Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

AP-42 Section 12.2
Reference
Report Sect. 4
Reference 176

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA

Report on

MEASUREMENT OF PARTICULATE MATTER, VOLATILE ORGANIC COMPOUND AND NITROGEN OXIDE EMISSIONS FROM THE COKE BATTERY COMBUSTION STACK DIAGNOSTIC TEST PROGRAM - AUGUST 8, 1996

OCTOBER 1996

ATS
ADVANCED TECHNOLOGY SYSTEMS, INC.

ATS

2000 Tech Center Drive
Monroeville, Pennsylvania 15146-3055
Telephone (412) 829-2208
FAX (412) 829-2415

ADVANCED TECHNOLOGY SYSTEMS, INC.

Ref. No. 591

October 18, 1996

Mr. William J. Wetzel
Plant Manager
Erie Coke Corporation
P.O. Box 6180
Erie, PA 16512

Dear Mr. Wetzel:

RE: BOILER NO. 2 AND COKE BATTERY COMBUSTION STACK TEST REPORTS

Please find enclosed three copies each of the reports which summarize the results of the stack testing project conducted at Boiler No. 2 and the Coke Battery Combustion Stack on August 7 and 8, 1996. Per your request, the results of the analyses of the EPA Reference Method 5 samples submitted for particle size analyses are summarized below:

	Boiler No. 2 (Run No. 3)	Coke Battery Combustion Stack (Run No. 2)	lbs/ton Coke
Total Particulate Matter Concentration (gr/dscf)	0.0104	0.0213	
Emission Rate (lb/hr)	1.47	3.82	0.11
Percent Mass with Aerodynamic Diameter <= 10 Micrometers	30.6%	26.2%	
PM_{10} Concentration (gr/dscf)	0.0032	0.0056	
Emission Rate (lb/hr)	0.45	1.00	0.029

The particle size analyses were conducted using computer-controlled scanning electron microscopy (CCSEM) techniques. A copy of the CCSEM report is attached to this letter.

ATS again appreciates the opportunity to provide air emissions testing services to Erie Coke Corporation. Please call me at (412) 829-2208 Ext. 210 if you have any questions regarding this package.

Very truly yours,

John P. Shimshock

John P. Shimshock, Ph.D.
Senior Project Scientist,
Process Measurements Department

Approved by:

Robinson P. Khosah/lkk

Robinson P. Khosah, Ph.D.
Vice President,
Technology and Product Development

JPS/lkk

Attachments

591:591d.ltr

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ADVANCED TECHNOLOGY SYSTEMS, INC.

Measurement of Particulate Matter, Volatile Organic Compound and Nitrogen Oxide Emissions from the Coke Battery Combustion Stack, Erie Coke Corporation, Erie, Pennsylvania

October 1996

Prepared by: Joseph M. Frank

Approved by: Robinson P. Khosah, Ph.D.

Project No.: 591

Advanced Technology Systems, Inc.
3000 Tech Center Drive
Monroeville, PA 15146

Phone: 412-829-2208
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ATS

ADVANCED TECHNOLOGY SYSTEMS, INC.

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1.0 INTRODUCTION

1.1 Summary of Test Program

On August 8, 1996, a diagnostic air emissions test program was conducted to measure particulate matter, volatile organic compound (VOC) and nitrogen oxide (NO_x) emissions from the Coke Battery Combustion Stack at the Erie Coke Corporation facility located in Erie, Pennsylvania. The test program was conducted as part of an Erie Coke Corporation in-house engineering study.

Air emissions from the coke battery underfire system are exhausted to the atmosphere through a single stack. Concentrations and emission rates of particulate matter, volatile organic compounds and nitrogen oxides in the exhaust gas stream were measured in triplicate. Testing was performed only during periods of normal plant operation. Advanced Technology Systems, Inc. (ATS) was contracted by Erie Coke Corporation (host site) to conduct this particular air emissions test program.

1.2 Key Personnel

The key personnel who coordinated the test program and their telephone numbers are listed below:

Name	Affiliation and Assignment	Telephone Number
William J. Wetzel	Erie Coke Corporation Erie, Pennsylvania Plant Manager	814-454-0177
John P. Shimshock	Advanced Technology Systems, Inc. Monroeville, Pennsylvania Senior Project Scientist	412-829-2208

2.0 PROCESS DESCRIPTION AND EXHAUST GAS SAMPLING LOCATION

Cleaned coke oven gas is used as the underfiring fuel for the coke battery. The products of combustion from the coke battery underfire system flow through a horizontally-aligned rectangular duct to the exhaust stack. A schematic of the coke battery underfire exhaust system and traverse points can be found in Figure 1. Since no test platform is installed on the exhaust stack, air emissions measurements were conducted at the rectangular duct. The duct dimensions are 38 inches (depth) by 130 inches (height). Six equally-spaced test ports in the same vertical plane are installed on the duct. The test ports are located approximately two feet downstream of the nearest duct disturbance (less than two duct diameters) and approximately two feet upstream of the nearest duct disturbance (less than one-half duct diameters). For gas stream velocity profile traverses, thirty-six traverse points (six per test port) were located in accordance with EPA Reference Method 1.

3.0 SUMMARY AND DISCUSSION OF TEST RESULTS

3.1 Objective

The purpose of this particular emissions testing program was to provide data in support of an Erie Coke Corporation in-house engineering study. The specific objective for the test program was to measure, in triplicate, particulate matter, volatile organic compound and nitrogen oxide emissions from the Coke Battery Combustion Stack.

3.2 Field Test Changes and Problems

Upon removal of the test port caps, the field test crew observed that a significant amount of materials had collected at the bottom of the test duct. The field test crew estimated that materials were deposited in the lower 44 inches of the test duct, thus reducing the effective cross sectional area of the test duct by 34 percent from 34.3 square feet (130 inches by 38 inches) to 22.7 square feet (86 inches by 38 inches).

There were no deviations from standard EPA Reference Methods for emissions testing. The test program was also conducted in accordance with the requirements of the PA DEP Source Testing Manual (Revision No. 2, June 1995). There were no analytical problems or plant operational problems encountered during the test program.

3.3 Presentation of Results

Copies of the field data sheets and equipment calibration data can be found in Appendix A. The analytical results and emissions calculations for each stack test can be found in Appendix B.

3.3.1 Particulate Matter

The test results have been summarized in Table 1. Particulate matter concentrations and emission rates are listed in units of grains per dry standard cubic foot (gr/dscf) and pounds per hour (lb/hr), respectively. The average particulate matter concentration in the exhaust gas stream and emission rate was 0.0237 gr/dscf and 4.24 lb/hr, respectively.

Table 1 also lists other pertinent stack and sampling parameters which include stack gas flow rate in units of actual cubic feet per minute (acfm), standard cubic feet per minute (scfm), and dry standard cubic feet per minute (dscfm), stack gas temperature (^{o}F), and moisture content of the stack gas (percent by volume), gas volume sampled for each test in units of dry standard cubic feet (dscf) and the isokinetics value for each test. The isokinetics value is equal to the ratio of the average linear gas velocity sampled through the probe nozzle to the average stack gas velocity. An isokinetics value between 90 percent and 110 percent is considered acceptable. All isokinetics values were within the acceptable range of values. Actual test sampling times have also been included in Table 1.

3.3.2 Volatile Organic Compounds and Nitrogen Oxides

The volatile organic compound (expressed as carbon) and nitrogen oxide (expressed as nitrogen dioxide) test results have been summarized in Table 2. VOC and NO_x concentrations are listed in units of parts per million by volume (ppmv). VOC and NO_x emission rates are listed in units of pounds per hour (lb/hr). The average NO_x emission rate was 18.5 lb/hr, which is less than the allowable NO_x emission rate of 19.9 lb/hr as specified in PA DEP Permit No. OP 25-029 for this source.

Table 2 lists other pertinent stack and sampling parameters as described in Section 3.3.1. Concentrations of oxygen and carbon dioxide are also listed in Table 2 in units of percent by volume (%).

4.0 SAMPLING AND ANALYTICAL PROCEDURES

The execution of the emissions test program required the use of several test procedures approved by U.S. EPA and PA DEP. This section outlines the stack sampling and analytical procedures utilized.

4.1 Location of Traverse Points

As outlined in Sections 2.0 and 3.2, the products of combustion from the coke battery underfire system flow through a horizontally-aligned rectangular duct with effective dimensions of 38 inches (depth) by 86 inches (height). For gas stream velocity profile traverses, twenty-four traverse points (six per test port) were located in accordance with EPA Reference Method 1.

4.2 Gas Stream Velocity and Volumetric Flow Rate

Gas velocities and volumetric flow rates of the exhaust gas stream were measured using a calibrated S type pitot tube in accordance with EPA Reference Method 2. Gas velocity differential pressures were recorded at each traverse point. Static pressure of the exhaust gas stream was measured with the same pitot tube. Exhaust gas temperatures were measured with a type K thermocouple.

4.3 Dry Gas Molecular Weight

Dry gas concentrations of oxygen (O_2), carbon dioxide (CO_2) and nitrogen (N_2, by difference) were measured continuously throughout the test program with the use of continuous emission monitoring (CEM) techniques in accordance with EPA Reference Method 3A. Gas concentrations were used to calculate the molecular weight of the exhaust gas on a dry basis.

Continuous emission monitoring for CO_2 and O_2 was accomplished by means of a gas extraction and conditioning system. Conditioning of the sample gas was accomplished by pulling it from the stack through a stainless steel probe and glass fiber filter maintained at 250°F. The filtered gas was routed through a heated Teflon line to ATS's mobile CEM laboratory located nearby. The heated line temperature was maintained at 250°F or higher to prevent condensation from occurring in the sample line. A portion of the gas stream was split from the main sample gas stream in the CEM laboratory and treated to remove moisture by a non-contact refrigerative method such that the dew point of the

treated sample gas was 40°F or lower. The "dry" sample was then manifolded and routed to the following analyzers for CO_2 and O_2 analysis: Fuji Electric CO_2 Infrared Gas Analyzer and Milton Roy Model ZAJ O_2 Analyzer, respectively. Sample gas flow not delivered to the analyzers was sufficient to allow a bypass stream which minimized sample residence time.

Data recording was accomplished with the use of a computer based, automated digital data acquisition system. Concentrations of CO_2 and O_2 were scanned at one-second intervals. The scanned values were averaged every minute, displayed on a system monitor and recorded on magnetic storage media. As a backup system, the data was also continuously recorded on a strip chart recorder.

4.4 Moisture Content

Percent moisture content, by volume, of the exhaust gas stream was measured by the weight gain of the impingers used in an EPA Reference Method 5 sampling train. Moisture content was calculated from the knowledge of the weight gain of the four sample train impingers and dry gas volume sampled.

4.5 Particulate Matter

Particulate matter sampling was performed in accordance with EPA Reference Method 5 and PA DEP Reference Method 5. Exhaust gas samples were withdrawn isokinetically from the stack, with particulate emissions collected in a nozzle, a heated glass-lined probe, and on a heated glass fiber filter. A gas sample volume greater than 50 dry standard cubic feet was collected during each of the three 72-minute test runs.

Clean up of the sampling trains included an acetone rinse of front-half sample train components (nozzle, probe liner and top half of filter holder). The rinse was saved in a separate bottle (identified as Bottle No. 1). The particulate filter was removed from the holder and placed in a petri dish. Following the gravimetric analysis of the impingers for moisture gain, the contents of the first three impingers were collected in a separate bottle (identified as Bottle No. 2). The empty impingers, bottom half of the filter holder and connecting glassware were then rinsed with distilled deionized water; these washes were added to Bottle No. 2.

The contents of Bottle No. 1 (front-half acetone rinse) was evaporated to dryness, desiccated and weighed to a constant weight. The particulate filter was desiccated and weighed to a constant weight. The contents of Bottle No. 2 (back-half water rinse) were filtered under suction through a preweighed 0.22 micrometer membrane filter to measure water-insoluble materials. The filter used to capture the insoluble material was dried, desiccated and weighed to a constant weight. The filtrate was discarded. The total particulate catch was the sum of the front-half sample train acetone rinse residue (corrected for blank), the particulate filter catch plus the back-half sample train water-insoluble materials catch.

4.6 Volatile Organic Compounds

Volatile organic compound (VOC, measured as total gaseous hydrocarbon compounds) concentrations were measured using CEM techniques in accordance with EPA Reference Method 25A. Three one-hour test runs were conducted. The gas extraction and conditioning system are the same as described in Section 4.3 except that the moisture removal system was bypassed (the analyzer, a J.U.M. Engineering Model VE-7 Heated Total Hydrocarbon Analyzer, requires a "wet" sample).

As previously mentioned, EPA Reference Method 25A was used to measure volatile organic compound emissions from the coke battery combustion stack. Typically, PA DEP requires the use of EPA Reference Method 25 to measure volatile organic compound emissions (reference PA DEP Source Testing Manual [Revision No. 2, June 1995], Section 9.0 - Volatile Organic Compound Testing). However, the regulations recognize the potential use of alternative procedures (e.g. Method 25A) to measure VOC emissions. In accordance with EPA Reference Method 25, Section 1.1 - Applicability, a flame ionization detector (FID, per Method 25A) may be used to measure VOC emissions under any of the following conditions:

1. Where only one compound is known to exist;
2. When the organic compounds consist of only hydrogen and carbon;
3. Where the relative percentages of the compounds are known or can be determined, and the FID responses to the compounds are known;
4. Where a consistent mixture of the compounds exists before and after emission control and only the relative concentrations are to be assessed; or
5. Where the FID can be calibrated against mass standards of the compounds emitted.

The cleaned coke oven gas used as the underfiring fuel at Erie Coke Corporation has a nearly constant and uniform composition. Since methane and ethane are the primary hydrocarbons present in the fuel gas, and since methane and ethane are composed of only hydrogen and carbon, condition No. 2 above is satisfied. As such, the use of an FID prescribed in EPA Reference Method 25A was used in this test program to measure VOC emissions.

It should be noted that the FID used in this test program responded to the presence of methane and ethane in the sample gas stream. Since methane and ethane are not typically considered to be volatile organic compounds, the reported VOC concentration in the exhaust gas stream was calculated as the VOC concentration measured with the EPA Reference Method 25A analyzer minus the methane and ethane concentrations in the exhaust gas stream. The methane and ethane concentrations in the exhaust gas stream were measured by collecting one integrated gas sample in a Tedlar bag for each test run and than analyzing the gas sample using gas chromatography with thermal conductivity detection techniques in accordance with ASTM Method D-1945.

4.7 Nitrogen Oxides

Nitrogen oxide (NO_x, expressed as nitrogen dioxide) concentrations were measured using CEM techniques in accordance with EPA Reference Method 7E. Three one-hour test runs were conducted. The gas extraction and conditioning system are the same as described in Section 4.3. A Thermo Electron Instruments Model 10 NO-NO_2-NO_x Analyzer was used.

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC Problems

There were no QA/QC problems associated with either the test equipment calibrations or the analytical laboratory analyses.

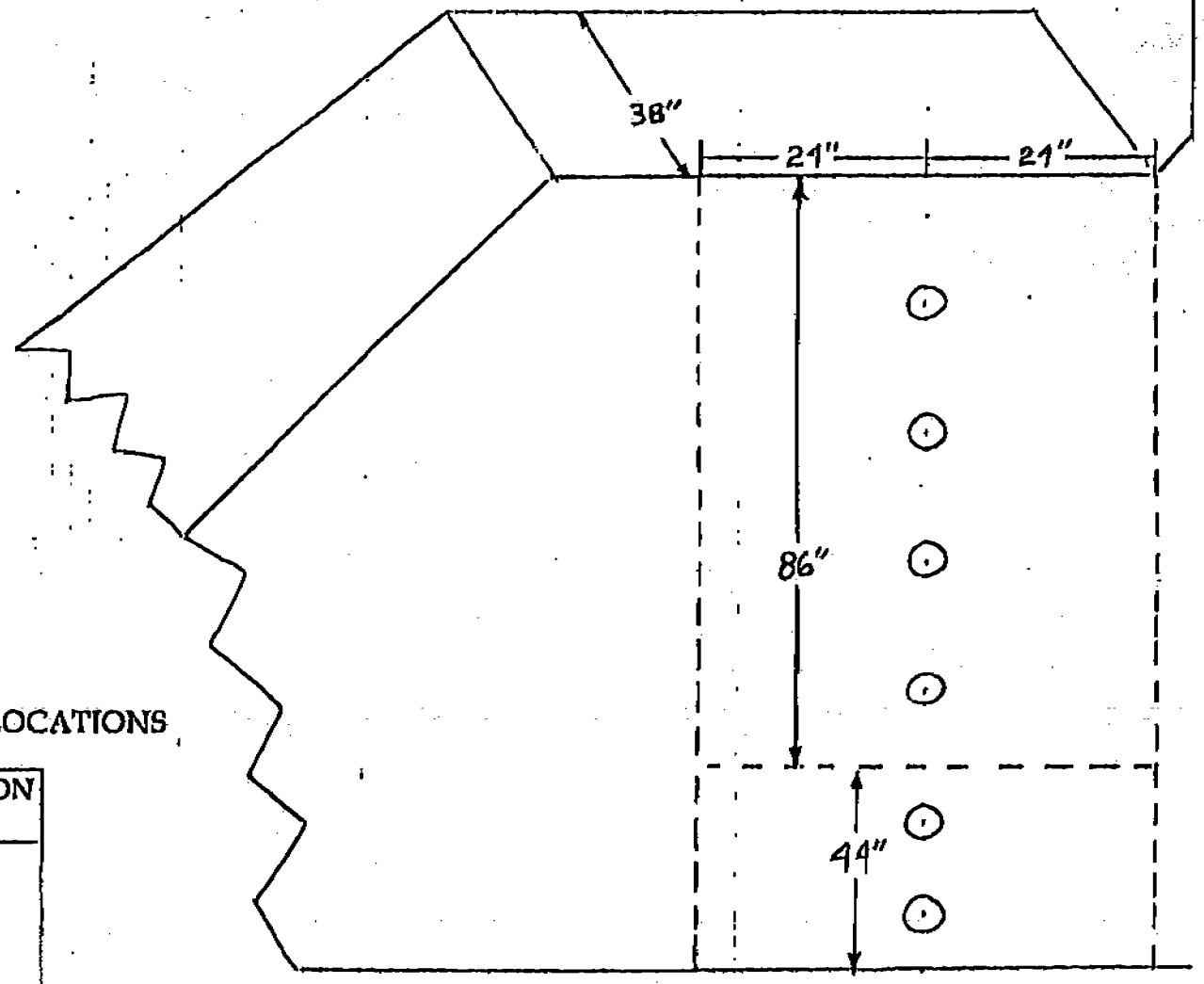
5.2 QA Audits

No on-site or analytical laboratory audits were conducted.

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA

FIGURE 1

SCHEMATIC OF THE COKE BATTERY UNDERFIRE EXHAUST SYSTEM AND TRAVERSE POINTS



TRAVERSE POINT LOCATIONS

POINT #	LOCATION (in.)
1	3.2
2	9.5
3	15.8
4	22.2
5	28.5
6	34.8

4 SAMPLE PORTS
6 SAMPLE POINTS PER PORT
24 TOTAL SAMPLE POINTS

Erie Coke Corporation

Erie, Pennsylvania

Table 1

Battery Combustion Stack
Particulate Matter Emissions Data

		Run 1	Run 2	Run 3	Average
Test Number		ECC-BATT-1	ECC-BATT-2	ECC-BATT-3	
Test Date		08-08-96	08-08-96	08-08-96	
Mass Emissions Rate and Concentrations:					
Total Particulate Matter	(lb/hr)	5.41	3.82	3.49	4.24
	(gr/dscf)	0.0299	0.0213	0.0199	0.0237
Stack Conditions:					
Flow Rate	(acfm)	43100	43200	41800	42700
	(scfm)	24200	24100	23400	23900
	(dscfm)	21100	20900	20500	20833
Temperature	(F)	472	477	474	474
Moisture Content	(%)	12.6	13.2	12.5	12.8
Sampling Conditions:					
Test Times (includes port change)	(EDT)	957 to 1113	1205 to 1321	1440 to 1555	
Sampling Time	(minutes)	72	72	72	
Sample Volume	(dscf)	59.284	59.245	58.227	
Isokinetics	(%)	97.4	98.4	98.8	

ATS

ADVANCED TECHNOLOGY SYSTEMS, INC.

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA

MEASUREMENT OF PARTICULATE MATTER, VOLATILE ORGANIC COMPOUND AND NITROGEN OXIDE EMISSIONS FROM A COKE BATTERY COMBUSTION STACK DIAGNOSTIC TEST PROGRAM - AUGUST 8, 1996

APPENDIX A

FIELD DATA SHEETS, EQUIPMENT CALIBRATION DATA

GAS STREAM VELOCITY PROFILE DATA SHEET

CLIENT Erie Coke Corp.	TEST DATE 08-07-96	Page 1 of 1	
PLANT LOCATION Erie, PA	TEST NO. Flows	STACK DIA. (in.) —	
TEST UNIT Battery Combustion Stack	B.P. (in. Hg) 29.60	STACK ~~WIDTH~~ length (in.) 86	
TEST CREW PS, TM, KA, JF, MB, JJ	PROBE NO. 3 - 1	STACK DEPTH (in.) 38	
PROJECT NO. 591	PITOT COEF. 0.84	COMMENTS	

TIME: 1700 EDT

Test Port	Traverse Point (in.)	Pitot ΔP (in. H2O)	Stack Temp. (°F)	Static Pressure (in. H2O)
A	34.8	~~.19~~ → .16		
	28.5	~~.22~~ .21		
	22.2	.20		
	15.8	.16		
	9.5	.12		
	3.2	.05	350	
B	34.8	~~.16~~ → .19		
	28.5	.17		
	22.2	.16		
	15.8	.12		
	9.5	.04		
	3.2	.03	343	
C	34.8	~~.15~~ .16		
	28.5	.14		
	22.2	.13		
	15.8	.11		
	9.5	.08		
	3.2	.04	348	
	Avg. ΔP = [(ΔP^0.5)avg.]^2 =			
Field	Velocity (ft/sec) =			
Estimate	Flow Rate (acfm) =			
	Flow Rate (scfm) =			
	Flow Rate (dscfm) =			

TIME: 1700 EDT

Test Port	Traverse Point (in.)	Pitot ΔP (in. H2O)	Stack Temp. (°F)	Static Pressure (in. H2O)
D	34.8	~~.16~~ .18		
	28.5	.17		
	22.2	.17		
	15.8	.16		
	9.5	.16		
	3.2	.05	347	-1.2
		(Tstack)AB = 347F		
		(0.12)		
	Avg. ΔP = [(ΔP^0.5)avg.]^2 = 0.12			
Field	Velocity (ft/sec) = 24.7			
Estimate	Flow Rate (acfm) = 33655			
	Flow Rate (scfm) = 21719			
	Flow Rate (dscfm) = 19113			

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

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STACK SAMPLING DATA SHEET

CLIENT Erie Coke Corp.	TEST DATE 08-08-96 (Thurs.)	ORIFICE CORRECTION (ΔH@) 1.65	HOT/COLD BOX NO. 3
TEST UNIT Battery Combustion Stack	TEST NO. EC-BATT-1	METER CORRECTION (Y) 1.0010	PROBE NO. [illegible]
PROJECT NO. 591	NOZZLE (SIZE, ") Ø.402"	CALIBRATION DATE 4-9-96	FILTER NO. [illegible]
TEST CREW JF, TM, JS	STATIC PRESSURE -1.2" H_2O	PITOT CORRECTION 0.84	STACK DIA. (D) X [illegible]
BAROMETRIC PRESSURE 29.73	PORT DIRECTION A, B	CONTROL BOX NO. Apex-3	PORT SIZE 3" nipples

Traverse Point (inches)	Time EDT	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
34.8	10:57	807.005	.18	2.37	2.37	86	86	6.0	460	~250	<68°	~250	3 min./point
28.5			.20	2.59	2.59	87	86	7.0	474	240	66	238	typical 12% O_2
22.2			.21	2.72	2.72	91	86	7.0	474	239	65	240	6.5% CO_2
15.8			.20	2.59	2.59	92	86	7.0	471	240	65	240	12% H_2O
9.5			.18	2.37	2.37	97	86	6.5	466	238	66	242	
3.2			.14	1.85	1.85	100	87	5.0	468	238	66	240	
	10:15	823.305											
34.8	10:17	823.305	.18	2.38	2.38	94	87	6.0	465	240	66	240	
28.5			.20	2.65	2.65	101	88	7.0	461	244	62	238	
22.2			.19	2.52	2.52	103	88	6.5	466	244	60	239	
15.8			.17	2.26	2.24	104	89	6.0	468	243	60	242	
9.5			.14	1.86	1.86	105	89	5.0	469	245	61	238	
3.2			.13	1.73	1.73	105	89	5.0	469	240	61	238	
	10:35	838.865											Estimates:
													MW= 28.1
													%H2O= 12

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.005
After	8.0	0.009

PITOT LEAK CHECK (15 sec.)

	Positive	Negative
Before	OK	OK
After	OK	OK

GAS	1	2
CO2	4%	1.3
O2	18.96	18.1
CO	—	—
N2	80%	80.6

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100mL DI. H_2O	629.0	484.3	144.7
2.	100mL DI. H_2O	586.3	568.5	17.8
3.	Empty	448.3	444.6	3.7
4.	Silica Gel	618.8	603.2	15.6
5.				
6.				
7.				
8.				

total 181.8 g

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STACK SAMPLING DATA SHEET

CLIENT Erie Coke Corp. | TEST DATE 08-08-96 (Thur.) | ORIFICE CORRECTION (ΔH@) 1.653 | HOT/COLD BOX NO. 3
TEST UNIT Battery Combustion Stack | TEST NO. ECC-BATT-1 | METER CORRECTION (Y) 1.0010 | PROBE NO. 190 190'
PROJECT NO. 591 | NOZZLE (SIZE, in) Φ.408" | CALIBRATION DATE 4-9-96 | FILTER NO. 3-1
TEST CREW JF, TM, KL | STATIC PRESSURE -1.2" H_2O | PITOT CORRECTION 0.84 | STACK DIA 38"(D) x 86"(W)
BAROMETRIC PRESSURE 29.73 | PORT DIRECTION E,D | CONTROL BOX NO. Apex-3 | PORT SIZE 3" Nipple

Traverse Point (Inches)	Time EDT	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
34.8	10:36	838.865	.13	1.73	1.73	100	90	5.0	465	241	61	238	3 min./point
29.5			.13	1.71	1.71	103	90	5.0	475	241	61	240	
22.2			.13	1.71	1.71	105	90	5.0	482	238	62	240	
15.8			.14	1.84	1.84	106	90	5.0	482	241	64	238	
9.5			.14	1.84	1.84	107	91	5.0	479	242	64	237	
3.2			.14	1.84	1.84	107	91	5.0	477	240	65	239	
	10:54	852.676											
34.8	10:55	852.676	.20	2.66	2.66	99	91	7.0	465	238	65	240	
28.5			.20	2.65	2.65	104	92	7.0	475	243	65	238	
22.2			.21	2.78	2.78	105	92	7.5	480	243	66	238	
15.8			.20	2.65	2.65	106	92	7.5	483	242	66	239	
9.5			.17	2.25	2.25	107	92	6.0	477	243	67	241	
3.2			.13	1.72	1.72	107	93	5.0	475	240	67	238	
	11:13	868.973											Estimates:
Test	Δ=	Δ=	(ΔP)avg=						(Stack)avg=				MW= 28.1
Totals	(72 min)	(61.968)	0.17	(ΔH)avg=	2.22	(Meter)avg=	95°F		471.9 °F=				%H2O= 12

SYSTEM LEAK CHECK dcf

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

$= \left[\frac{2\sqrt{\Delta p_i}}{n}\right]^2$

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

ATS

STACK SAMPLING DATA SHEET

CLIENT Erie Coke Corp.
TEST UNIT Dentley Combustion Stack
PROJECT NO. 541
TEST CREW JF, TM, KA
BAROMETRIC PRESSURE 29.73

TEST DATE 08-08-96 (Thurs)
TEST NO. ECC-BATT-2
NOZZLE (SIZE, in) 0.408"
STATIC PRESSURE -1.2" H2O
PORT DIRECTION A, B D, C

ORIFICE CORRECTION (ΔH@) 1.653
METER CORRECTION (Y) 1.0010
CALIBRATION DATE 4-5-96
PITOT CORRECTION 0.84
CONTROL BOX NO. Apex-3

HOT/COLD BOX NO. 2
PROBE NO. 3-4
FILTER NO. 1924
STACK DIA 38"(D) x 86"(H)
PORT SIZE 7" nipple

Traverse Point (inches)	Time EDT	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
34.8	12:05	870.~~150~~ 353	~~.24~~ .24	~~3.16~~ 2.50	~~3.16~~ 2.50	90	90	5.0	465	~250	<68°	~250	3 min./point
28.5			.22	2.83	2.83	92	88	6.5	487	239	66	238	
22.2			.21	2.70	2.70	96	88	6.5	490	248	65	238	
15.8			.20	2.57	2.57	98	88	5.5	493	248	64	241	
9.5			.20	2.57	2.57	102	89	5.5	489	243	65	244	
3.2			.14	1.80	1.80	103	89	4.0	488	245	66	240	
	12:23	886.643											
34.8	12:24	886.643	.18	2.36	2.36	97	89	5.5	475	237	65	239	
28.5			.15	1.97	1.97	103	90	5.0	472	242	64	237	
22.2			.15	1.97	1.97	104	90	5.0	476	241	65	239	
15.8			.14	1.85	1.85	105	90	4.5	476	246	66	238	
9.5			.12	1.58	1.58	105	90	4.0	476	245	66	240	
3.2			.11	1.45	1.45	106	91	4.0	478	247	67	238	
	12:42	900.764											Estimates:
													MW= 28.1
													%H2O= 12

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	6.0	0.010
After	7.0	0.010

PITOT LEAK CHECK (15 sec)

	Positive	Negative
Before	ok	ok
After	ok	ok

GAS	1	2
CO2	4%	3.1
O2	14%	13.7
CO	—	—
N2	82%	83.2

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	Dome D.I. H2O	713.9	561.8	152.1
2.	Dome D.I. H2O	578.7	556.8	21.9
3.	Empty	466.5	464.8	1.7
4.	Silica Gel	648.6	633.0	15.6
5.				
6.				
7.				
8.				

total = 191.7 g

ATS

STACK SAMPLING DATA SHEET

CLIENT Eastern Coke Corp. | TEST DATE 08-08-96 (Thurs) | ORIFICE CORRECTION (ΔH@) 1.653 | HOT/COLD BOX NO. 2
TEST UNIT Battery Combustion Stack | TEST NO. ECC-BATT-2 | METER CORRECTION (Y) 1.0010 | PROBE NO. 3-4
PROJECT NO. 591 | NOZZLE (SIZE, in) Ø.408" | CALIBRATION DATE 4-9-96 | FILTER NO. 1924
TEST CREW JG, TM, KA | STATIC PRESSURE -1.2" H2O | PITOT CORRECTION Ø.84 | STACK DIA 38"(a) x 86"(b)
BAROMETRIC PRESSURE 29.73 | PORT DIRECTION C,D | CONTROL BOX NO. Apex-3 | PORT SIZE 3" nipples

Traverse Point (inches)	Time EDT	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
34.8	12:44	900.764	.16	2.11	2.11	101	91	5.5	475	243	66	238	3 min./point
28.5			.16	2.15	2.15	105	91	5.5	462	242	66	239	
22.2			.18	2.41	2.41	106	91	5.5	465	246	67	240	
15.8			.17	2.28	2.28	106	91	5.5	468	251	67	239	
9.5			.16	2.15	2.15	107	92	5.0	473	249	65	240	
3.2			.10	1.34	1.34	107	92	4.0	470	248	65	240	
	13:02	915.509											
34.8	13:03	915.509	.23	3.05	3.05	100	91	6.0	470	240	66	240	
28.5			.23	3.04	3.04	107	92	6.5	479	240	65	241	
22.2			.24	3.17	3.17	108	92	6.5	481	249	64	240	
15.8			.22	2.91	2.91	109	92	6.0	483	250	64	244	
9.5			.18	2.40	2.40	109	93	5.0	474	249	65	238	
3.2			.17	2.26	2.26	109	93	5.0	478	248	66	239	
	13:21	932.832											Estimates:
Test Totals	Δ= (73 min)	Δ= (62.479)	(ΔP)avg= 0.17	(ΔH)avg= 2.31		(Tmeters)avg= 97°F			(Tstack)avg= 477°F				MW= 28.1
													%H2O= 12

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (afm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

ATS

STACK SAMPLING DATA SHEET

CLIENT Erie Coke Corp. | TEST DATE 08-08-96 (7247) | ORIFICE CORRECTION (ΔH@) 1.653 | HOT/COLD BOX NO. 1
TEST UNIT Battery Combustion Stack | TEST NO. ECC-BATT-3 | METER CORRECTION (Y) 1.0010 | PROBE NO. 3-4
PROJECT NO. 591 | NOZZLE (SIZE,#) Ø.408" | CALIBRATION DATE 4-9-96 | FILTER NO. 1901
TEST CREW JE JM JB | STATIC PRESSURE -1.2" H_2O | PITOT CORRECTION 0.84 | STACK DIA. 75"Ø X 86"W
BAROMETRIC PRESSURE 29.73 | PORT DIRECTION A,B | CONTROL BOX NO. Apex-3 | PORT SIZE 1" Apex

Traverse Point (inches)	Time EST	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
34.8	14:40	~~933.300~~	.20	2.59	2.59	86	86	5.0	475	~250	<68°	~250	3 min./point
28.5		936.219	.17	2.20	2.20	89	86	4.0	480	241	66	238	
22.2			.24	3.11	3.11	92	86	5.5	474	245	66	241	
15.8			.21	2.80	2.80	96	86	5.0	456	253	67	239	
9.5			.18	2.40	2.40	97	86	4.5	459	251	66	239	
3.2			.15	2.00	2.00	100	86	4.0	463	251	66	251	
	14:58	952.676											
34.8	14:59	952.674	.19	2.51	2.51	94	87	5.0	470	241	66	255	
28.5			.20	2.64	2.64	102	87	5.0	479	240	65	244	
22.2			.17	2.23	2.23	104	88	4.5	480	250	65	246	
15.8			.17	2.23	2.23	105	88	4.5	486	249	66	247	
9.5			.15	1.97	1.97	106	89	4.0	485	249	67	245	
3.2			.15	1.97	1.97	106	90	4.0	489	249	67	252	
	15:17	968.251											Estimates:
													MW= 28.1
													%H2O= 12

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	.005
After	4.0	.001

PITOT LEAK CHECK (15 sec)

	Positive	Negative
Before	ok	ok
After	ok	ok

GAS	1	2
CO2	4%	2.8
O2	14%	14.7
CO	—	—
N2	82%	82.5

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100mL DI H_2O	700.3	562.0	138.3
2.	100mL DI H_2O	581.4	560.0	21.4
3.	Empty	440.2	438.7	1.5
4.	Silica Gel	638.2	622.7	15.5
5.				
6.				
7.			total =	176.7g
8.				

ATS

STACK SAMPLING DATA SHEET

CLIENT Eric Cuko. Corp. | TEST DATE 08-08-96 (Thur) | ORIFICE CORRECTION (ΔH@) 1.653 | HOT/COLD BOX NO. 1

TEST UNIT Battery Combustion Stack | TEST NO. ECC-BATT-3 | METER CORRECTION (Y) 1.0010 | PROBE NO. 3-4

PROJECT NO. 491 | NOZZLE (SIZE,#) Ø.408" | CALIBRATION DATE 4-9-96 | FILTER NO. 1901

TEST CREW JF, TM, JS | STATIC PRESSURE -1.2" H2O | PITOT CORRECTION 0.84 | STACK DIA. 38" (D) x 86" (H)

BAROMETRIC PRESSURE 29.73 | PORT DIRECTION C, D | CONTROL BOX NO. Apex-3 | PORT SIZE 3" nipples

Traverse Point (inches)	Time EDT	Dry Gas Meter Reading (cf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
34.8	15:18	968.251	.13	1.71	1.71	100	90	3.5	475	242	67	251	3 min./point
28.5			.19	2.50	2.50	104	90	5.0	462	240	65	252	
22.2			.17	2.24	2.24	105	91	4.5	470	245	66	251	
15.8			.15	1.99	1.99	106	91	4.0	472	249	66	250	
9.5			.10	1.33	1.33	106	91	3.0	472	249	66	250	
3.2			.09	1.06	1.06	105	91	3.0	472	250	67	250	
	15:36	982.109											
34.8	15:37	982.109	.19	2.53	2.53	101	90	5.0	471	245	65	251	
28.5	~~15:37~~		.19	2.53	2.53	106	91	5.0	480	245	65	240	
22.2			.18	2.35	2.35	106	91	4.5	489	241	66	250	
15.8			.17	2.22	2.22	107	91	4.0	475	250	66	249	
9.5			.16	2.14	2.14	107	91	4.0	467	248	66	249	
3.2			.11	1.47	1.47	107	91	3.0	475	244	66	251	
	15:55	997.420											Estimates:
Test Totals	Δ=72 min	Δ=61.201 dcf	$(\Delta P)_{avg}$ = 0.16	$(\Delta H)_{avg}$ = 2.20		$(T_{meter})_{avg}$ = 95°F			$(T_{stack})_{avg}$ = 474°F				MW=28.1
													%H2O=12

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2		
O2		
CO		
N2		

$$= \left[\frac{\Sigma \sqrt{\Delta p}}{n}\right]^2$$

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

ATS

CERTIFICATE OF CALIBRATION

This certifies that your AL-20 AMERICAN WET TEST gas meter,

serial no. P-1146

has been calibrated with a bell prover.

AMERICAN 10 foot, # 3157

It is treaceable to the N.I.S.T., reference no. 1249811.

Calibration by Carl Poe Co., Inc.

99 Reinerman Houston, TX 77007

713-861-3816

2-8-96

Date

Mark Poe

Signature

CONTROL BOX NO. Apix-3
CALIBRATION DATE 4-9-96
BAROMETRIC PRESSURE (in. Hg) 28.75

PRE-TEST X
POST-TEST
CALIBRATION OFFICER Tom Mossad

	WET TEST METER			DRY TEST METER					COMMENTS
	ELAPSED TIME (min.*)	METER TEMP Tw (°F)	VOLUME Vw (cf)	TEMP IN Ti (°F)	TEMP OUT To (°F)	ORIFICE DIFF. PRESSURE ΔH (in. H2O)	VOLUME Vd (dcf)	VACUUM (in. Hg)	
START/MIDWAY	0:00	75	0.000	90	76	.50	94.418	2.0	
STOP	11:39		5.000				99.464		
DIFFERENCE	11.65		5.000				5.046		
START/MIDWAY	0:00	75	0.000	91	78	1.0	102.501	4.0	
STOP	8:18		5.000				107.556		
DIFFERENCE	8.30		5.000				5.055		
START/MIDWAY	0:00	75	0.000	92	79	2.0	109.591	6.0	
STOP	6:06		5.000				114.691		
DIFFERENCE	6.10		5.000				5.100		
DRY GAS METER LEAK CHECK									
START	0:00		.200				119.993		Leak Check = .004 cfm (tolerance <0.02)
STOP	10:00		.395				120.183		
DIFFERENCE	10.0		.195				.191		

(*) Final elapsed time must be expressed in decimal form.

FORMS:DRY-GAS.CAL

	Run #1	Run #2	Run #3	Avg.
BP (in. Hg)	28.75	28.75	28.75	
Time (min)	11.65	8.30	6.10	
Tw (°F)	75	75	75	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	90	91	92	
To (°F)	76	78	79	
ΔH (in. H2O)	0.50	1.00	2.00	
Vm (dcf)	5.046	5.055	5.100	
ΔH@ (in. H2O)	1.598	1.616	1.743	1.653
Y (Pre-test)	1.0044	1.0041	0.9945	1.0010

$$\Delta H@ = \frac{0.0317 * \Delta H * [(Tw+460) * Time]^2}{BP * (To + 460) * (Vw)^2}$$

$$Y = \frac{Vw * BP * [(Ti+460+To+460)/2]}{Vm * [BP+(\Delta H/13.6)] * (Tw+460)}$$

MAGNEHELIC CHECK

TEST X POST-TEST _____ CONTROL BOX NO. Apex 3 DATE 4-7-94

MAGNEHELIC Δ P 0 - 10"	MANOMETER READING	ALLOWABLE TOLERANCE (± 5%)	MAGNEHELIC Δ P 0 - 0.5"	MANOMETER READING	ALLOWABLE TOLERANCE (± 5%)	MAGNEHELIC Δ H 0 - 5.0"	MANOMETER READING	ALLOWABLE TOLERANCE (± 5%)	NOTES
0.50	—	± 0.025	0.10	—	± 0.005	0.50	—	± 0.025	
1.0	Manometer	± 0.05	0.20	Manometer	± 0.010	1.0	Manometer	± 0.05	
2.0	—	± 0.10	0.30	—	± 0.015	2.0	—	± 0.10	
4.0	—	± 0.20	0.40	—	± 0.020	3.0	—	± 0.15	
6.0	—	± 0.30	0.50	—	± 0.025	4.0	—	± 0.20	
8.0		± 0.40							

CALIBRATION OFFICER TM

PYROMETER CHECK

TEST X POST-TEST _____ CONTROL BOX NO. APEX 3 DATE 4-7-96

MILLIVOLT IMPUT	CORRESPONDING TEMPERATURE °F	ACTUAL TEMPERATURE °F	ALLOWABLE TOLERANCE (°F)	NOTES
0.18	40	41	± 2	
0.40	50	51	± 2	
0.84	70	70	± 2	
1.29	90	90	± 2	
1.74	110	110	± 2	
2.66	150	151	± 2	
3.82	200	202	± 2	
6.09	300	302	± 2	
8.31	400	400	± 2	
10.57	500	500	± 2	

CALIBRATION OFFICER Tim Wagoner

CONTROL BOX NO. AnEX-3
CALIBRATION DATE 9-18-96
BAROMETRIC PRESSURE (in. Hg) 28.83

PRE-TEST X
POST-TEST
CALIBRATION OFFICER [illegible]

	WET TEST METER			DRY TEST METER					COMMENTS
	ELAPSED TIME (min.*)	METER TEMP Tw (°F)	VOLUME Vw (cf)	TEMP IN Ti (°F)	TEMP OUT To (°F)	ORIFICE DIFF. PRESSURE ΔH (in. H2O)	VOLUME Vd (dcf)	VACUUM (in. Hg)	
START/MIDWAY	0:00	75	0.000	87	85	2.0	810.208	13.0	
STOP	5:58		5.000				815.170		
DIFFERENCE	5.97		5.000				4.962		
START/MIDWAY	0:00	75	0.000	90	77	2.0	817.155	13.0	
STOP	5:59		5.000				822.127		
DIFFERENCE	5.98		5.000				4.972		
START/MIDWAY	0:00	75	0.000	91	77	2.0	823.121	13.0	
STOP	5:59		5.000				828.108		
DIFFERENCE	5.98		5.000				4.987		
DRY GAS METER LEAK CHECK									
START	00:00		0.121				828.330		Leak Check = .0010 cfm (tolerance <0.02)
STOP	10:00		0.275				828.374		
DIFFERENCE	10.0		0.154				0.144		

(*) Elapsed time must be expressed in decimal form.

FORM-DRY-GAS-CH

	Run #1	Run #2	Run #3	Avg.
BP (in. Hg)	28.83	28.83	28.83	
Time (min)	5.97	5.98	5.98	
Tw (°F)	75	75	75	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	87	90	91	
To (°F)	85	77	77	
ΔH (in. H2O)	2.00	2.00	2.00	
Vm (dcf)	4.962	4.972	4.987	
Y (Pre-test)				1.0010
ΔH@ (in. H2O)	1.647	1.677	1.677	1.667
Y (Post-test)	1.0232	1.0164	1.0143	1.0180
ΔY (%)				

$$\Delta H@ = \frac{0.0317 * \Delta H * [(Tw+460) * Time]^2}{BP * (To + 460) * (Vw)^2}$$

$$Y = \frac{Vw * BP * [(Ti+460+To+460)/2]}{Vm * [BP+(\Delta H/13.6)] * (Tw+460)}$$

MAGNEHELIC CHECK

T _____ POST-TEST X CONTROL BOX NO. Apex-3 DATE 7-18-96

HELIC P 0"	MANOMETER READING	ALLOWABLE TOLERANCE (± 5%)	MAGNEHELIC Δ P 0 - 0.5"	MANOMETER READING	ALLOWABLE TOLERANCE (± 5%)	MAGNEHELIC Δ H 0 - 5.0"	MANOMETER READING	ALLOWABLE TOLERANCE (± 5%)	NOTES
0		± 0.025	0.10		± 0.005	0.50		± 0.025	
1		± 0.05	0.20		± 0.010	1.0		± 0.05	
1	Manometer	± 0.10	0.30	Manometer	± 0.015	2.0	Manometer	± 0.10	
1		± 0.20	0.40		± 0.010	3.0		± 0.15	
3		± 0.30	0.50		± 0.025	4.0		± 0.20	
0		± 0.40							

CALIBRATION OFFICER Tom Morgan

PYROMETER CHECK

ST _____ POST-TEST X CONTROL BOX NO. Apex-3 DATE 9-18-96

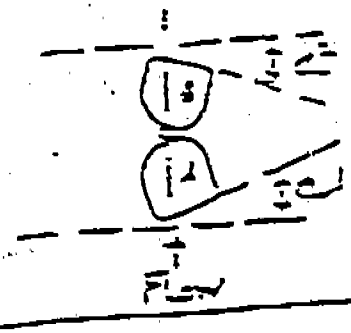
LLIVOLT MPUT	CORRESPONDING TEMPERATURE °F	ACTUAL TEMPERATURE °F	ALLOWABLE TOLERANCE (°F)	NOTES
0.18	40	42	± 2	
0.40	50	51	± 2	
0.84	70	70	± 2	
1.29	90	91	± 2	
1.74	110	111	± 2	
2.66	150	151	± 2	
3.81	200	202	± 2	
6.09	300	302	± 2	
8.31	400	402	± 2	
10.57	500	502	± 2	

CALIBRATION OFFICER Tom Morgan

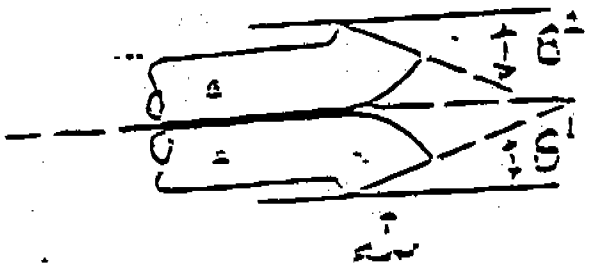
AGRIV.FRM

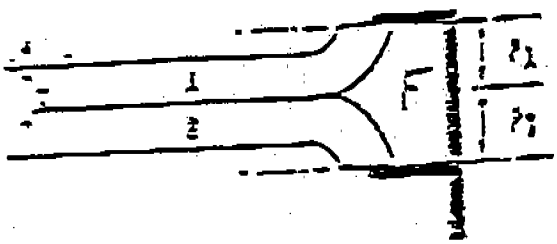
Caliper # XFS- 59
Precheck
Post Check

Probe # 3-1
Date 07-25-96
Initials KA

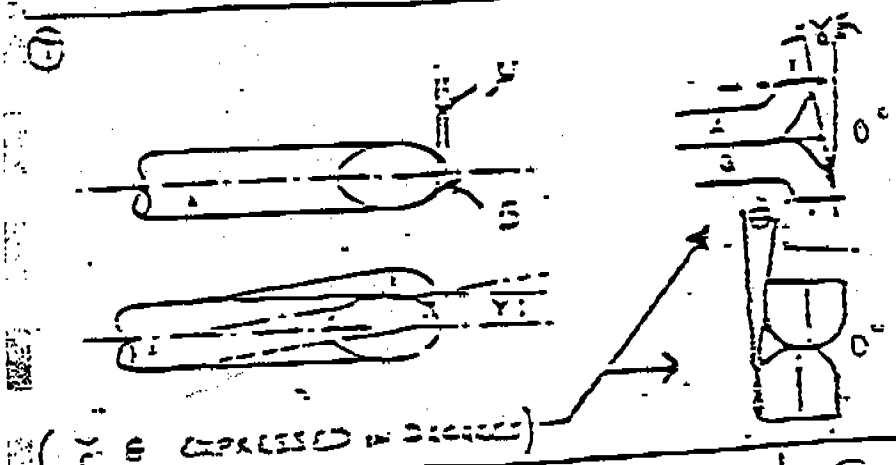


[illegible] = 0°		[illegible] = <10°
[illegible] = 0°		
[illegible] = 0°		[illegible] = <4°
[illegible] = 0°		
F = 0.838"		
[illegible] = 0.000"	[illegible] = ≤0.125" (STEM [illegible])	
Y = 0.000"	Y = ≤[illegible] (STEM [illegible])	
W = 0.248"	W ≥ 0"	
X = 0.880"	X ≥ 0.75" (STEM [illegible])	
Y = 6.398"	Y ≥ [illegible]	
Z = 2.750"	Z > [illegible]	
D_1 = 0.315"	D_1 > [illegible]	

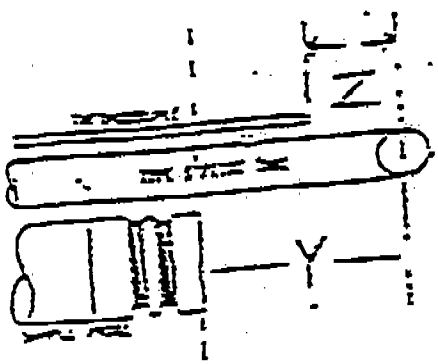


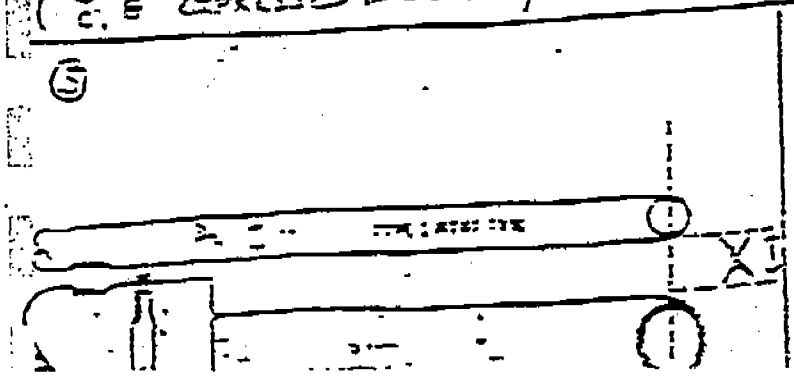


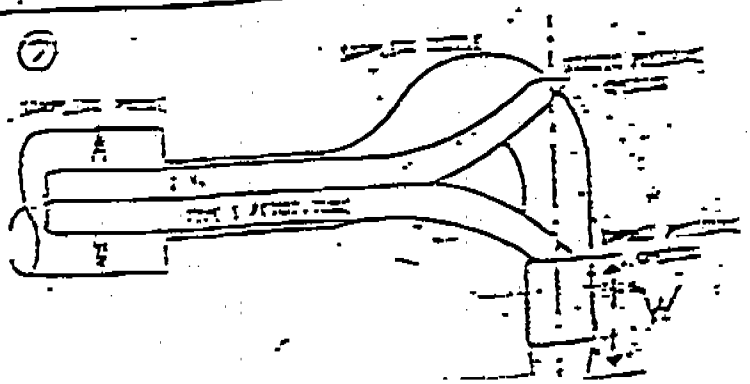
1.05 D_1 ≤ [illegible] D_2
D_1 = D_2
2.10 D_1 ≤ [illegible] D_2



(X, Y, Z EXPRESSED IN DIAGRAM)



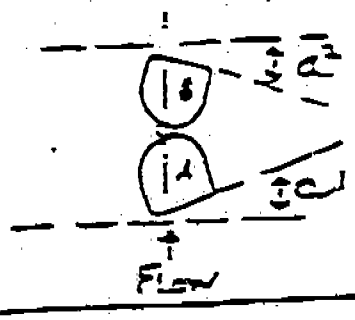




Caliper # XFS-59
Precheck
Post Check

Probe # 3-1
Date 09-06-96
Initials KA

①

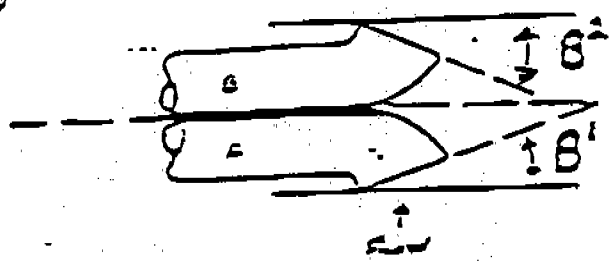


$z^1 =$ 0°
$z^2 =$ 0°
$z^1, z^2 = <10°$

$B^1 =$ 0°
$B^2 =$ 1°
$B^1, B^2 = <5°$

F = 0.840"

②



p = 0.000" $p = \leq 0.1250"$ ($\theta_{TEN} \times P_{A1}$)

V = 0.000" $V = \leq 0.05125"$ ($\theta_{TEN} \times P_{A1}$)

W = 0.920" $W \geq 0"$

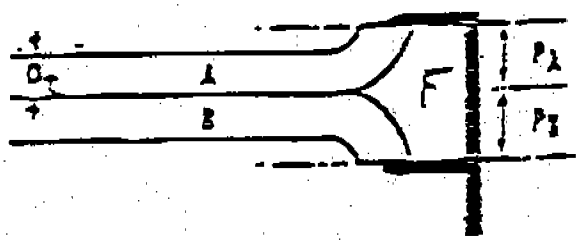
X = 0.890" $X \geq 0.750"$ (3/4" using 1/2" [illegible])

Y = 6.284" $Y \geq 3.0"$

Z = 2.475" $Z > 2.0"$

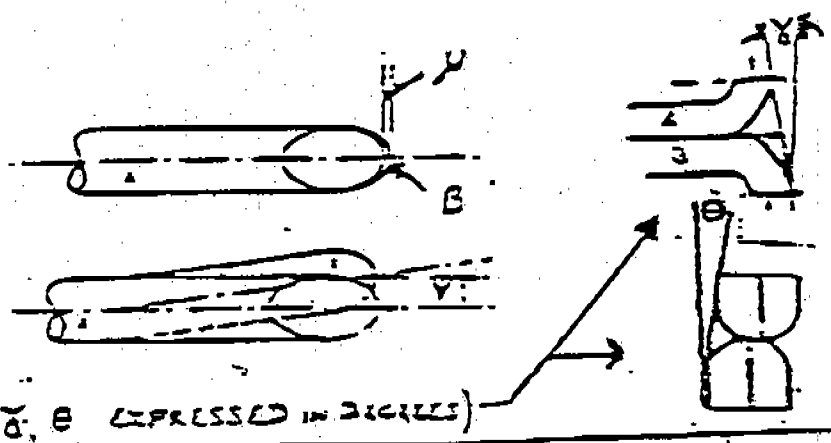
D_t = 0.315" $D_t > .1875"$

③



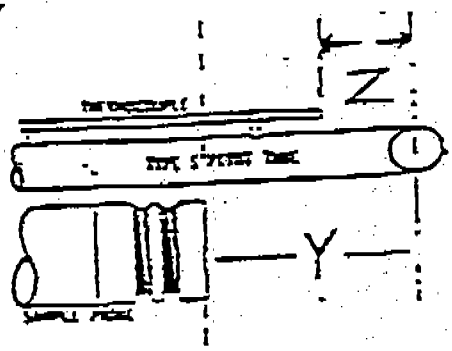
$1.05\ D_t < d < 1.50\ D_t$
$P_A = P_B$
$2.10\ D_t < d < 3.00\ D_t$

④

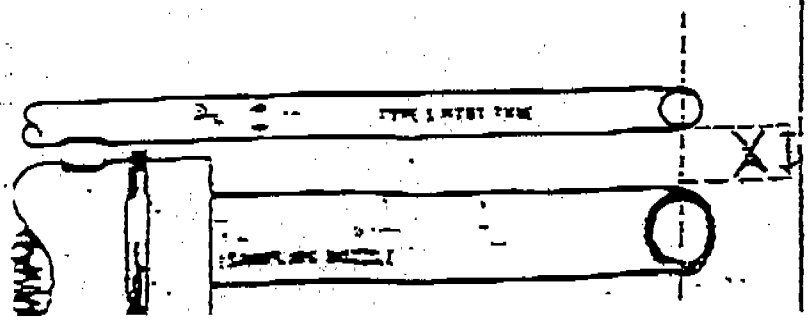


(α, β EXPRESSED IN DEGREES)

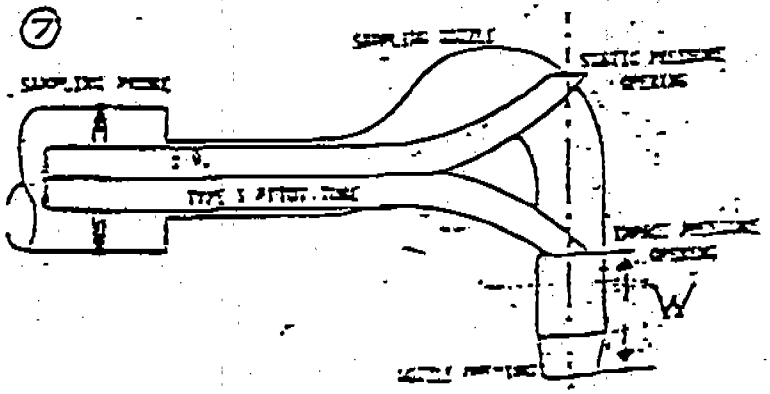
⑥



⑤

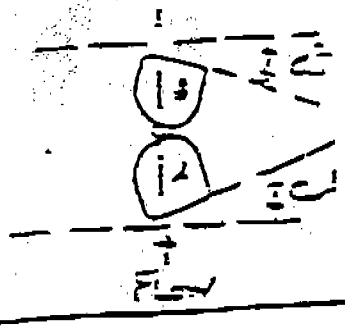


⑦

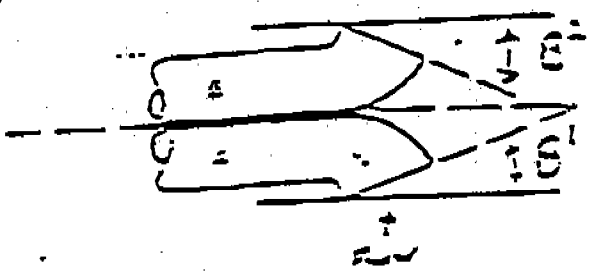


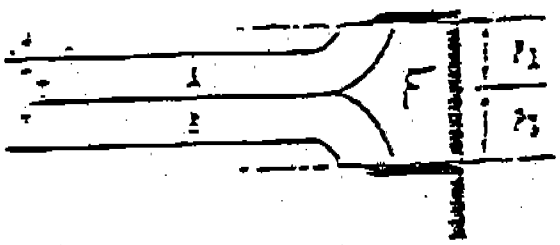
Caliper # XFS - 59
Precheck
Post Check

Probe # 3 - 4
Date 07 - 25 - 96
Initials KA

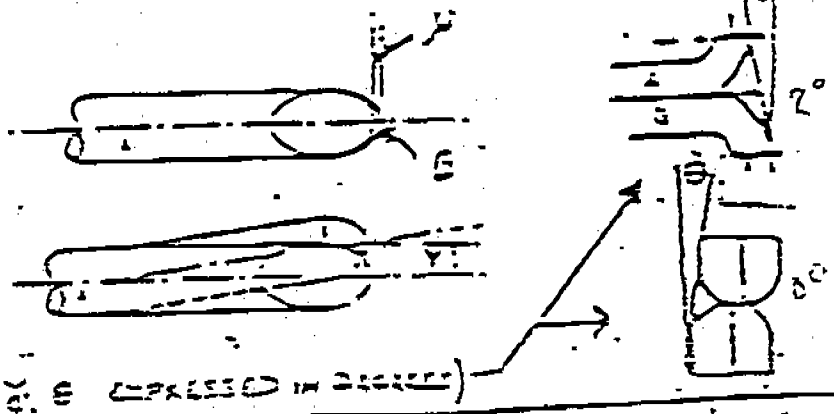


= 0°	
= 1°	
= 4°	
= 1°	
F = 0.920"	
= 0.032"	
V = 0.000"	
W = 0.266"	W ≥ 0"
X = 0.798"	X ≥ 0.750"
Y = 6.442"	Y ≥
Z = 2.491"	Z >
= 0.375"	>

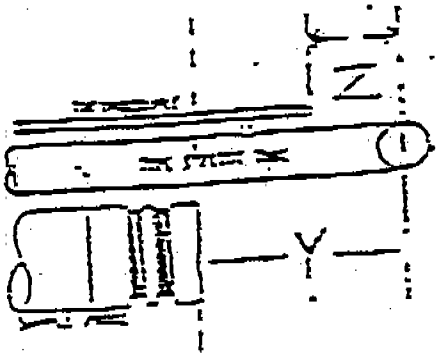


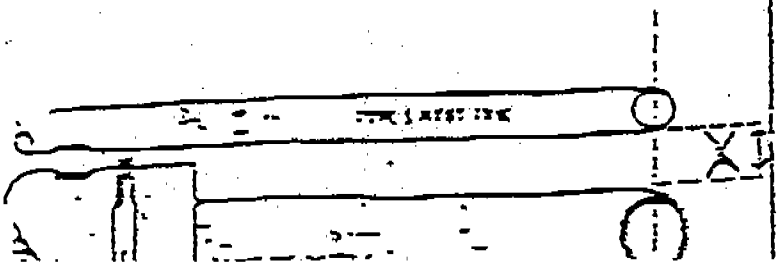


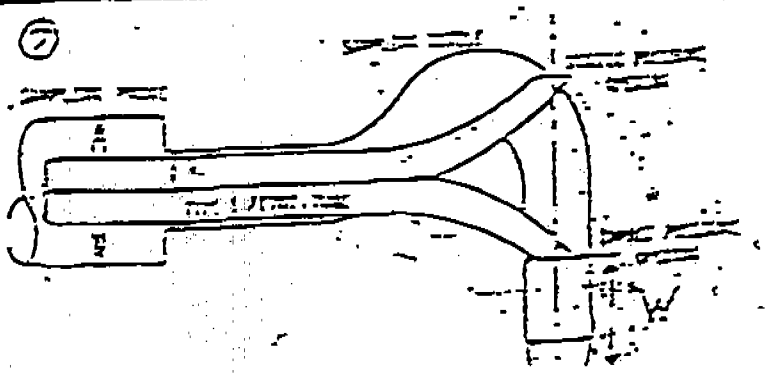
1.5 l_2 < 4.30 l_2
l_1 = l_1
2.10 l_2 < 4.00 l_2



(X, Y EXPRESSED IN DEGREES)



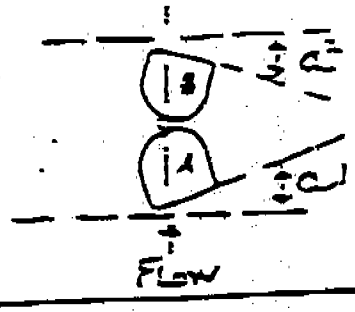




Caliper # XFS-59
Precheck
Post Check

Probe # 3-4
Date 09-06-96
Initials KA

①

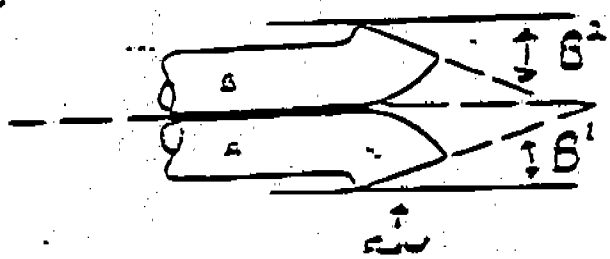


α^1 = 1°
α^2 = 1°
α^1, α^2 = <10°

β^1 = 3°
β^2 = 2°
β^1, β^2 = <5°

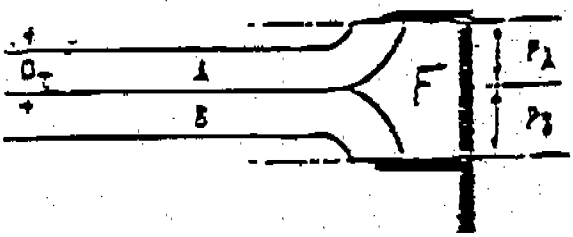
F = 0.922"

②



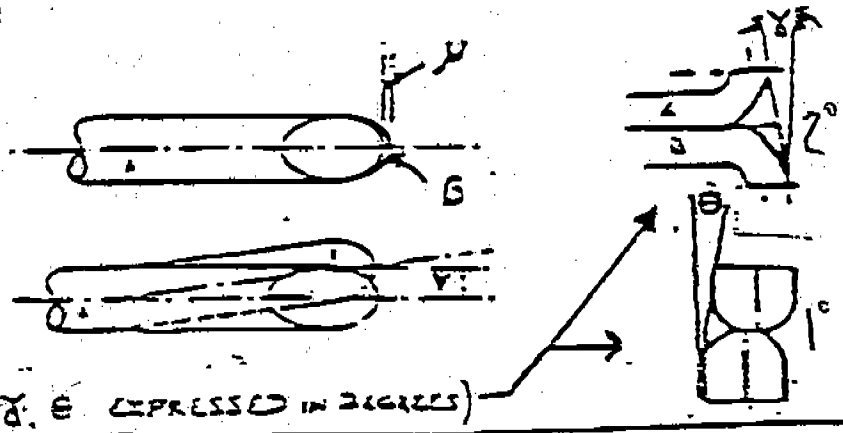
μ = 0.032 — μ = ≤ 0.1250" (X TAN X)
V = 0.016 — V = ≤ 0.03125" (Θ TAN X)
W = 0.481" — W ≥ 0"
X = 0.994" — X ≥ 0.750" (3/4" using 1/2" [illegible])
Y = 6.408" — Y ≥ 3.0"
Z = 2.192" — Z > 2.0"
D_t = 0.375" — D_t > .1875"

③



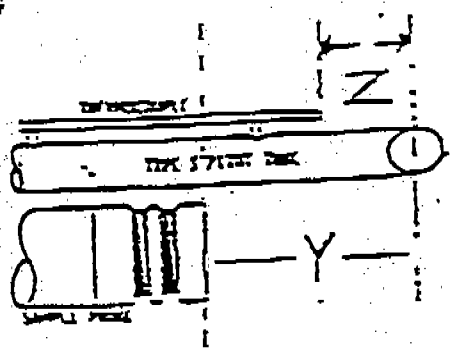
1.05 D_t ≤ <1.50 D_t
P_1 = P_3
2.10 D_t ≤ <3.00 D_t

④

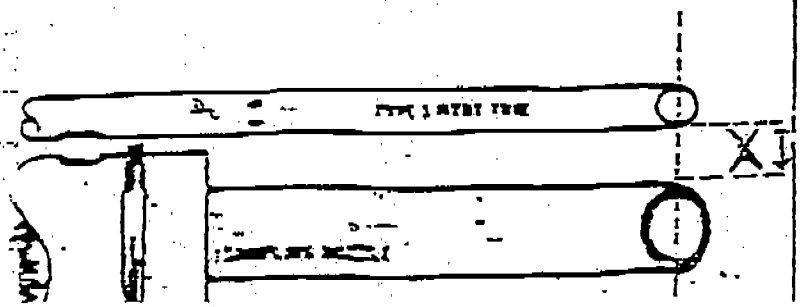


(α, β EXPRESSED IN DEGREES)

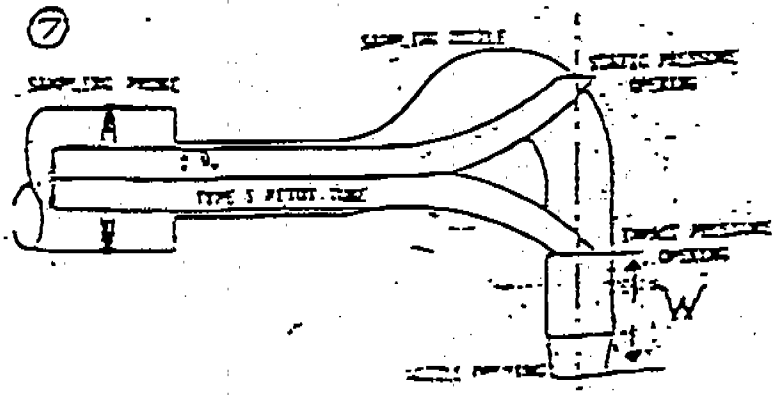
⑥

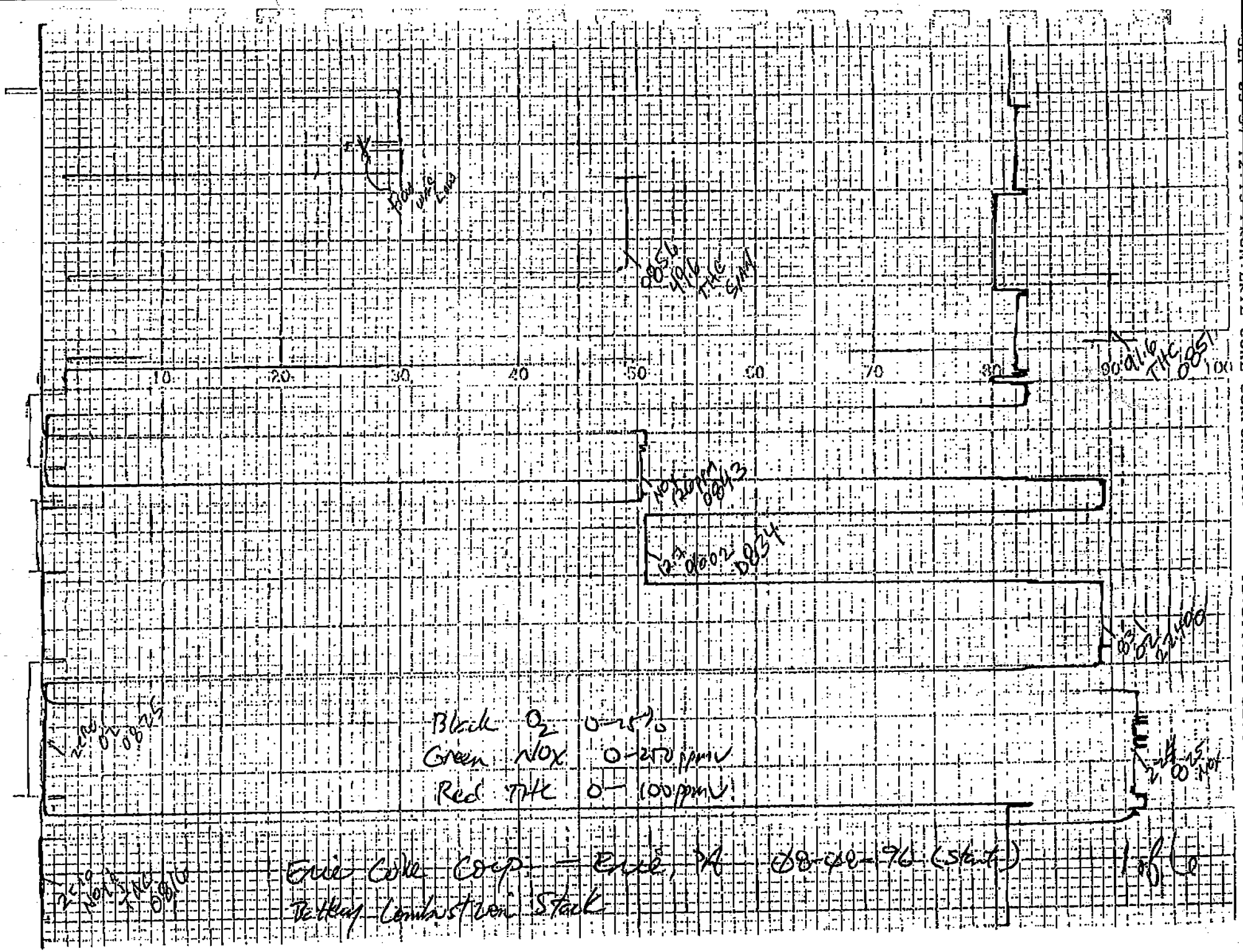


⑤

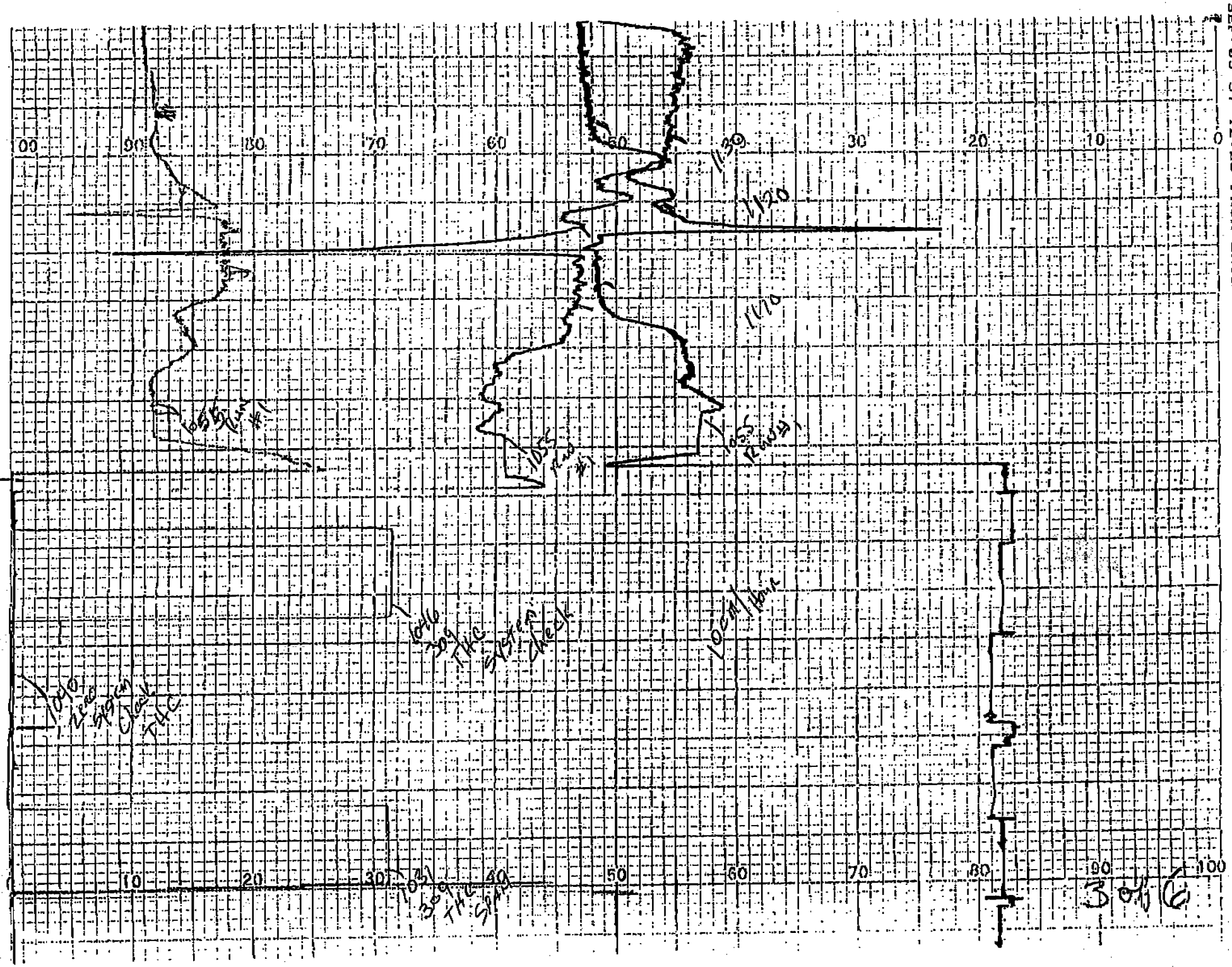


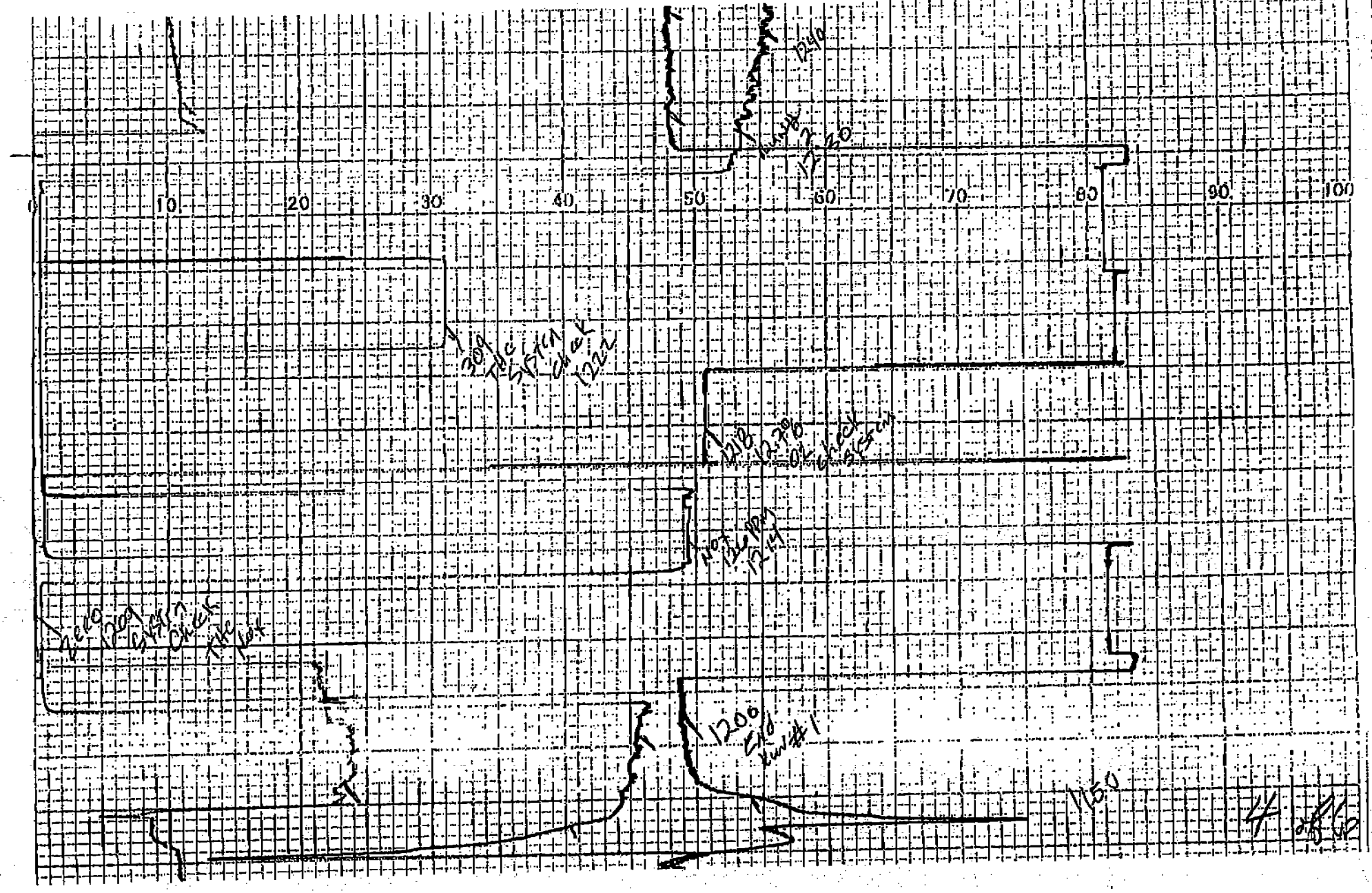
⑦

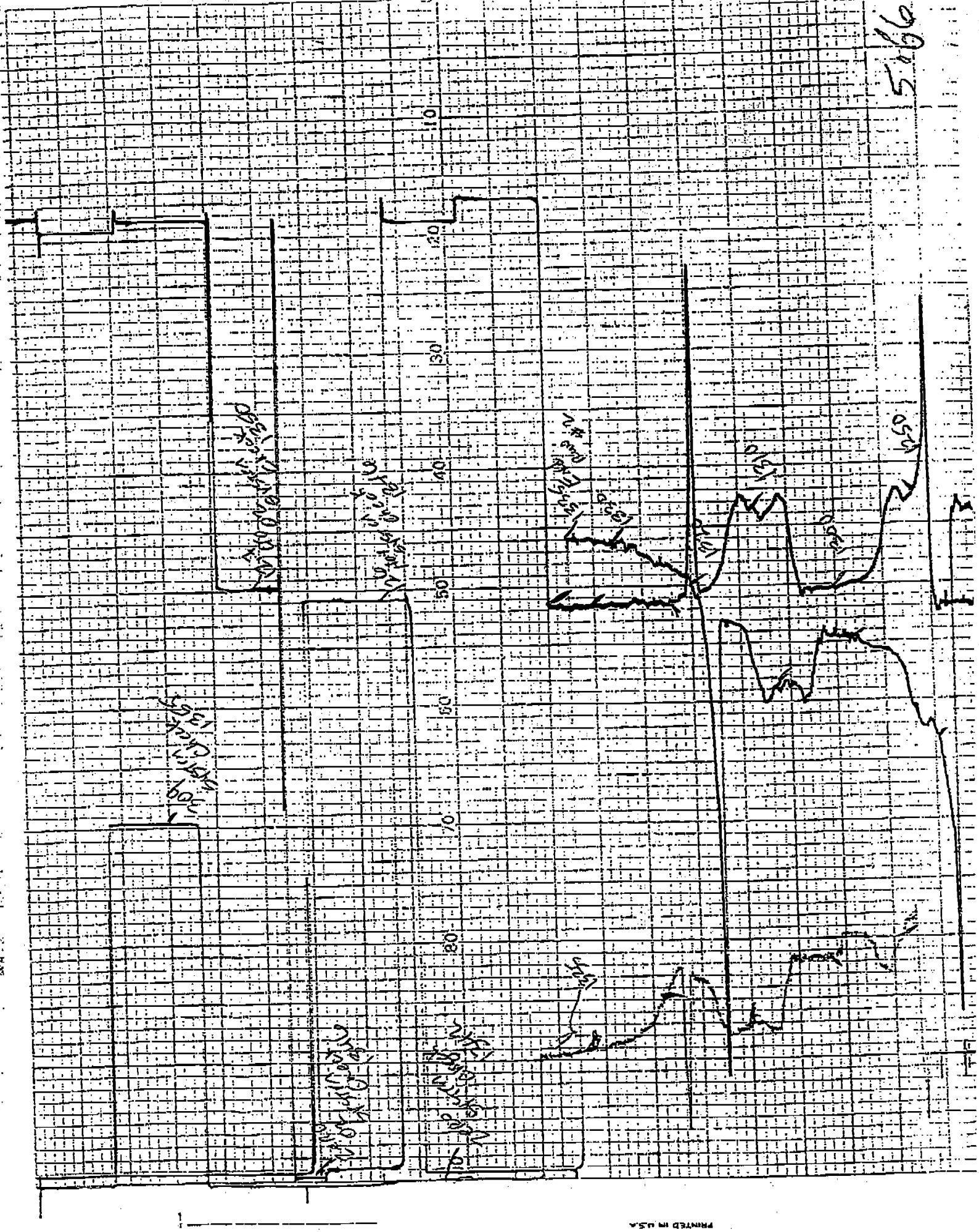



10
20
30
40
50
60
70
80
90
100
Black O_2 0-25%
Green NOx 0-250 ppmv
Red THC 0-100 ppmv
Erie Coke Corp — Erie, PA 08-28-96 (start)
Rotary Combustion Stack

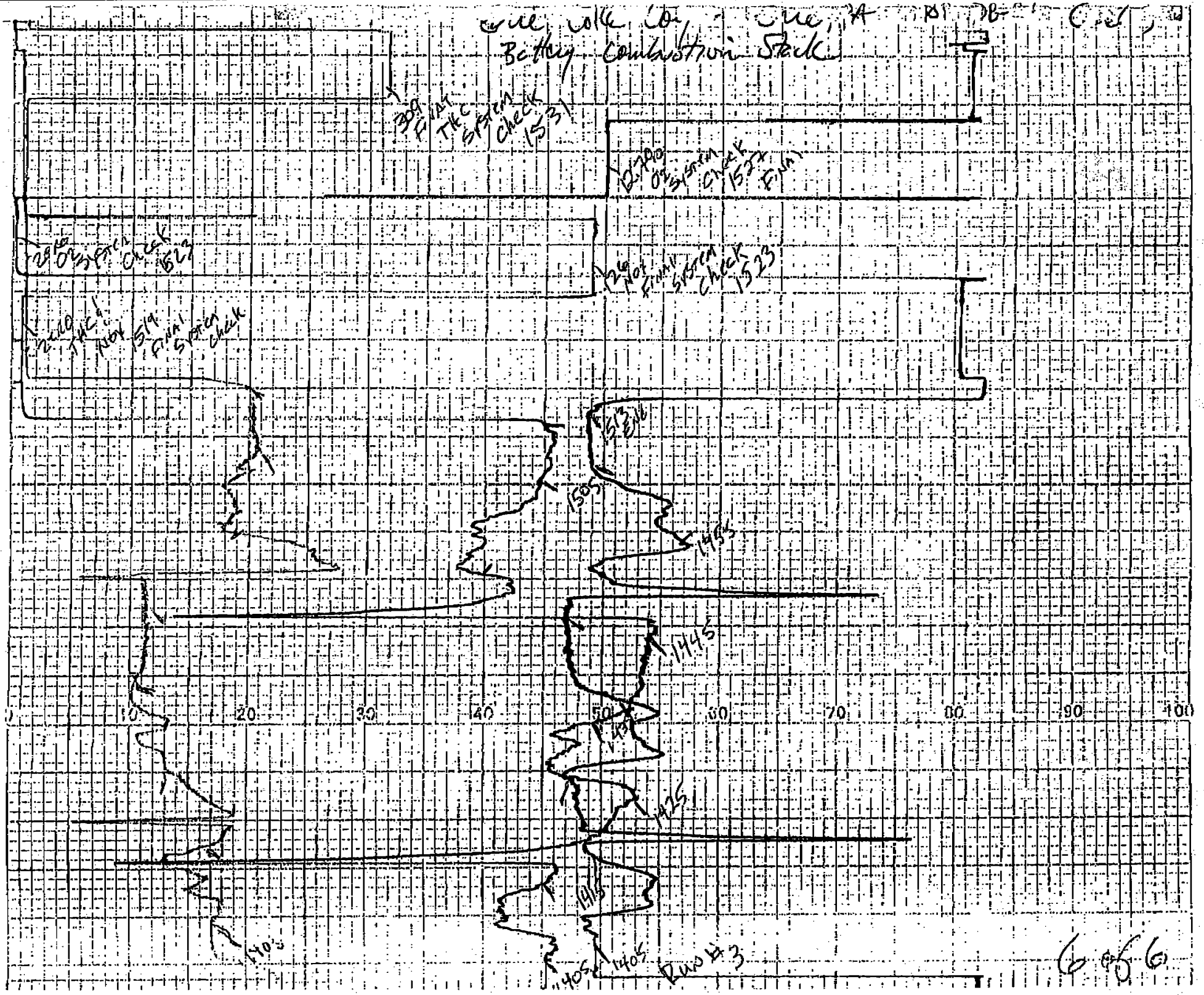
0
10
20
30
40
50
60
70
80
90
100


1055 Run #1
1055 Run #1
1055 Run #1
1120
1130
1110
1090 Red Sign Check THC
1046 30% THC System Check
Local Home
1021 30% THC Spike
3 of 6


0
10
20
30
40
50
60
70
80
90
100
1200
1150


5066
10
20
30
40
50
60
70
80
PRINTED IN U.S.A.

Battery Combustion Stack



666

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA
CEM DATA FOR BATTERY COMBUSTION STACK

"CO2 conc." (%)	"O2 conc." (%)	"NOX conc." (ppmv)	"THC conc." (ppmv)	"TIME" (EDT)
RUN # 1:				
2.9	14.6	99.4	118.8	10 55
2.9	14.7	96.8	115.3	10 56
3.0	14.4	98.9	120.7	10 57
3.1	14.1	100.4	127.1	10 58
3.2	14.1	98.4	141.6	10 59
3.1	14.2	97.2	149.0	11 00
3.1	14.1	98.6	152.5	11 01
3.1	14.0	100.0	144.4	11 02
3.1	14.0	99.7	140.8	11 03
3.2	13.9	102.1	136.7	11 04
3.4	13.6	106.3	141.3	11 05
3.7	12.8	112.4	160.1	11 06
3.8	12.4	113.7	169.4	11 07
3.9	12.3	114.1	175.6	11 08
3.9	12.2	113.6	175.8	11 09
4.0	12.2	114.7	173.4	11 10
4.0	12.2	116.0	175.2	11 11
4.0	12.2	115.6	175.4	11 12
4.0	12.1	116.5	176.0	11 13
4.0	12.2	116.0	174.0	11 14
4.0	12.0	116.5	183.3	11 15
4.0	12.2	115.9	170.7	11 16
2.5	15.6	74.0	96.9	11 17
3.0	14.4	86.5	168.5	11 18
3.3	13.7	106.1	152.7	11 19
3.5	13.4	115.0	147.7	11 20
3.4	13.6	113.9	137.3	11 21
3.4	13.6	114.7	132.1	11 22
3.7	13.0	122.8	126.6	11 23
3.7	12.8	126.1	124.0	11 24
3.5	13.3	120.6	113.6	11 25
3.5	13.5	120.5	118.0	11 26
3.7	12.9	126.1	118.6	11 27
4.0	12.2	131.8	121.7	11 28
4.1	12.0	134.4	123.4	11 29
4.1	11.9	134.2	114.4	11 30
4.1	11.9	135.3	121.0	11 31
4.2	11.9	135.5	119.7	11 32
4.1	11.9	135.2	115.3	11 33
4.1	11.9	135.3	116.7	11 34
4.2	11.9	136.4	110.1	11 35
4.2	11.8	136.3	111.1	11 36
4.2	11.8	136.8	114.4	11 37
4.2	11.8	137.5	106.6	11 38

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA
CEM DATA FOR BATTERY COMBUSTION STACK

"CO2 conc." (%)	"O2 conc." (%)	"NOX conc." (ppmv)	"THC conc." (ppmv)	"TIME" (EDT)
4.2	11.8	137.2	111.6	11 39
4.2	11.8	137.8	111.1	11 40
4.2	11.8	138.6	106.4	11 41
4.2	11.8	139.2	109.4	11 42
4.2	11.8	138.1	105.5	11 43
4.0	12.2	136.5	101.0	11 44
3.4	13.5	126.6	84.0	11 45
3.1	14.2	119.9	89.9	11 46
3.2	14.0	121.5	81.5	11 47
1.9	16.7	61.2	160.6	11 48
3.0	14.5	87.0	231.6	11 49
3.3	14.0	100.0	236.7	11 50
3.7	13.3	108.4	250.8	11 51
3.8	12.7	110.4	248.4	11 52
3.9	12.5	110.7	240.8	11 53
3.9	12.4	111.4	249.9	11 54
3.9	12.3	111.2	237.3	11 55
4.0	12.3	113.2	248.3	11 56
3.9	12.3	111.3	232.5	11 57
4.0	12.3	112.5	221.5	11 58
4.0	12.2	113.3	221.5	11 59
4.0	12.3	113.8	227.2	12 00
RUN1 AVG:				
3.7	12.9	115.7	151.7	

Corrected Values:

$$C_{stack} = \frac{[\bar{C} - C_o][C_{air}][CF]}{[C_{air} - C_o]}$$

$$CO_2 = \frac{[3.7 - 0.0][10.1][1]}{[10.1 - 0.0]} = 3.7\%$$

$$O_2 = \frac{[12.9 - 0.0][12.7][1]}{[12.7 - 0.0]} = 12.9\%$$

$$NO_x = \frac{[115.7 - 0.9][126][1]}{[122.9 - 0.9]} = 118.6 \text{ ppmv}$$

$$THC = \frac{[151.7 - 0.0][309][1]}{[313.8 - 0.0]} = 149.4 \text{ ppmv}$$

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA
CEM DATA FOR BATTERY COMBUSTION STACK

"CO2 conc." (%)	"O2 conc." (%)	"NOX conc." (ppmv)	"THC conc." (ppmv)	"TIME" (EDT)
RUN #2:				
4.0	12.1	132.9	110.8	12 30
4.0	12.1	135.0	117.8	12 31
4.0	12.0	133.6	103.8	12 32
4.0	12.1	135.1	107.8	12 33
4.0	12.1	136.3	112.3	12 34
4.0	12.1	135.3	106.5	12 35
4.0	12.0	135.6	103.4	12 36
4.0	12.0	136.7	108.1	12 37
4.0	12.0	137.8	105.3	12 38
4.0	12.0	137.5	108.8	12 39
4.0	12.0	137.7	100.5	12 40
4.0	12.1	138.2	108.3	12 41
4.0	12.0	138.9	103.7	12 42
4.0	12.1	138.0	102.1	12 43
4.0	12.0	137.8	99.9	12 44
4.0	12.0	140.1	106.2	12 45
4.0	12.0	139.8	103.1	12 46
4.0	12.2	138.9	91.4	12 47
2.1	16.4	66.1	153.8	12 48
2.9	14.7	84.1	217.6	12 49
3.1	14.3	92.7	199.1	12 50
3.1	14.3	94.8	187.3	12 51
3.0	14.4	95.7	180.2	12 52
3.2	14.0	99.7	180.0	12 53
3.5	13.2	105.9	200.8	12 54
3.7	12.7	108.4	199.5	12 55
3.8	12.6	109.8	202.3	12 56
3.8	12.5	109.9	201.9	12 57
3.8	12.5	110.6	190.6	12 58
3.8	12.5	111.9	193.4	12 59
3.8	12.4	112.0	179.1	13 00
3.8	12.4	113.2	186.0	13 01
3.8	12.4	113.5	191.7	13 02
3.9	12.4	113.8	192.6	13 03
3.8	12.4	113.1	179.9	13 04
3.5	13.2	107.8	141.7	13 05
3.0	14.2	100.9	125.3	13 06
3.0	14.3	101.6	126.4	13 07
3.2	14.1	103.6	139.1	13 08
3.2	14.0	102.9	126.2	13 09
3.1	14.1	102.4	125.6	13 10
3.0	14.4	100.5	124.9	13 11
3.1	14.2	102.7	126.4	13 12
3.3	13.6	109.4	144.3	13 13

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA
CEM DATA FOR BATTERY COMBUSTION STACK

"CO2 conc." (%)	"O2 conc." (%)	"NOX conc." (ppmv)	"THC conc." (ppmv)	"TIME" (EDT)
3.7	12.9	114.8	158.7	13 14
3.8	12.5	115.8	170.6	13 15
3.9	12.4	116.0	168.4	13 16
2.6	15.2	80.3	111.9	13 17
3.4	13.4	91.4	166.3	13 18
4.0	12.3	117.1	168.3	13 19
4.0	12.2	123.2	153.8	13 20
4.0	12.1	126.1	134.7	13 21
4.0	12.2	126.9	126.0	13 22
4.0	12.2	128.3	125.4	13 23
4.0	12.2	129.4	126.9	13 24
4.0	12.2	129.6	119.0	13 25
4.0	12.1	130.3	112.1	13 26
4.0	12.1	132.2	113.1	13 27
4.0	12.1	133.0	118.4	13 28
4.0	12.1	133.3	110.4	13 29
4.0	12.1	132.4	109.7	13 30
4.0	12.1	133.9	110.7	13 31
4.0	12.1	133.3	104.8	13 32
4.0	12.0	134.4	110.0	13 33
4.0	12.1	133.9	105.9	13 34
4.0	12.1	134.4	107.3	13 35
AVG RUN2:				
3.7	12.8	119.4	138.6	

Corrected Values:

$$C_{stack} = \frac{[\bar{C} - C_0][C_{ma}][CF]}{[C_m - C_0]}$$

$$CO_2 = \frac{[3.7 - 0.1][10.1][1]}{[10.1 - 0.1]} = 3.6\%$$

$$O_2 = \frac{[12.8 - 0.1][12.7][1]}{[12.6 - 0.1]} = 12.9\%$$

$$NO_x = \frac{[119.4 - 1.8][126][1]}{[123.2 - 1.8]} = 122.1 \text{ ppmv}$$

$$THC = \frac{[138.6 - 0.0][309][1]}{[311.4 - 0.0]} = 137.5 \text{ ppmv}$$

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA
CEM DATA FOR BATTERY COMBUSTION STACK

"CO2 conc." (%)	"O2 conc." (%)	"NOX conc." (ppmv)	"THC conc." (ppmv)	"TIME" (EDT)
RUN #3:				
3.9	12.5	113.0	172.1	14 05
4.0	12.4	117.5	191.8	14 06
3.9	12.3	115.1	184.8	14 07
3.8	12.8	112.2	161.2	14 08
3.4	13.7	106.1	163.9	14 09
3.3	13.6	103.3	161.7	14 10
3.4	13.6	104.0	153.0	14 11
3.3	13.8	105.9	147.0	14 12
3.3	13.6	104.5	140.3	14 13
3.7	13.0	111.6	167.5	14 14
3.8	12.6	115.8	194.0	14 15
3.9	12.3	113.4	176.4	14 16
2.8	14.9	81.6	120.3	14 17
3.4	13.6	92.0	201.7	14 18
4.1	12.3	116.5	186.9	14 19
4.1	12.2	123.0	169.6	14 20
4.1	12.2	125.7	161.8	14 21
4.0	12.1	125.1	146.0	14 22
4.1	12.1	128.1	144.5	14 23
4.0	12.0	128.6	135.0	14 24
4.2	12.0	135.9	158.6	14 25
4.1	12.0	128.4	117.1	14 26
3.7	13.2	128.4	128.4	14 27
3.3	13.9	117.2	124.8	14 28
3.4	13.6	113.9	138.3	14 29
3.5	13.5	118.4	150.7	14 30
3.6	13.3	118.6	124.7	14 31
3.5	13.4	119.8	114.7	14 32
3.3	13.8	114.7	109.8	14 33
3.4	13.6	120.6	118.4	14 34
3.8	13.0	126.4	108.9	14 35
3.8	12.3	129.7	121.9	14 36
4.2	12.2	134.6	128.8	14 37
4.0	11.9	128.5	104.9	14 38
4.2	12.0	136.3	133.6	14 39
4.1	11.9	132.2	113.8	14 40
4.2	12.0	135.0	125.1	14 41
4.1	11.9	132.9	115.8	14 42
4.2	12.0	136.8	131.8	14 43
4.1	11.9	133.9	113.4	14 44
4.2	11.9	137.6	130.3	14 45
4.2	11.9	137.9	125.4	14 46
4.1	11.9	132.6	110.3	14 47
2.4	16.1	75.2	192.5	14 48

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA
CEM DATA FOR BATTERY COMBUSTION STACK

"CO2 conc." (%)	"O2 conc." (%)	"NOX conc." (ppmv)	"THC conc." (ppmv)	"TIME" (EDT)
3.6	13.3	95.7	291.1	14 49
3.9	12.7	102.0	259.3	14 50
4.0	12.5	108.7	273.0	14 51
3.8	12.6	104.7	230.5	14 52
3.4	13.6	100.6	194.1	14 53
3.1	14.5	98.7	197.6	14 54
3.1	14.3	98.3	193.8	14 55
3.2	14.0	98.4	194.4	14 56
3.3	13.8	99.9	188.5	14 57
3.2	13.9	97.9	182.3	14 58
3.2	14.1	101.1	198.7	14 59
3.3	14.0	104.1	210.4	15 00
3.5	13.3	106.3	207.0	15 01
3.6	12.9	108.0	200.9	15 02
3.9	12.6	112.8	219.7	15 03
3.8	12.4	109.7	203.2	15 04
4.0	12.5	114.3	222.5	15 05
3.8	12.3	109.4	191.1	15 06
3.9	12.4	116.0	222.6	15 07
4.0	12.4	112.1	197.3	15 08
3.9	12.4	116.3	223.1	15 09
3.8	12.2	109.8	188.5	15 10
4.0	12.6	117.1	220.8	15 11
3.7	12.7	109.8	171.6	15 12
RUN3 AVG:				
3.7	12.9	115.0	167.7	

Corrected Values:

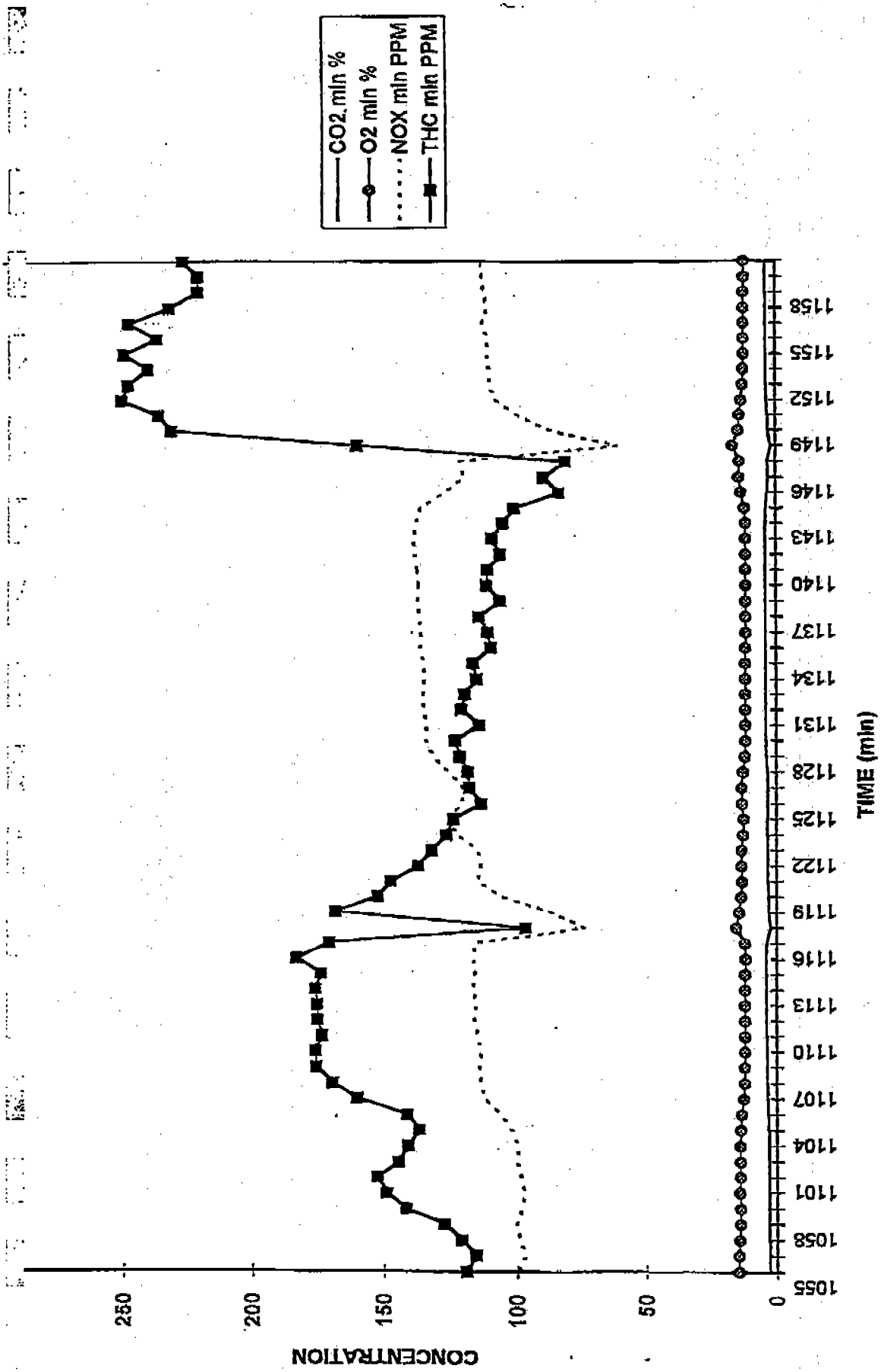
$$C_{stack} = \frac{[\bar{C} - C_o][C_m - C_o][CF]}{[C_m - C_o]}$$

$$CO_2 = \frac{[3.7 - 0.1][10.1][1]}{[10.1 - 0.1]} = 3.6\%$$

$$O_2 = \frac{[13.9 - 0.1][12.7][1]}{[12.6 - 0.1]} = 13.0\%$$

$$NO_x = \frac{[115.0 - 2.0][126][1]}{[122.8 - 2.0]} = 117.9 \text{ ppmv}$$

$$THC = \frac{[167.7 - 4.75][309][1]}{[314.6 - 4.75]} = 162.5 \text{ ppmv}$$


CO2 min %
O2 min %
NOX min PPM
THC min PPM
CONCENTRATION
250
200
150
100
50
0
TIME (min)
1055
1058
1101
1104
1107
1110
1113
1116
1119
1122
1125
1128
1131
1134
1137
1140
1143
1146
1149
1152
1155
1158

MONITORING STATION
INSTRUMENT DATA SHEET

PLANT Erie Coke Corp DATE 08/08/96 PAGE # 1 of 2
LOCATION Waste Heat Stack TEST # MODEL 600 USED
ACTIVITY # Battery Stack HEATED LINE # OTHER EQUIP.
TESTERS B.P. COMMENTS

AVG	162	119	12.8	3.7		
TIME	PARAMETER - UNITS THC ppm	NOx ppm	O2 %	CO2 %		
1100	152	101	14.2	3.1		
1105	150	108	14.0	3.9		
1110	175	116	12.2	3.9		
1115	180	121	12.0	4.1		
1120	141	117	13.3	3.4	Run #1	
1125	120	123	13.3	3.4		
1130	120	138	11.7	4.1		
1135	110	133	11.6	4.1		
1140	—	—	—	—	missed	Reading
1145	100	138	12.9	3.7		
1150	233	100	13.7	3.4		
1155	240	114.3	12.2	3.9		
1200	220	115.0	12.2	3.9		
1230	110	132.8	12.1	4.0		
1235	103	136.0	12.0	4.0		
1240	100	139.3	12.0	4.0		
1245	—	—	—	—	missed	Reading
1250	200	92.5	14.4	3.0		
1255	205	109.5	12.7	3.7		
1300	184	112.5	12.4	3.8		
1305	130	110.0	12.9	3.6	Run #2	
1310	128	103.0	14.1	3.0		End
1315	167	115	12.5	3.7		
1320	140	127.5	12.0	4.0		(1335)
1325	115	130.5	12.2	4.0		
1330	109	133.5	12.1	4.0		
1335	107	135.0	12.0	4.0		
AVG	138	121	12.6	3.8		

ATS

MONITORING STATION
INSTRUMENT DATA SHEET

PLANT Erie Coke Corp. DATE 8/08/96 PAGE # 2 of 2
LOCATION Battery Stack TEST # MODEL 600 USED 0
ACTIVITY # HEATED LINE # OTHER EQUIP.
TESTERS B.P. COMMENTS

TIME	PARAMETER—UNITS					
	THC ppm	NOx ppm	O2 %	CO2 %		
1405	180	113.5	12.5	3.8		
1410	169	105.0	13.6	3.3		
1415	181	113.8	12.5	3.7		
1420	—	—	—	—		
1425	130	132.5	11.9	4.0		
1430	120	115.3	13.3	3.5		
1435	111	123.5	13.1	3.5		
1440	119	133.0	11.8	4.1		
1445	112	135.0	11.8	4.1		
1450	252	101.0	12.7	3.7		
1455	195	100.5	13.7	3.1		
1500	191	98.5	13.9	3.1		
1505	208	111.3	12.3	3.8		
1510						
Avg	156	115	12.8	3.6		

ATS

CEM CALIBRATION ERROR TEST DATA

CLIENT Erie Coke Corp.
PLANT LOCATION Erie, PA
TEST UNIT Battery Stack
TEST DATE 08-08-96
PROJECT NO. 591

Page 1 of 1
ANALYZER O_2
INSTRUMENT Milton Roy
SPAN 0-25 (ppmv or %)
OPERATOR MG

Time EDT	Calibration Gas Conc. (A) (ppmv or %)	Analyzer Response (B) (ppmv or %)	Arithmetic Difference (A – B) (ppmv or %)	Δ as Percent of Span (100 * (A–B) / Span) (%)	Δ as Percent of Cal. Gas Conc. (100 * (A–B) / Gas Conc.) (%)	Notes
0816	zero	0.0	0.0	0.0	—	
0831	22.4	22.4	0.0	0.0	—	
0834	12.7	12.7	0.0	0.0	—	

Specifications: Δ (Percent of Span) ≤ 2% for O2, CO2, SO2, NOx, CO
Δ (Percent of Calibration Gas Conc.) ≤ 5% for THC

CEM SAMPLING SYSTEM BIAS AND DRIFT DATA

Mid-Level or High-Level Calibration Gas: 12.7 (ppmv or %)
(Use the one closest to the actual stack gas concentration)

Time	Calibration Gas	Analyzer Response (B) (ppmv or %)	System Response (C) (ppmv or %)	System Cal. Bias (100 * (C–B) / Span) (%)	Drift = 100 * (Final SCB – Initial SCB) / Span	Drift (%)
0924	Zero	0.0	0.0	0.0		0.0
0929	Upscale	12.7	12.7	0.0		0.4
1214	Zero	0.0	0.0	0.0		0.4
1218	Upscale	12.7	12.6	0.4		0.0
1346	Zero	0.0	0.1	0.4		0.0
1350	Upscale	12.7	12.6	0.4		0.0
1519	Zero	0.0	0.1	0.4		
1527	Upscale	12.7	12.6	0.4		
	Zero					
	Upscale					
	Zero					
	Upscale					
	Zero					
	Upscale					

Specifications: System Cal. Bias ≤ 5% for O2, CO2, SO2, NOx, CO; ≤ 3% for THC
Drift ≤ 3% for O2, CO2, SO2, NOx, CO; ≤ 3% for THC

CEM CALIBRATION ERROR TEST DATA

CLIENT Erie Coke Corp. Page 1 of 1

PLANT LOCATION Erie, PA ANALYZER CO2

TEST UNIT Battery STACK INSTRUMENT Fuji Electric

TEST DATE 08-08-96 SPAN 0-20 (ppmv or %)

PROJECT NO. 591 OPERATOR MG

Time EDT	Calibration Gas Conc. (A) (ppmv or %)	Analyzer Response (B) (ppmv or %)	Arithmetic Difference (A – B) (ppmv or %)	Δ as Percent of Span (100 * (A–B) / Span) (%)	Δ as Percent of Cal. Gas Conc. (100 * (A–B) / Gas Conc.) (%)	Notes
2818	zero	0.0	0.0	0.0	—	
0834	10.1	10.1	0.0	0.0	—	
0838	17.9	17.6	0.3	1.5	—	

Specifications: Δ (Percent of Span) ≤ 2% for O2, CO2, SO2, NOx, CO

Δ (Percent of Calibration Gas Conc.) ≤ 5% for THC

CEM SAMPLING SYSTEM BIAS AND DRIFT DATA

Mid-Level or High-Level Calibration Gas: 10.1 (ppmv or %)

(Use the one closest to the actual stack gas concentration)

Time	Calibration Gas	Analyzer Response (B) (ppmv or %)	System Response (C) (ppmv or %)	System Cal. Bias (100 * (C–B) / Span) (%)	Drift = 100 * (Final SCB – Initial SCB) / Span	Drift (%)
0917	Zero	0.0	0.0	0.0		0.0
0929	Upscale	10.1	10.1	0.0		0.5
1209	Zero	0.0	0.0	0.0		0.5
1218	Upscale	10.1	10.0	0.5		0.5
1342	Zero	0.0	0.1	0.5		0.5
1350	Upscale	10.1	10.1	0.0		0.5
1519	Zero	0.0	0.0	0.0		
1527	Upscale	10.1	10.0	0.5		
	Zero					
	Upscale					
	Zero					
	Upscale					
	Zero					
	Upscale					

Specifications: System Cal. Bias ≤ 5% for O2, CO2, SO2, NOx, CO; ≤ 3% for THC

CEM CALIBRATION ERROR TEST DATA

CLIENT Erie Coke Corp. Page 1 of 1

PLANT LOCATION Erie, PA ANALYZER NOx

TEST UNIT WASTE HEAT STACK (BATTERY) INSTRUMENT Thermo Electron

TEST DATE 08-08-96 SPAN 0-250 (ppmv or %)

PROJECT NO. 591 OPERATOR MG

Time EDT	Calibration Gas Conc. (A) (ppmv or %)	Analyzer Response (B) (ppmv or %)	Arithmetic Difference (A – B) (ppmv or %)	Δ as Percent of Span (100 * (A–B) / Span) (%)	Δ as Percent of Cal. Gas Conc. (100 * (A–B) / Gas Conc.) (%)	Notes
0816	ZERO	0.0	0.0	0.0	—	
0825	224	223.2	0.8	0.32	—	
0843	126	124.3	1.7	0.68	—	

Specifications: Δ (Percent of Span) ≤ 2% for O2, CO2, SO2, NOx, CO

Δ (Percent of Calibration Gas Conc.) ≤ 5% for THC

CEM SAMPLING SYSTEM BIAS AND DRIFT DATA

Mid-Level or High-Level Calibration Gas: 126 (ppmv or %)

(Use the one closest to the actual stack gas concentration)

Time	Calibration Gas	Analyzer Response (B) (ppmv or %)	System Response (C) (ppmv or %)	System Cal. Bias (100 * (C–B) / Span) (%)	Drift = 100 * (Final SCB – Initial SCB) / Span	Drift (%)
0917	Zero	0.0	0.0	0.0		0.72
0924	Upscale	124.3	122.2	0.84		0.52
1209	Zero	0.0	1.8	0.72		0.0
1214	Upscale	124.3	123.5	0.32		0.28
1342	Zero	0.0	1.8	0.72		0.12
1346	Upscale	124.3	122.8	0.60		0.0
1519	Zero	0.0	2.1	0.84		
1523	Upscale	124.3	122.8	0.60		
	Zero					
	Upscale					
	Zero					
	Upscale					
	Zero					
	Upscale					

Specifications: System Cal. Bias ≤ 5% for O2, CO2, SO2, NOx, CO; ≤ 3% for THC

Drift ≤ 3% for O2, CO2, SO2, NOx, CO, THC

Matheson Gas Products
World Leader in Specialty Gases & Equipment

** CERTIFICATE OF ANALYSIS - EPA PROTOCOL MIXTURE **

CUSTOMER: ADVANCE TECHNOLOGY SYSTEMS
CYLINDER #: SX-26016
CYLINDER PRESSURE: 2,000 psig
LAST ANALYSIS DATE: 11-02-95
EXPIRATION DATE: 10-31-98

REFERENCE #: 109-44566
PROTOCOL: 1

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 150 psig

REPLICATE CONCENTRATIONS

Component: CARBON DIOXIDE
Mean Conc: 10.1 PCT

Date: 10-31-95
10.1 PCT
10.1 PCT
10.0 PCT

COMPONENT: OXYGEN
Mean Conc: 12.7 PCT

Date: 11-02-95
12.7 PCT
12.7 PCT
12.7 PCT

Date:

BALANCE GAS: NITROGEN

REFERENCE STANDARDS

SRM #:	1674B	2659A
CYLINDER #:	CLM-006435	CLM-006965
CONCENTRATION:	6.98 PCT	20.72 PCT

CERTIFICATION INSTRUMENTS

COMPONENT	CARBON DIOXIDE	OXYGEN
MAKE/MODEL	Nicolet 550	Rosemount 755
SERIAL NUMBER	ACN99402192	2002832
MEASUREMENT PRINC.	FTIR	Paramagnetic
LAST CALIBRATION	10-11-95	10-31-95

THIS CERTIFICATION WAS PERFORMED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY & CERTIFICATION OF GASEOUS CALIBRATION STANDARDS REVISED SEPT. 1993, USING PROCEDURE G1 AND/OR G2. THE TOTAL ANALYTICAL UNCERTAINTY OF THIS MIXTURE IS ESTIMATED TO BE + OR - 1%.

ANALYST [signature] DATE 11/9/95

1650 Enterprise Parkway
Twinsburg, Ohio 44087
Phone: (216) 425-4406
Toll Free: (800) 426-9427

Matheson Gas Products — World Leader in Specialty Gases & Equipment

CERTIFICATE OF ANALYSIS – EPA PROTOCOL MIXTURE

1650 Enterprise Parkway, Twinsburg, Ohio 44087 - (216) 425-4406 - (800) 426-9427

** CERTIFICATE OF ANALYSIS - EPA PROTOCOL MIXTURE **

CUSTOMER: JACKSON WELDING
CYLINDER #: SX-10882
CYLINDER PRESSURE: 2,000 psig
LAST ANALYSIS DATE: 07-24-96
EXPIRATION DATE: 07-24-98

REFERENCE #: 109-51406
PROTOCOL: 1

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 150 psig

Component: NITRIC OXIDE	REPLICATE CONCENTRATIONS Date: 07-16-96	Date: 07-24-96
Mean Conc: 126 PPM	126 PPM	125 PPM
	126 PPM	126 PPM
	126 PPM	126 PPM

COMPONENT: NITROGEN DIOXIDE
Mean Conc: <0.7 PPM

BALANCE GAS: NITROGEN

REFERENCE STANDARDS
SRM #: 1685B
CYLINDER #: CLM-9611
CONCENTRATION: 242.4 PPM

CERTIFICATION INSTRUMENTS

COMPONENT	NITRIC OXIDE	NITROGEN DIOXIDE
MAKE/MODEL	Nicolet 550	
SERIAL NUMBER	ACN99402192	
MEASUREMENT PRINC.	FTIR	
LAST CALIBRATION	07-17-96	

THIS CERTIFICATION WAS PERFORMED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY & CERTIFICATION OF GASEOUS CALIBRATION STANDARDS REVISED SEPT. 1993, USING PROCEDURE G1 AND/OR G2. THE TOTAL ANALYTICAL UNCERTAINTY OF THIS MIXTURE IS ESTIMATED TO BE + OR - 1%.

ANALYST [signature] DATE 7/25/96

Matheson Gas Products
World Leader in Specialty Gases & Equipment

CERTIFICATE OF ANALYSIS-EPA PROTOCOL MIXTURES

CUSTOMER: CHESTER LAB NET

REFERENCE #: 109-24820

CYLINDER #: SX-23804

PROTOCOL: 1

CYLINDER PRESSURE: 2000

LAST ANALYSIS DATE: 10/18/93

EXPIRATION DATE: 10/18/96

REPLICATE CONCENTRATIONS

COMPONENT : PROPANE	DATE: 10/18/93	DATE: / /	
MEAN CONC : 309 PPM	309 PPM 310 PPM 308 PPM		
COMPONENT :	DATE: / /	DATE: / /	
MEAN CONC :			
COMPONENT :	DATE: / /	DATE: / /	
MEAN CONC :			

BALANCE GAS: AIR

REFERENCE STANDARDS

SRM # : 2646A

CYLINDER # : FF-26657

CONCENTRATION: 1001 PPM

1650 Enterprise Parkway
P.O. Box 358
Twinsburg, Ohio 44087
Phone: (216) 425-4406
Toll Free: (800) 426-9427

CERTIFICATION INSTRUMENTS

COMPONENT	PROPANE
MAKE/MODEL	HP 5730A
SERIAL NUMBER	2151A92413
MEASUREMENT PRINC.	FID
LAST CALIBRATION	10/08/93

REPLICATE DATA COMPONENT: PROPANE

DATE 10/18/93			DATE / /		
1. Z =0	C =6757	R =21917	Z =	C =	R =
2. C =6770	R =21895	Z =0	C =	R =	Z =
3. R =21937	Z =0	C =6756	R =	Z =	C =

REPLICATE DATA COMPONENT:

DATE / /			DATE / /		
1. Z =	C =	R =	Z =	C =	R =
2. C =	R =	Z =	C =	R =	Z =
3. R =	Z =	C =	R =	Z =	C =

REPLICATE DATA COMPONENT:

DATE / /			DATE / /		
1. Z =	C =	R =	Z =	C =	R =
2. C =	R =	Z =	C =	R =	Z =
3. R =	Z =	C =	R =	Z =	C =

R = Reference Gas, C = Candidate Gas, Z = Zero Gas

This certification was performed according to EPA Protocol method (s) described in section 3.0.4.G1 and/or section 3.0.4.G2.

ANALYST Gary E Kogeski DATE 10-19-93

Matheson Gas Products
World Leader in Specialty Gases & Equipment

CERTIFICATE OF ANALYSIS-EPA PROTOCOL MIXTURES

CUSTOMER: CHESTER LAB NET

REFERENCE #: 109-24820

CYLINDER #: SX-18767

PROTOCOL: 1

CYLINDER PRESSURE: 2000

LAST ANALYSIS DATE: 10/18/93

EXPIRATION DATE: 10/18/96

REPLICATE CONCENTRATIONS

COMPONENT : PROPANE

DATE: 10/18/93

DATE: / /

MEAN CONC : 512 PPM

513 PPM
513 PPM
509 PPM

COMPONENT :

DATE: / /

DATE: / /

MEAN CONC :

COMPONENT :

DATE: / /

DATE: / /

MEAN CONC :

BALANCE GAS: AIR

REFERENCE STANDARDS

SRM # : 2646A

CYLINDER # : FF-26657

CONCENTRATION: 1001 PPM

1650 Enterprise Parkway
P.O. Box 359
Twinsburg, Ohio 44087
Phone: (216) 425-4406
Toll Free: (800) 426-9427

CERTIFICATION INSTRUMENTS

COMPONENT	PROPANE
MAKE/MODEL	HP 5730A
SERIAL NUMBER	2151A92413
MEASUREMENT PRINC.	FID
LAST CALIBRATION	10/08/93

REPLICATE DATA COMPONENT: PROPANE

DATE 10/18/93			DATE / /		
1. Z =0	C =11240	R =21917	Z =	C =	R =
2. C =11218	R =21895	Z =0	C =	R =	Z =
3. R =21937	Z =0	C =11150	R =	Z =	C =

REPLICATE DATA COMPONENT:

DATE / /			DATE / /		
1. Z =	C =	R =	Z =	C =	R =
2. C =	R =	Z =	C =	R =	Z =
3. R =	Z =	C =	R =	Z =	C =

REPLICATE DATA COMPONENT:

DATE / /			DATE / /		
1. Z =	C =	R =	Z =	C =	R =
2. C =	R =	Z =	C =	R =	Z =
3. R =	Z =	C =	R =	Z =	C =

R = Reference Gas, C = Candidate Gas, Z = Zero Gas

This certification was performed according to EPA Protocol method (s) described in section 3.0.4.G1 and/or section 3.0.4.G2.

ANALYST Amy E Kozanski DATE 10-19-93

Matheson Gas Products
World Leader in Specialty Gases & Equipment

CERTIFICATE OF ANALYSIS-EPA PROTOCOL MIXTURES

CUSTOMER: CHESTER LAB NET

REFERENCE #: 109-24820

CYLINDER #: SX-22740

PROTOCOL: 1

CYLINDER PRESSURE: 2000

LAST ANALYSIS DATE: 10/18/93

EXPIRATION DATE: 10/18/96

REPLICATE CONCENTRATIONS

COMPONENT : PROPANE	DATE: 10/18/93	DATE: / /	
MEAN CONC : 907 PPM	908 PPM		
	909 PPM		
	904 PPM		
COMPONENT :	DATE: / /	DATE: / /	
MEAN CONC :			
COMPONENT :	DATE: / /	DATE: / /	
MEAN CONC :			

BALANCE GAS: AIR

REFERENCE STANDARDS

SRM # : 2646A

YLINDER # : FF-26657

CONCENTRATION: 1001 PPM

1650 Enterprise Parkway
P.O. Box 358
Twinsburg, Ohio 44087
Phone: (216) 425-4406
Toll Free: (800) 426-9427

CERTIFICATION INSTRUMENTS

COMPONENT	PROPANE
MAKE/MODEL	HP 5730A
SERIAL NUMBER	2151A92413
MEASUREMENT PRINC.	FID
LAST CALIBRATION	10/08/93

REPLICATE DATA COMPONENT: PROPANE

DATE 10/18/93			DATE / /		
1. Z =0	C =19876	R =21917	Z =	C =	R =
2. C =19883	R =21895	Z =0	C =	R =	Z =
3. R =21937	Z =0	C =19818	R =	Z =	C =

REPLICATE DATA COMPONENT:

DATE / /			DATE / /		
1. Z =	C =	R =	Z =	C =	R =
2. C =	R =	Z =	C =	R =	Z =
3. R =	Z =	C =	R =	Z =	C =

REPLICATE DATA COMPONENT:

DATE / /			DATE / /		
1. Z =	C =	R =	Z =	C =	R =
2. C =	R =	Z =	C =	R =	Z =
3. R =	Z =	C =	R =	Z =	C =

R = Reference Gas, C = Candidate Gas, Z = Zero Gas

This certification was performed according to EPA Protocol method (s) described in section 3.0.4.G1 and/or section 3.0.4.G2.

ANALYST Amy E. Kozenski DATE 10-19-93

INTERFERENCE RESPONSE TEST — per EPA Reference Method 20 Section 5.4

DATE OF TEST JANUARY 18, 1980

ANALYZER TYPE 10A/R Range 0 - 2.5 PPM SERIAL NO. 10 A/R - 0148-80

Thermo Electron Instruments
Model 10 $NO-NO_2-NO_x$ Analyzer

TEST GAS TYPE	CONCENTRATION PPM	ANALYZER OUTPUT RESPONSE	% OF SPAN
CO	500	< .1 PPM	< .1 %
SO_2	201	< .1 PPM	< .1 %
CO_2	10%	< .1 PPM	< .1 %
O_2	20.9 %	< .1 PPM	< .1 %

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA

MEASUREMENT OF PARTICULATE MATTER, VOLATILE ORGANIC COMPOUND AND NITROGEN OXIDE EMISSIONS FROM A COKE BATTERY COMBUSTION STACK DIAGNOSTIC TEST PROGRAM - AUGUST 8, 1996

APPENDIX B

ANALYTICAL RESULTS, EMISSIONS CALCULATIONS

ADVANCED TECHNOLOGY SYSTEMS, INC.
GC ANALYSIS REPORT

Client:	Erie Coke
Project No:	591
Sample Type:	Gas

Samples Received:	08/09/96
Analized By:	TLJ
Analysis Reported:	08/09/96

Sample Date	Field Number Lab Number	Sample Description	Sample Volume	Analyte(s)	Results	Units	Detection Limits	Method
08/08/96	ECC-BATT-1	GAS SAMPLE BAG	N/A	METHANE	241	ppm	10 ppm	GC-FID
				ETHANE	6	ppm	1 ppm	GC-FID
08/08/96	ECC-BATT-2	GAS SAMPLE BAG	N/A	METHANE	230	ppm	10 ppm	GC-FID
				ETHANE	6	ppm	1 ppm	GC-FID
08/08/96	ECC-BATT-3	GAS SAMPLE BAG	N/A	METHANE	221	ppm	10 ppm	GC-FID
				ETHANE	6	ppm	1 ppm	GC-FID

ATS

ADVANCED TECHNOLOGY SYSTEMS, INC.
3000 TECH CENTER DRIVE
MONROEVILLE, PA 15146-3055
(412) 829-2208

CHAIN OF CUSTODY RECORD

PROJECT NUMBER 591
PROJECT NAME ERIE COKE
ANALYTICAL LAB ATS
DELIVER TO Tom JONES
COMMENTS

SAMPLE IDENTIFICATION NUMBER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	NUMBER OF CONTAINERS	COMPOSITE OR GRAB	ANALYSES TO BE CONDUCTED: METHANE	ETHANE									REMARKS OR OBSERVATIONS
ECC-BATT-1	8/8/96	1131-1136	1	C	✓	✓									
ECC-BATT-2	8/8/96	1304-1309	1	C	✓	✓									
ECC-BATT-3	8/8/96	1516-1532	1	C	✓	✓									

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
Patrick J. Stockton	8/9/96	1240	[illegible]	8/9/96	1340	
						CHEST TEMP.
						TAG #

ERIE COKE CORPORATION
ERIE, PENNSYLVANIA

BATTERY COMBUSTION STACK
VOLATILE ORGANIC COMPOUNDS CONCENTRATION DATA

Test Number : Test Date:		ECC-BATT-1 08-08-96	ECC-BATT-2 08-08-96	ECC-BATT-3 08-08-96	Average
THC Concentration (as C3H8)	(ppmv)	149.4	137.7	160.6	149.2
THC Concentration (as C)		448.2	413.1	481.8	447.7
Methane Concentration	(ppmv)	241.0	230.0	221.0	230.7
Methane Concentration (as C)		241.0	230.0	221.0	230.7
Ethane Concentration	(ppmv)	6.0	6.0	6.0	6.0
Ethane Concentration (as C)		12.0	12.0	12.0	12.0
VOC Concentration (as C)	(ppmv)	195.2	171.1	248.8	205.0

Note: Analyzer calibrated with propane (C3H8)
VOC concentration = Total Gaseous Hydrocarbon concentration (as C) - Methane concentration (as C) - Ethane concentration (as C)

Particulate Stack Test
90010 E

Sample Number : ECC-BATT-1
Analyst : PJS
Date : 8/30/96

Final Results

Front Half Acetone 0.0749 g
Back Half Insoluble 0.0068 g
GF/F 0.0391 g
Total Condensate

Acetone Washings

	Front Half	Acetone Blank
Dish #		
Total Volume (ml)	(C)	
Aliquot (ml)	(D)	(A)
Final Weight (g)	92.9170	91.0390
Initial Weight (g)	92.8421	91.0390
Soluble Weight (g)	(E) 0.0749	(B) 0.0000

$$Acetone\ Weight = \left[E - \left(\frac{B \times D}{A}\right)\right] \times \left(\frac{C}{D}\right)$$

$$Acetone\ Weight = \left[\quad g - \left(\frac{\quad g \times \quad ml}{\quad ml}\right)\right] \times \left(\frac{\quad ml}{\quad ml}\right) =$$

ECC-BATT-1

Water Washings

	Back Half	Back Half	Blank
Filter #	0.22 u		.22 u
Final Weight (g)	0.0930		0.0926
Initial Weight (g)	0.0922		0.0926
Insoluble Weight (g)	(F) 0.0008	(G)	(H) 0.0000

Total Insoluble Weight = F + G - H = g

GF/F Filter

GF/F Filter # 1909	
Final Weight (g)	0.5867
Initial Weight (g)	0.5476
Insoluble Weight (g)	0.0391

Silica Gel

Beaker Weight (g)	
Wet Weight (g)	
Dry Weight (g)	
Moisture (g)	(I)

Impinger Volumes

Impinger #	Initial Volume (ml)	Final Volume (ml)
1		
2		
3		
4		
Total	(J)	(K)

Condensate = I + K - J = g

Particulate Stack Test
90010 E

Sample Number : ECC-BATT-2
Analyst : PJS
Date : 8/30/96

Final Results

Front Half Acetone 0.0422 g
Back Half Insoluble 0.0062 g
GF/F 0.0394 g
Total Condensate

Acetone Washings

	Front Half	Acetone Blank
Dish #		
Total Volume (ml)	(C)	
Aliquot (ml)	(D)	(A)
Final Weight (g)	89.2477	91.0390
Initial Weight (g)	89.2055	91.0390
Soluble Weight (g)	(E) 0.0422	(B) 0.0000

$$Acetone\ Weight = \left[E - \left(\frac{B \times D}{A}\right)\right] \times \left(\frac{C}{D}\right)$$

$$Acetone\ Weight = \left[\quad g - \left(\frac{\quad g \times \quad ml}{\quad ml}\right)\right] \times \left(\frac{\quad ml}{\quad ml}\right) =$$

ECC-BATT-2

Water Washings

	Back Half	Back Half	Blank
Filter #	0.22 u		.22 u
Final Weight (g)	0.0930		0.0926
Initial Weight (g)	0.0928		0.0926
Insoluble Weight (g)	(F) 0.0002	(G)	(H) 0.0000

Total Insoluble Weight = F + G - H = g

GF/F Filter

GF/F Filter # 1924	
Final Weight (g)	0.5912
Initial Weight (g)	0.5517
Insoluble Weight (g)	0.0395

Silica Gel

Beaker Weight (g)	
Wet Weight (g)	
Dry Weight (g)	
Moisture (g)	(I)

Impinger Volumes

Impinger #	Initial Volume (ml)	Final Volume (ml)
1		
2		
3		
4		
Total	(J)	(K)

Condensate = I + K - J = g

Particulate Stack Test
90010 E

Sample Number : ECC-BATT-3
Analyst : PJS
Date : 8/30/96

Final Results

Front Half Acetone 0.0317 g
Back Half Insoluble 0.0007 g
GFF 0.0428 g
Total Condensate _____ g

Acetone Washings

	Front Half	Acetone Blank
Dish #		
Total Volume (ml)	(C)	
Aliquot (ml)	(D)	(A)
Final Weight (g)	96.9028	91.0390
Initial Weight (g)	96.8711	91.0390
Soluble Weight (g)	(E) 0.0317	(B) 0.0000

$$Acetone\ Weight = \left[E - \left(\frac{B \times D}{A}\right)\right] \times \left(\frac{C}{D}\right)$$

$$Acetone\ Weight = \left[\quad g - \left(\frac{\quad g \times \quad ml}{\quad ml}\right)\right] \times \left(\frac{\quad ml}{\quad ml}\right) =$$

ECC-BATT-3

Water Washings

	Back Half	Back Half	Blank
Filter #	022		.22
Final Weight (g)	0.0933		0.0926
Initial Weight (g)	0.0926		0.0926
Insoluble Weight (g)	(F) 0.0007	(G)	(H) 0.0000

Total Insoluble Weight = F + G - H = g

GF/F Filter

GF/F Filter # 1901	
Final Weight (g)	0.5996
Initial Weight (g)	0.5568
Insoluble Weight (g)	0.0428

Silica Gel

Beaker Weight (g)	
Wet Weight (g)	
Dry Weight (g)	
Moisture (g)	(I)

Impinger Volumes

Impinger #	Initial Volume (ml)	Final Volume (ml)
1		
2		
3		
4		
Total	(J)	(K)

Condensate = I + K - J = g

STACK SAMPLING CALCULATIONS

CLIENT: ERIE COKE CORPORATION - ERIE, PENNSYLVANIA TEST DATE: 08-08-96
TEST SITE: BATTERY STACK TEST NUMBER: ECC-BATT-1

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)		29.73
B.	Stack Static Pressure (in. H2O)		-1.2
C.	Pitot Tube Coefficient		0.84
D.	Dry Gas Meter Calibration Factor		1.0010
	>>> Is the Stack Round (Y/N)?	N	
E.	Stack Diameter (in.) - for round stack		0
F.	Stack Width (in.) - for rectangular stack		38
G.	Stack Depth (in.) - for rectangular stack		86
H.	Nozzle Diameter (in.) - (enter 0 if none used)		0.408
I.	Average □P (in. H2O) = [(□P^0.5)avg]^2		0.170
J.	Average □H (in. H2O) - (enter 0 for low flow sampling)		2.25
K.	Average Stack Temperature (°F)		472
L.	Average Meter Temperature (°F)		92
M.	Dry Gas Composition (should total to 100%)		
	Carbon Dioxide (%)		1.3
	Oxygen (%)		18.1
	Nitrogen (%)		80.6
	Carbon Monoxide (%)		0.0
	Hydrogen (%)		0.0
	Methane (%)		0.0
	Ethane (%)		0.0
	Argon (%)		0.0
N.	Sample Time (min)		72
O.	Total H2O Mass Collected in Impingers (g)		181.8
	>>> Is Isokinetic or Method 4 Sampling Required (Y/N)?	Y	
P.	Metered Gas Volume (dcf) - for iso. or M4 sampling		61.968
Q.	Metered Gas Volume (dry L) - for low flow sampling		0.000

Calculated Parameters (excluding analytical data)

R.	Absolute Stack Pressure (in. Hg)	29.64	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.90	[A+(J/13.6)]
T.	Stack Area (ft.)	2.27E+01	[□*E²/(4*144) or F*G/144]
U.	Nozzle Area (ft.) - (for isokinetic sampling only)	9.08E-04	[□*H²/(4*144)]
V.	Average Absolute Stack Temperature (R)	932	[K+460]
W.	Average Absolute Meter Temperature (R)	552	[L+460]
X.	Dry Gas Volume Sampled (dscf) - (for iso./M4 sampling)	59.284	[P*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf) - (for iso./M4 sampling)	8.572	[O*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	12.6	[100*Y/(X+Y)]
AA.	Dry Gas Volume Sampled (dsL) - (for low flow sampling)	NA	[Q*D*(528/W)*(S/29.92)]
BB.	H2O Vapor Condensed (std. L) - (for low flow sampling)	NA	[O*1.335]
CC.	Calculated Percent H2O in Gas Stream (%)	NA	[100*BB/(AA+BB)]
DD.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T 6.1A)	NA	[100*Saturated Water Vapor Pressure / Stack Pressure]
EE.	Actual Percent H2O in Gas Stream (%)	12.6	[Calculated % H2O □ Theoretical Max. % H2O]

FF. Stack Gas Molecular Weight

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.126		18	2.274
CO2	0.013	0.874	44	0.500
O2	0.181	0.874	32	5.060
N2	0.806	0.874	28	19.717
CO	0.000	0.874	28	0.000
H2	0.000	0.874	2	0.000
CH4	0.000	0.874	16	0.000
C2H6	0.000	0.874	30	0.000
Ar	0.000	0.874	40	0.000
	Stack Gas Molecular Weight (lb/lb-mol)			27.55

GG.	Average Stack Gas Velocity (ft/sec)	3.16E+01	[85.49*C*[(I*V)/(R*EE)]^0.5]
HH.	Stack Gas Flow Rate (acfm)	4.31E+04	[GG*T*60]
II.	Stack Gas Flow Rate (scfm)	2.42E+04	[HH*(528/V)*(R/29.92)]
JJ.	Stack Gas Flow Rate (dscfm)	2.11E+04	[II*(1-(EE/100))]
KK.	Isokinetics (%) - (for isokinetic sampling only)	97.4	[100*V*{(0.002669*O)+(P*D*S/W)}] /

STACK SAMPLING CALCULATIONS

CLIENT: ERIE COKE CORPORATION - ERIE, PENNSYLVANIA TEST DATE: 08-08-96
TEST SITE: BATTERY STACK TEST NUMBER: ECC-BATT-1

[60*N*R*U*GG]

Particulate Matter Results (corrected for blank)

LL.	Filter Weight (g)	0.0391	
MM.	Front-Half Residue Weight (g)	0.0749	
NN.	Back-Half H2O-Insoluble Weight (g)	0.0008	
OO.	Total Weight (g)	0.1148	[LL+MM+NN]
PP.	Concentration (gr/dscf)	0.0299	[(7000/454)*OO/X]
QQ.	Mass Flow Rate (lb/hr)	5.41E+00	[PP*]]*60/7000]

STACK SAMPLING CALCULATIONS

CLIENT: ERIE COKE CORPORATION - ERIE, PENNSYLVANIA TEST DATE: 08-08-96
TEST SITE: BATTERY STACK TEST NUMBER: ECC-BATT-2

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)		29.73
B.	Stack Static Pressure (in. H2O)		-1.2
C.	Pitot Tube Coefficient		0.84
D.	Dry Gas Meter Calibration Factor		1.0010
	>>> Is the Stack Round (Y/N)?	N	
E.	Stack Diameter (in.) - for round stack		0
F.	Stack Width (in.) - for rectangular stack		38
G.	Stack Depth (in.) - for rectangular stack		86
H.	Nozzle Diameter (in.) - (enter 0 if none used)		0.408
I.	Average □P (in. H2O) = [(□P^0.5)avg]^2		0.170
J.	Average □H (in. H2O) - (enter 0 for low flow sampling)		2.31
K.	Average Stack Temperature (°F)		477
L.	Average Meter Temperature (°F)		97
M.	Dry Gas Composition (should total to 100%)		
	Carbon Dioxide (%)		3.1
	Oxygen (%)		13.7
	Nitrogen (%)		83.2
	Carbon Monoxide (%)		0.0
	Hydrogen (%)		0.0
	Methane (%)		0.0
	Ethane (%)		0.0
	Argon (%)		0.0
N.	Sample Time (min)		72
O.	Total H2O Mass Collected in Impingers (g)		191.3
	>>> Is Isokinetic or Method 4 Sampling Required (Y/N)?	Y	
P.	Metered Gas Volume (dcf) - for iso. or M4 sampling		62.479
Q.	Metered Gas Volume (dry L) - for low flow sampling		0.000

Calculated Parameters (excluding analytical data)

R.	Absolute Stack Pressure (in. Hg)	29.64	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.90	[A+(J/13.6)]
T.	Stack Area (ft)	2.27E+01	[□*E²/(4*144) or F*G/144]
U.	Nozzle Area (ft) - (for isokinetic sampling only)	9.08E-04	[□*H²/(4*144)]
V.	Average Absolute Stack Temperature (R)	937	[K+460]
W.	Average Absolute Meter Temperature (R)	557	[L+460]
X.	Dry Gas Volume Sampled (dscf) - (for iso./M4 sampling)	59.245	[P*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf) - (for iso./M4 sampling)	9.020	[O*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	13.2	[100*Y/(X+Y)]
AA.	Dry Gas Volume Sampled (dsL) - (for low flow sampling)	NA	[Q*D*(528/W)*(S/29.92)]
BB.	H2O Vapor Condensed (std. L) - (for low flow sampling)	NA	[O*1.335]
CC.	Calculated Percent H2O in Gas Stream (%)	NA	[100*BB/(AA+BB)]
DD.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T 6.1A)	NA	[100*Saturated Water Vapor Pressure / Stack Pressure]
EE.	Actual Percent H2O in Gas Stream (%)	13.2	[Calculated % H2O □ Theoretical Max. % H2O]
FF.	Stack Gas Molecular Weight		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.132		18	2.378
CO2	0.031	0.868	44	1.184
O2	0.137	0.868	32	3.805
N2	0.832	0.868	28	20.218
CO	0.000	0.868	28	0.000
H2	0.000	0.868	2	0.000
CH4	0.000	0.868	16	0.000
C2H6	0.000	0.868	30	0.000
Ar	0.000	0.868	40	0.000
	Stack Gas Molecular Weight (lb/lb-mol)			27.58

GG.	Average Stack Gas Velocity (ft/sec)	3.17E+01	[85.49*C*[(P*V)/(R*FF)]^0.5]
HH.	Stack Gas Flow Rate (acfm)	4.32E+04	[GG*T*60]
II.	Stack Gas Flow Rate (scfm)	2.41E+04	[HH*(528/V)*(R/29.92)]
JJ.	Stack Gas Flow Rate (dscfm)	2.09E+04	[II*(1-(EE/100))]
KK.	Isokinetics (%) - (for isokinetic sampling only)	98.4	[100*V*{(0.002669*O)+(P*D*S/W)}] /

STACK SAMPLING CALCULATIONS

CLIENT: ERIE COKE CORPORATION - ERIE, PENNSYLVANIA TEST DATE: 08-08-96
TEST SITE: BATTERY STACK TEST NUMBER: ECC-BATT-2

[60*N*R*U*GG]

Particulate Matter Results (corrected for blank)

LL.	Filter Weight (g)	0.0395	
MM.	Front-Half Residue Weight (g)	0.0422	
NN.	Back-Half H2O-Insoluble Weight (g)	0.0002	
OO.	Total Weight (g)	0.0819	[LL+MM+NN]
PP.	Concentration (gr/dscf)	0.0213	[(7000/454)*OO/X]
QQ.	Mass Flow Rate (lb/hr)	3.82E+00	[PP*J]*60/7000]

STACK SAMPLING CALCULATIONS

CLIENT: ERIE COKE CORPORATION - ERIE, PENNSYLVANIA
TEST SITE: BATTERY STACK

TEST DATE: 08-08-96
TEST NUMBER: ECC-BATT-3

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.73
B.	Stack Static Pressure (in. H2O)	-1.2
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	1.0010
	>>> Is the Stack Round (Y/N)?	N
E.	Stack Diameter (in.) - for round stack	0
F.	Stack Width (in.) - for rectangular stack	38
G.	Stack Depth (in.) - for rectangular stack	86
H.	Nozzle Diameter (in.) - (enter 0 if none used)	0.408
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2	0.160
J.	Average ΔH (in. H2O) - (enter 0 for low flow sampling)	2.20
K.	Average Stack Temperature (°F)	474
L.	Average Meter Temperature (°F)	95
M.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	2.8
	Oxygen (%)	14.7
	Nitrogen (%)	82.5
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
N.	Sample Time (min)	72
O.	Total H2O Mass Collected in Impingers (g)	176.7
	>>> Is Isokinetic or Method 4 Sampling Required (Y/N)?	Y
P.	Metered Gas Volume (dcf) - for iso. or M4 sampling	61.201
Q.	Metered Gas Volume (dry L) - for low flow sampling	0.000

Calculated Parameters (excluding analytical data)

R.	Absolute Stack Pressure (in. Hg)	29.64	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.89	[A+(J/13.6)]
T.	Stack Area (ft.)	2.27E+01	[D*E/(4*144) or F*G/144]
U.	Nozzle Area (ft.) - (for isokinetic sampling only)	9.08E-04	[D*H/(4*144)]
V.	Average Absolute Stack Temperature (R)	934	[K+460]
W.	Average Absolute Meter Temperature (R)	555	[L+460]
X.	Dry Gas Volume Sampled (dscf) - (for iso./M4 sampling)	58.227	[P*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf) - (for iso./M4 sampling)	8.331	[O*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	12.5	[100*Y/(X+Y)]
AA.	Dry Gas Volume Sampled (dsL) - (for low flow sampling)	NA	[Q*D*(528/W)*(S/29.92)]
BB.	H2O Vapor Condensed (std. L) - (for low flow sampling)	NA	[O*1.335]
CC.	Calculated Percent H2O in Gas Stream (%)	NA	[100*BB/(AA+BB)]
DD.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III,	NA	[100*Saturated Water Vapor Pressure / Stack Pressure]
EE.	Actual Percent H2O in Gas Stream (%) 53.5.6, T 6.1A)	12.5	[Calculated %H2O ⊡ Theoretical Max. %H2O]
FF.	Stack Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.125		18	2.253
CO2	0.028	0.875	44	1.078
O2	0.147	0.875	32	4.115
N2	0.825	0.875	28	20.203
CO	0.000	0.875	28	0.000
H2	0.000	0.875	2	0.000
CH4	0.000	0.875	16	0.000
C2H6	0.000	0.875	30	0.000
Ar	0.000	0.875	40	0.000

	Stack Gas Molecular Weight (lb/lb-mol)	27.65	
GG.	Average Stack Gas Velocity (ft/sec)	3.07E+01	[85.49*C*[(I*V)/(R*FF)]^0.5]
HH.	Stack Gas Flow Rate (acfm)	4.18E+04	[GG*T*60]
II.	Stack Gas Flow Rate (scfm)	2.34E+04	[HH*(528/V)*(R/29.92)]
JJ.	Stack Gas Flow Rate (dscfm)	2.05E+04	[II*(1-(EE/100))]
KK.	Isokinetics (%) - (for isokinetic sampling only)	98.8	[100*V*((0.002669*O)+(P*D*S/W))] / [60*N*R*U*GG]

STACK SAMPLING CALCULATIONS

CLIENT: ERIE COKE CORPORATION - ERIE, PENNSYLVANIA
TEST SITE: BATTERY STACK

TEST DATE: 08-08-96
TEST NUMBER: ECC-BATT-3

Particulate Matter Results (corrected for blank)

LL.	Filter Weight (g)	0.0428	
MM.	Front-Half Residue Weight (g)	0.0317	
NN.	Back-Half H2O-Insoluble Weight (g)	0.0007	
OO.	Total Weight (g)	0.0752	[LL+MM+NN]
PP.	Concentration (gr/dscf)	0.0199	[(7000/454)*OO/X]
QQ.	Mass Flow Rate (lb/hr)	3.49E+00	[PP*]]*60/7000]