ROTAMETER							DRY GAS METER					
POINT	SET I	SET F	SET A	T_M	VAC		$T_{M_{IN}}$	$T_{M_{OUT}}$	$T_{M_{AVG}}$	P_1	P_2	REMARKS
1	1.1	1.1	1.1		1	1	51	51		.1		
2	1.1	1.1	1.1		2	2	51	52		.08		
3	1.1	1.1	1.1		2	3	52	54		.11		
4	1.1	1.1	1.1		2	4	52	54		.02		
5	1.1	1.1	1.1		2	5	52	55		.04		
6	1.1	1.1	1.1		2	6	62	56		.07		
7	1.1	1.1	1.1		2	7	62			1		
8	1.1	1.1	1.1		2	8	58	58		.16		
9	1.1	1.1	1.1		2	9	54	60		.18		
10		1.1			2	10	55	57		.19		
11	1.1	1.1	1.1		2	11	52	56		.04		
12					—	12				.1		
		AVG.					AVG.					
		FLOW RATE							AVG.			

LEAK CHECKS

FRONT HALF
PRE.: _____ @ "Hg
POST: _____ @ "Hg

RIGID CONTAINER
APPROX. CONTAINER VOL.:

INIT
T_I: _____ P_I: _____
T_F: _____ P_F: _____
LEAK RATE = _____%

FINAL
T_I: _____ P_I: _____
T_F: _____ P_F: _____
LEAK RATE = _____%

METER DATA

ID#: _____ Y = _____
ORIFICE ID#: _____ ΔH@ = _____
FINAL VOL.: 2003.952
INIT. VOL.: 988.771
Vm : _____ * Y = _____

TESTED BY: _____

_____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF TECHNICAL SERVICES
VOS SAMPLING DATA SHEET

COMPANY: [redacted]		ID #:
STACK: OUTLET	INLET or OUTLET	N.J. #:
ADDITIONAL TEST:	RUN #: 3	DATE:
DILUTION FACTOR: DILUTION GAS:	Pst (H2O): .	Pb (Hg): 30.19

IMPINGERS:	TEST TIMES	TEDLAR BAG ID #:
1 _____ _____	START: AM PM	ROTAMETER ID #:
2 _____ _____		
3 _____ _____	STOP: AM PM	SAMPLING TIME (MIN): —
4 _____ _____		

	ROTAMETER						DRY GAS METER					
POINT	SET$_1$	SET$_F$	SET$_A$	T_M	VAC		$T_{M_{IN}}$	$T_{M_{OUT}}$	$T_{M_{AVG}}$	P_1	P_2	REMARKS
1						1	50	<2		.1		
2						2				.1		
3						3				.1		
4						4				.1		
5						5				.1		
6						6				.1		
7						7	54	66		.1		
8						8				.1		
9						9				.1		
10						10				.1		
11						11				.1		
12						12				.1		
		AVG.					AVG.					
		FLOW RATE							AVG.			

LEAK CHECKS

FRONT HALF
PRE.: 0.00 @ "Hg
POST: _____ @ "Hg

METER DATA
ID#: _____ Y = _____
ORIFICE ID#: _____ ΔH@ = _____
FINAL VOL.: 995.495
INIT. VOL.: 991.13
Vm : _____ * Y = _____

RIGID CONTAINER
APPROX. CONTAINER VOL.:

INIT
T_I: _____ P_I: _____
T_F: _____ P_F: _____
LEAK RATE = _____%

FINAL
T_I: _____ P_I: _____
T_F: _____ P_F: _____
LEAK RATE = _____%

TESTED BY: _____

_____

Appendix D

Laboratory Data

1153-01

[redacted]

NJ Air Test Method 3
Data Summary

	IPA (ppmV)	MEK (ppmV)	ETAC (ppmV)	Toluene (ppmV)
1-In	<2.0	742.3	35.2	60.0
2-In	<2.0	731.9	32.6	59.3
3-In	11.1	881.3	<1.0	18.8
1-Out	<2.0	26.9	<1.0	2.5
2-Out	<2.0	25.9	<1.0	2.5
3-Out	<2.0	9.5	<1.0	1.0