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 167

COKE BATTERY AND BOILER STACKS EMISSION TEST RESULTS LTV STEEL COMPANY BY-PRODUCTS PLANT PITTSBURGH, PENNSYLVANIA

Prepared for:

LTV STEEL COMPANY
PITTSBURGH, PENNSYLVANIA

Prepared by:

CHESTER ENVIRONMENTAL
3000 TECH CENTER DRIVE
MONROEVILLE, PA 15146

PROJECT NO. 300240-01

FEBRUARY 1994

LTV STEEL COMPANY
PITTSBURGH, PENNSYLVANIA

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1.0 INTRODUCTION

Chester Environmental (Chester) was retained by the LTV Steel Company (LTV) to perform nitrogen oxides (NOx) emission testing on seven sources at the Pittsburgh, Pennsylvania By-Products Plant. These sources included Battery Stack #P1, Battery Stack #P2, Battery Stack #P3N, Battery Stack #P3S, Battery Stack #P4, Boiler Stack #2 and Keeler Boiler.

Process samples of coal, coke oven gas and windbox gas were also collected during the emission testing effort. The coal and windbox process sampling was performed by LTV personnel while Chester personnel conducted the coke oven gas process sampling. Chester was responsible for coal (ultimate and proximate) and coke oven gas (ammonia and cyanide) analyses. The remaining process samples were analyzed by LTV laboratory personnel.

Emission testing was performed on the seven sources to collect data for in-house engineering use by LTV personnel. Testing was conducted over a period from August 17, 1993 to November 9, 1993, by a Chester test team comprised of Mr. Mark Grunebach, Mr. Tom Dickey and Mr. Tom Morgan. Process samples were collected on August 18 and 19, 1993.

Section 2.0 presents a summary of results for the testing effort. The final section includes the testing methodology and quality assurance procedures used to collect and verify the data.

2.0 SUMMARY OF RESULTS

Table 2-1 presents the summary of results for the NOx emission testing effort conducted on the seven sources at the LTV By-Products Plant located in Pittsburgh, Pennsylvania. Table 2-2 provides the coke oven gas ammonia and cyanide test results. Results of coal analyses are included in Table 2-3. Windbox gas results are presented in Table 2-4. Process samples were only collected on August 18 and 19, 1993 due to difficulties in locating an appropriate sampling location on the coke oven batteries. Supporting field and laboratory data for the entire testing effort are included in Appendices A through D.

LTV STEEL COMPANY
PITTSBURGH, PENNSYLVANIA

TABLE 2-1
SUMMARY OF NO_x RESULTS

Sample Information							
Source	P1	P2	P3S	P3N	P4	Boiler #2	Keeler Boiler
Date	8-19-93	8-19-93	8-18-93	8-18-93	8-17-93	9-03-93	11-09-93
Time Start	1210	0800	0900	1325	1205	1230	1047
Time Finish	1410	0959	1115	1525	1440	1440	1257
Stack Gas Parameters							
Stack Temperature, %	625	602	723	713	580	252	250
0_2 Concentration, %	12.0	13.0	9.0	9.0	12.0	16.5	10.9
CO_2 Concentration, %	5.0	4.0	5.5	5.8	7.0	3.5	7.5
Flue Gas Moisture, %	13.57	18.39	20.71	17.78	17.38	12.17	17.80
Average Gas Velocity, ft/sec	17.46	16.43	21.02	26.39	30.11	30.40	37.43
Average Flue Gas Flow, DSCFM	4.58×10^4	4.16×10^4	4.80×10^4	6.04×10^4	6.57×10^4	5.83×10^4	2.01×10^4
NO_x							
Concentration, ppm							
Actual	273	246	393	268	166	61	245
Corrected to 3% 0_2	549	557	591	403	334	---	---
Emission Rate; lb/hr	89.7	73.4	135.1	116.0	78.1	25.5	35.3
Emission factor; lb/ton Coal	1.91	1.56	2.47	2.12	1.22		

LTV STEEL COMPANY
PITTSBURGH, PENNSYLVANIA

TABLE 2-2

SUMMARY OF RESULTS - COKE OVEN GAS PROCESS SAMPLES

	Run 1	Run 2	Run 3	Run 4
Sample Information				
Date	8-18-93	8-18-93	8-19-93	8-19-93
Time Start	1640	1747	1235	1343
Time Finish	1740	1847	1335	1443
Cyanide Concentration, mg/m^3	2.31×10^{-2}	--	--	2.71×10^{-2}
Ammonia Concentration, mg/m^3	--	1.18×10^{-1}	1.01×10^{-1}	--

LTV STEEL COMPANY
PITTSBURGH, PENNSYLVANIA

TABLE 2-3

SUMMARY OF RESULTS - COAL PROCESS SAMPLES

	8/18/93 Sample		8/19/93 Sample	
PROXIMATE ANALYSIS	As Received	Dry Basis	As Received	Dry Basis
% Moisture	7.18	---	6.98	---
% Ash	5.43	5.85	4.90	5.27
% Volatile	23.12	24.91	23.89	25.68
% Fixed Carbon	64.27	69.24	64.23	69.05
	100.00	100.00	100.00	100.00
Btu/lb	13597	14649	13745	14776
% Sulfur	1.09	1.17	1.08	1.16
MAF Btu		15559		15598
OXIDATION INDEX =	97		97	
ULTIMATE ANALYSIS				
% Moisture	7.18	---	6.98	---
% Carbon	77.24	83.21	77.63	83.46
% Hydrogen	4.39	4.73	4.41	4.74
% Nitrogen	1.49	1.61	1.51	1.62
% Sulfur	1.09	1.17	1.08	1.16
% Ash	5.43	5.85	4.90	5.27
% Oxygen (diff)	3.18	3.43	3.49	3.75
	100.00	100.00	100.00	100.00

LTV STEEL COMPANY
PITTSBURGH, PENNSYLVANIA

TABLE 2-4
SUMMARY OF RESULTS - WINDBOX GAS PROCESS SAMPLES

	P3 Underfire	P1 Windbox	P2 Windbox	P3S Windbox	P3N Windbox	P3 Underfire	P4 Windbox
Sample Information							
Date	8/18/93	8/19/93	8/19/93	8/19/93	8/19/93	8/19/93	8/19/93
Time Collected	----	1355	1325	0950	1250	----	1935
Gas Parameters							
CO_2, %	0.5	3.9	3.5	5.0	5.1	0.4	4.3
ILL, %	2.7	--	--	--	--	2.8	--
O_2, %	0.9	5.7	8.3	6.6	6.6	0.4	6.8
CO, %	4.3	--	--	--	--	4.1	--
H_2, %	55.8	--	--	--	--	55.6	--
CH_4, %	22.9	--	--	--	--	22.5	--
N_2, %	6.6	68.5	63.7	71.4	72.6	3.6	62.7
Gross BTU	477	--	--	--	--	474	--
Net BTU	423	--	--	--	--	420	--
Specific Gravity	0.320	--	--	--	--	0.281	--

3.0 SAMPLING AND ANALYSIS PROCEDURES

This section describes the stack sampling and analysis protocols that were used to determine emissions from the seven sources at the LTV Pittsburgh, Pennsylvania By-Products Plant.

3.1 Sampling Procedures

Specifics of the individual procedures used to obtain representative samples for accurate determination of concentrations and emission rates are detailed in the following sections.

3.1.1 Volumetric Flow Rate

Determination of the volumetric flow rate from the seven sources was performed in accordance with EPA Reference Methods 1 through 4 before and after each test run. Volumetric flow rate sampling was performed through two sampling ports in the same horizontal plane separated by 90 degrees.

Twelve traverse points per diameter (each port) for a total of 24 points per cross-sectional plane were utilized. The velocity head pressures from each traverse point were measured with a pitot tube. Temperature measurements were performed concurrently with the velocity measurements using a type K thermocouple.

Molecular weight (oxygen, carbon dioxide and nitrogen by difference) at the sampling locations were determined using Fyrite apparatus. The Fyrite oxygen measurement for the Keeler Boiler was not used. The average continuous oxygen monitor value replaced the Fyrite reading. Moisture content was determined gravimetrically using an impinger train.

3.1.2 NOx and O_2

Continuous monitoring for NOx was accomplished by means of a gas extraction and conditioning system in accordance with EPA Method 7E. Continuous oxygen monitoring was also performed on the Keeler Boiler at the request of LTV personnel. This oxygen monitoring was conducted in accordance with EPA Method 3A using the NOx extraction and conditioning system. One two-hour run was conducted on each source.

Stack gas was extracted from the stack through a heated probe and filter assembly located near the sampling point. The filtered gas was then routed through a heated teflon line to the mobile continuous emissions monitoring laboratory located nearby. The heated line temperature was maintained at 250°F or higher to prevent condensation from occurring in the sample line.

The NOx and O_2 CEMs requires the delivery of a clean, dry gas sample for analysis. The moisture of the filtered gas was removed at the monitoring laboratory by a non-contact refrigerative method such that the dew point of the sample gas was 40° F or lower.

3.1.3 Process Samples

Sampling for ammonia and cyanide was performed using a modification of EPA Method 6. This modification involves changing the solution in the first two impingers to 0.1 N sulfuric acid for the ammonia train and 0.1 N sodium hydroxide for the cyanide train.

Coal and windbox gas samples were collected by LTV personnel. The August 18, 1993 coal sample was composited from samples collected at the P4 Scales, No. 3 Larrycar, No. 3 Hopper and No. 8 Coal Bin. The August 19, 1993 coal sample was a composite from the P4 Scales, No. 3 Larrycar, No. 1 Hopper and No. 9 Coal Bin samples. These composited samples were placed into containers and provideed to Chester for analysis. The windbox gas samples were collected in stainless steel bombs.

3.2 Analytical Procedures

Descriptions of the individual procedures used to accurately quantify specific constituents are detailed in the following sections.

3.2.1 Volumetric Flow Rate and Moisture Content

Gas velocities, volumetric flow rates, and moisture content of the exhaust gas were determined for each source tested in accordance with EPA Methods 1 through 4. The volumetric flow rate of each source was calculated using stack velocity traverses, dry gas molecular weights, and moisture content in accordance with EPA Method 2 and reported in terms of actual cubic feet per minute (acfm) and dry standard cubic feet per minute (dscfm). Moisture determination was accomplished by gravimetric analysis of the moisture train impingers.

3.2.2 NOx and O_2

Analyses of NOx and O_2 (Keeler Boiler only) were accomplished by means of a CEM housed in Chester's mobile monitoring laboratory. NOx concentrations and emission rates were determined by the use of EPA Method 7E procedures through the use of a Thermo Electron Model 10AR Chemiluminescent Analyzer. A Combustion Engineering Model 305A monitor was used to measure O_2 concentrations in accordance with EPA Method 3A.

3.2.3 Process Samples

Coke oven gas process samples were analyzed for ammonia (as nitrogen) and total cyanide in accordance with EPA Methods 350.1 and 335.3, respectively. Coal process samples were analyzed in accordance with the following American Society for Testing & Materials (ASTM) methods:

Parameter	ASTM Method
Moisture Content	D3173
Ash Content	D3174
Volatile Content	D3175
Carbon & Hydrogen Content	D3178
Nitrogen Content	D3179
Gross Heating Value	D1989
Sulfur Content	D5016

Oxidation Index Analysis of the coal samples was performed using United States Steel (USS) Methodology. Windbox gas process sample analysis was performed by LTV laboratory personnel and the results were provided to Chester for inclusion in this report.

3.3 Quality Assurance

The quality of the data was assured by the adherence to the quality control criteria outlined in the applicable reference methods. All field measurements were completed on pre-prepared data sheets and were input into computer programs to aid in accurate data reduction. Reported results have been reviewed by a second independent person prior to submittal.

3.3.1 Volumetric Flow Rate

All pitot tubes, thermocouples, differential pressure gauges and scales used in the test program are calibrated on a routine basis and inspected prior to their use. Pitot tubes, connecting tubing, and differential pressure gauges were leak checked on-site before and after each velocity traverse. Impinger weight measurements were performed with a calibrated balance. This balance was checked periodically using standard weights. Following completion of the program, a calibration check of the equipment used in the test effort was performed in accordance with EPA Method 2.

3.3.2 NOx and O_2

Instrument calibrations and a system bias check were performed prior to and immediately following each NOx and O_2 (Keeler Boiler only) test run to ensure proper instrument operation. System bias and calibration checks fell within method specifications. All calibration gas standards used were certified by the manufacturer to be within 2% of the stated value.

3.3.3 Process Samples

The ammonia and cyanide sampling trains were leak checked on-site before and after each test run. Samples were collected using dedicated containers at each location to eliminate the possibility of cross contamination. Chain-of-custody forms were completed for all samples. Laboratory analyses were performed in accordance with applicable methodologies.

APPENDIX A

FIELD DATA SHEETS

EPA Reference Methods 1–4, 7E Data Reduction

PLANT NAME: LTV

Sample Information							
Source	P1	P2	P3S	P3N	P4	Boiler #2	Keeler Boiler
Date	8–19–93	8–19–93	8–18–93	8–18–93	8–17–93	9–03–93	11–09–93
Time Start	1210	0800	0900	1325	1205	1230	1047
Time Finish	1410	0959	1115	1525	1440	1440	1257
Stack Gas Parameters							
Stack Diameter, ft	11.667	11.667	11.917	11.667	10.667	8.000	4.333
Static Pressure, in H2O	–0.86	–0.84	–1.00	–0.90	–0.93	–0.32	–0.25
O2 Concentration, %	12.0	13.0	9.0	9.0	12.0	16.5	10.9
CO2 Concentration,	5.0	4.0	5.5	5.8	7.0	3.5	7.5
Sampling Parameters							
Barametric Pressure, in Hg	29.19	29.19	28.92	28.92	29.10	29.25	29.75
Correction Factors							
Pitot Tube	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Dry Gas Meter	1.0338	1.0338	1.0338	1.0338	0.9812	0.9619	1.0151
Volume of Gas Sampled, ft3	33.967	32.144	32.069	32.868	28.352	35.049	35.379
Condensed Water, g	107.4	151.0	170.5	143.1	114.2	87.9	147.5
Square Root Delta P, in H2O^1/2	0.2099	0.1973	0.2371	0.3010	0.3679	0.4527	0.5600
Delta H, in H2O	1.0	1.0	1.0	1.0	0.7	0.9	1.0
Stack Temperature	625	602	723	713	580	252	250
Meter Temperature, F	103	84	92	98	100	124	129
Calculated Results							
Dry Standard Meter Volume, DSCF	32.20	31.53	30.72	31.14	25.55	29.85	32.06
Flue Gas Moisture, %	13.57	18.39	20.71	17.78	17.38	12.17	17.80
Gas Molecular Weight (wet), g/g–mole	27.75	27.11	26.91	27.28	27.58	27.85	27.56
Absolute Stack Pressure, in Hg	29.13	29.13	28.85	28.85	29.03	29.23	29.73
Average Gas Velocity, ft/sec	17.46	16.43	21.02	26.39	30.11	30.40	37.43
Average Flue Gas Flow, ACFM	1.12E+05	1.05E+05	1.41E+05	1.69E+05	1.61E+05	9.17E+04	3.31E+04
Average Flue Gas Flow, DSCFM	4.58E+04	4.16E+04	4.80E+04	6.04E+04	6.57E+04	5.83E+04	2.01E+04
NOx							
Concentration, ppm							
Actual	273	246	393	268	165	61	245
Corrected to 3% O2	549	557	591	403	332	—	—
Emission Rate, lb/hr	89.7	73.4	135.1	116.0	77.7	25.5	35.3

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: LTV (PCH) DATE: 8.19.93 ΔH@: 1.883 HOT BOX NO.: 3
LOCATION: Battery Stack TEST NO.: LTV-P1-1 METER CORRECTION: 1.0338 COLD BOX NO.: 3
ACTIVITY NO.: NOZZLE: None PITOT CORRECTION: 0.84 PROBE NO.: 5-1
CONTROL BOX OPERTOR: TM STATIC PRESSURE Ps: -0.8 CONTROL BOX NO.: 1 FILTER NO.: BYPASS
PROBE HANDLER: TM PORT DIRECTION: West NOMOGRAPH SET POINT: STACK DIA.: 140
CLEAN UP: BAROMETRIC PRESSURE: 29.17 LENGTHS OF UMBILICAL ___ x 25' / x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	Imp. Temp. °C/°F	Hot Box °F	Comments
50"	13:00	843.620	.02	1.00	1.00	99	94	5.0	649	~250°	<68°	250	60 min test
			.02	1.0	1.00	108	96	5.0	619		Ice down		5 min readings
			.03	1.0	1.00	109	96	5.0	623				1 port/1 point
			.02	1.0	1.00	110	96	5.0	625				
			.02	1.0	1.00	110	97	5.0	632				
			.02	1.0	1.00	111	97	5.0	640				
	13:30		.02	1.0	1.00	110	98	5.0	644				
			.02	1.0	1.00	110	98	5.0	649				
			.02	1.0	1.00	110	98	5.0	633				
			.02	1.0	1.00	110	98	5.0	627				
			.03	1.0	1.00	110	97	5.0	639				
			.03	1.0	1.0	110	97	5.0	641				
	14:00	877.587											

LEAK CHECK

	in. Hg.	Rate
Before	5.0	0.010
After	5.0	0.010

ORSAT

	1	2
CO_2	5.0	
O_2	12.0	
CO		
N		

PITOT LEAK CHECK

POS.	NEG.

Impinger No.	Final	Initial	Difference
1	582.9	498.4	
2	447.4	433.2	
3	467.3	465.9	
4	~~[illegible]~~	~~[illegible]~~	
5	701.9	694.6	

13.61% H2O

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT LTV (IPCH) | TEST DATE 8.19.93 | PAGE ____ of ____
PLANT LOCATION Battery Hall C | TEST NO. Flow | STACK DIAMETER (in.) ~~144~~ 140
TEST SITE ~~P2~~ P12 | PROBE TYPE 15' SS | STACK LENGTH (in.) ____
PROJECT NO. ____ | PROBE NO. 15-1 | STACK WIDTH (in.) ____
TEST CREW TH MG TD | B.P. (in. Hg) 29.19 | COMMENTS ____

TIME: 1125

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
SW	137.0	.04	625	-.86
	130.6	.035		
	123.5	.035		
	115.2	.04		
	105.0	.045		
	90.2	.045		
	49.8	.05		
	35.0	.05		
	24.8	.045		
	16.5	.045		
	9.4	.06		
	3.0	.06		
		0.0455		
		[illegible]		

TIME: ~~1~~ 1135

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
SW	137.0	.05	625	-.86
	130.6	.055		
	123.5	.05		
	115.2	.04		
	105.0	.04		
	90.2	.045		
	49.8	.04		
	35.0	.045		
	24.8	.04		
	16.5	.03		
	9.4	.035		
	3.0	.045		
		0.0427		
		[illegible]		

AVG = 0.0441

A. Barometric Pressure	29.19	in. Hg	
B. Static Pressure		in. H2O	
C. Average ΔP		in. H2O	
D. Average Stack Temperature		°F	
E. Average Stack Temperature		°R	(D+460)
F. Average Molecular Weight	27.49	lb./lb. mol	
G. Stack Pressure		in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor	.84		
I. Average Stack Velocity	17.6	fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round		ft²	(0.00545*DIAMETER²)
Rectangular		ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate	112538	acfm	(I*J*60)
L. Standard Flow Rate	53313	scfm	[K*(528/E)*(G/29.92)]

5/92

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: LTV (126H) | DATE: 8·19·93 | ΔH@: 1.883 | HOT BOX NO.: 7
LOCATION: Batting Stack | TEST NO.: LTV-PT-1 | METER CORRECTION: 1.0338 | COLD BOX NO.: 7
ACTIVITY NO.: | NOZZLE: NONE | PITOT CORRECTION: | PROBE NO.: S-1
CONTROL BOX OPERTOR: TM | STATIC PRESSURE Ps: -90 | CONTROL BOX NO.: 1 | FILTER NO.: BY PTS
PROBE HANDLER: TM | PORT DIRECTION: SOUTH | NOMOGRAPH SET POINT: | STACK DIA.: 140"
CLEAN UP: | BAROMETRIC PRESSURE: 29.19 | LENGTHS OF UMBILICAL ___ x 25' ___ x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Act.	Meter Temp °F In	Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	Imp. Temp. °C/°F	Hot Box °F	Comments
36"	8:30	836.841	.04	1.00	1.00	77	75	3.0	615	~250°	<68°	250°	6 MIN TEST
			.03	1.00	1.00	85	76	3.0	619		FILLUP		5 MIN READINGS
			.03	1.00	1.00	87	76	3.0	613				1 PORT/1 PT
			.03	1.00	1.00	89	77	3.0	619				
			.03	1.00	1.00	91	78	3.0	640				
			.03	1.00	1.00	91	79	3.0	631				
	9:00		.03	1.00	1.00	92	78	3.0	652				
			.03	1.00	1.00	92	80	3.0	648				
			.04	1.00	1.00	93	80	3.0	606				
			.03	1.00	1.00	95	80	3.0	610				
			.03	1.00	1.00	95	81	3.0	607				
			.04	1.00	1.00	96	87	3.0	608				

9:30 838.985

LEAK CHECK

	in. Hg.	Rate
Before	5.0	0.009
After	4.0	0.005

ORSAT

	0 (AIR)	1	2
CO_2		4.0	
O_2		13.0	
CO			
N			

PITOT LEAK CHECK

POS.	NEG.
15 SEC OK	15 SEC OK

Impinger No.	Final	Initial	Difference
1	665.7	564.0	101.7
2	609.10	585.6	24
3	451.6	442.5	9.1
4	695.9	672.1	

18.5% H_2O

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

check B.P IN Tel Host BOX

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT L.T.V
PLANT LOCATION ~~PT~~ Battery Stack
TEST SITE PZ
PROJECT NO.
TEST CREW

TEST DATE 08/19/93
TEST NO. Flow
PROBE TYPE 15' SS
PROBE NO. 15-1
B.P. (in. Hg) 29.19

PAGE ____ of ____
STACK DIAMETER (in.) 140"
STACK LENGTH (in.) —
STACK WIDTH (in.) 0 —
COMMENTS

TIME: 0725 ±700

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
137.0		.04	600	-.84
130.6		.045		
123.5		.05		
115.2		.045		
105.0		.055		
90.2		.05		
49.8		.04		
35.0		.03		
24.8		.035		
16.5		.035		
9.4		.03		
3.0		.03		
		.04		
		0.0[illegible]		

TIME: 0733

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
	137.0	.035	603	-.84
	130.6	.035		
	123.5	.04		
	115.2	.04		
	105.0	.04		
	90.2	.04		
	49.8	.035		
	35.0	.04		
	24.8	.04		
	16.5	.04		
	9.4	.035		
	3.0	.035		
		.0379		
		0.[illegible]		

Avg = 0.0389

A. Barometric Pressure	29.19	in. Hg	
B. Static Pressure		in. H2O	
C. Average ΔP		in. H2O	
D. Average Stack Temperature		°F	
E. Average Stack Temperature		°R	(D+460)
F. Average Molecular Weight	27.09	lb./lb. mol	
G. Stack Pressure		in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor			
I. Average Stack Velocity	16.4	fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round		ft²	(0.00545*DIAMETER²)
Rectangular		ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate	105236	acfm	(I*J*60)
L. Standard Flow Rate	51032	scfm	[K*(528/E)*(G/29.92)]

5/92

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: LTV (PGH)
LOCATION: Stack P3S
ACTIVITY NO.:
CONTROL BOX OPERTOR: TM
PROBE HANDLER: TM
CLEAN UP:

DATE: 8-18-93
TEST NO.: LTV-P3S-1
NOZZLE: None - open
STATIC PRESSURE Ps: -1.0
PORT DIRECTION: North
BAROMETRIC PRESSURE: 29.22

ΔH@: 1.883
METER CORRECTION: 1.0338
PITOT CORRECTION: 0.84
CONTROL BOX NO.: 1
NOMOGRAPH SET POINT:
LENGTHS OF UMBILICAL ____ x 25' ✓ x 50'

HOT BOX NO.: 7
COLD BOX NO.: 7
PROBE NO.: 5-1
FILTER NO.: By Pass
STACK DIA.:

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	Imp. Temp. °C/°F	Hot Box °F	Comments
50"	9:20	741.091		1.00	1.00	86	81	3.5	735	-250	68°	250°	60 min Test
				1.00	1.00	90	81	3.5	738				5 min readings
				1.00	1.00	93	82	3.5	743				1 point
				1.00	1.00	97	85	3.5	752				
				1.00	1.00	101	87	3.5	768				
				1.00	1.00	101	88	3.5	746				
	9:50			1.00	1.00	101	87	3.5	735				
				1.00	1.00	102	89	3.5	745				
				1.00	1.00	102	89	4.0	742				
				1.00	1.00	102	90	4.0	754				
				1.00	1.00	102	90	4.0	757				
	[redacted]	723.160		1.00	1.00	103	90	4.0	762				

10:20 ~~[illegible]~~

LEAK CHECK

	in. Hg.	Rate
Before	5.0	0.008
After	4.0	0.004

ORSAT

	1	2
CO_2	5.5	5.5
O_2	9.0	9.0
CO		
N		

PITOT LEAK CHECK

POS.	NEG.
15 sec ok	15 sec ok

Impinger No.	Final	Initial	Difference
1 100 mL H_2O	677.5	564.5	
2 100 mL H_2O	586.2	548.4	
3 MT	449.9	440.6	
4 Silgel	657.1	646.7	
5			

19.63 % H_2O

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT L.T.V
TEST DATE ~~28.9~~ 08/18/93
PAGE _____ of _____
PLANT LOCATION Battery Stack P3
TEST NO. Flow
STACK DIAMETER (in.) 143"
TEST SITE P3 South South
PROBE TYPE 15-1
STACK LENGTH (in.) _____
PROJECT NO. _____
PROBE NO. _____
STACK WIDTH (in.) _____
TEST CREW TMMG TD
B.P. (in. Hg) 28.92
COMMENTS _____

TIME: 0750

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
SE	140	.04	721	-1.0
	133.4	.05		
	126.1	.03		
	117.7	.045		
	107.3	.05		
	92.1	.08		
	50.9	.065		
	35.8	.065		
	25.4	.065		
	16.9	.05		
	9.6	.05		
	3.0	.05		
		0.0526		
		[illegible]		

TIME: 0740

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
NE	140	.08	724	-1.0
		.08		
		.08		
		.085		
		.075		
		.07		
		.075		
		.05		
		.04		
		.035		
		.035		
	3.0	.035		
		.06		
		[illegible]		

0.0562

A. Barometric Pressure		in. Hg	
B. Static Pressure		in. H2O	
C. Average ΔP		in. H2O	
D. Average Stack Temperature		°F	
E. Average Stack Temperature		°R	(D+460)
F. Average Molecular Weight	26.10	lb./lb. mol	
G. Stack Pressure		in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor			
I. Average Stack Velocity	21.3	fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round		ft²	(0.00545*DIAMETER²)
Rectangular		ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate	142,668	acfm	(I*J*60)
L. Standard Flow Rate	61443	scfm	[K*(528/E)*(G/29.92)]

5/92

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: LTV (PGH) | DATE: 8·18·93 | ΔH@: 1.883 | HOT BOX NO.: 3
LOCATION: STACK #3 P3N | TEST NO.: LTV-P3N-1 | METER CORRECTION: 1.0338 | COLD BOX NO.: 3
ACTIVITY NO.: | NOZZLE: NONE OPEN | PITOT CORRECTION: 0.84 | PROBE NO.: 5-1
CONTROL BOX OPERTOR: TM | STATIC PRESSURE Ps: -1.0" H2O | CONTROL BOX NO.: 1 | FILTER NO.: BY PASS
PROBE HANDLER: TM | PORT DIRECTION: SOUTH | NOMOGRAPH SET POINT: | STACK DIA.: 140"
CLEAN UP: | BAROMETRIC PRESSURE: 28.92 | LENGTHS OF UMBILICAL ___ x 25' ✓ x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Act.	Meter Temp °F In	Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	Imp. Temp. °C/°F	Hot Box °F	Comments
50"	13:50	773.771	.07	1.00	1.00	96	92	4.0	645	~250°	<65°	250°	60 MIN TEST
			.08	1.00	1.00	100	92	4.0	646		ICE BATH		5 MIN READINGS
			.07	1.00	1.00	102	92	4.0	643				1 POINT
			.06	1.00	1.00	101	91	4.0	652				
			.08	1.00	1.00	102	91	4.0	653				
			.08	1.00	1.00	102	90	4.0	654				
	14:20		.08	1.00	1.00	104	91	4.0	672				
			.08	1.00	1.00	104	92	4.0	675				
			.09	1.00	1.00	105	92	4.0	687				
			.06	1.00	1.00	107	94	4.0	688				
			.10	1.00	1.00	110	96	4.0	705				
			.30	1.00	1.00	109	97	4.0	713				
	14:50	806.634											

LEAK CHECK

	in. Hg	Rate
Before	6.0	0.005
After	4.0	0.004

ORSAT

	1	2
CO_2	6.0	6.5
O_2	9.0	9.0
CO		
N		

PITOT LEAK CHECK

POS.	NEG.
NSEC OK	45EC OK

Impinger No.	Final	Initial	Difference
1	694.4	550.1	114.3
2	601.7	487.2	137.5
3	465.9	465.2	.7
4	668.2	655.6	12.6

17.8% H_2O

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT LTV | TEST DATE [illegible] | PAGE _____ of _____
PLANT LOCATION _____ | TEST NO. [illegible] | STACK DIAMETER (in.) [illegible]
TEST SITE [illegible] | PROBE TYPE [illegible] | STACK LENGTH (in.) _____
PROJECT NO. _____ | PROBE NO. [illegible] | STACK WIDTH (in.) _____
TEST CREW [illegible] | B.P. (in. Hg) [illegible] | COMMENTS _____

TIME: 1245

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
SW	12	.13	710	-.90
	11	.11		
	10	.12		
	9	.12		
	8	.14		
	7	.165		
	6	.16		
	5	.14		
	4	.09		
	3	.07		
	2	.06		
		.05		
		0.810		
		[illegible]		

TIME: 1255

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
NE	12	.06	715	-.92
	11	.085		
	10	.09		
	9	.09		
	8	.10		
	7	.095		
	6	.085		
	5	.08		
	4	.06		
	3	.05		
	2	.05		
		.05		
		.0734		
		[illegible]		

AVG = 0.091

A. Barometric Pressure	28.82	in. Hg	
B. Static Pressure		in. H2O	
C. Average ΔP		in. H2O	
D. Average Stack Temperature		°F	
E. Average Stack Temperature		°R	(D+460)
F. Average Molecular Weight	27.16	lb./lb. mol	
G. Stack Pressure		in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor			
I. Average Stack Velocity	26.5	fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round		ft²	(0.00545*DIAMETER²)
Rectangular		ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate	169 904	acfm	(I*J*60)
L. Standard Flow Rate	72753	scfm	[K*(528/E)*(G/29.92)]

5/92

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: L.T.V
DATE: 08/17/93
ΔH@: 2.002
HOT BOX NO.: 3
LOCATION: Battery Stack P4
TEST NO.: Run-1 LTV-P4-1
METER CORRECTION: 0.9812
COLD BOX NO.: 3
ACTIVITY NO.:
NOZZLE: —
PITOT CORRECTION: 0.84
PROBE NO.: 5-
CONTROL BOX OPERTOR:
STATIC PRESSURE Ps: -0.92
CONTROL BOX NO.: 6
FILTER NO.: By PASS
PROBE HANDLER:
PORT DIRECTION:
NOMOGRAPH SET POINT:
STACK DIA.:
CLEAN UP:
BAROMETRIC PRESSURE: 29.10
LENGTHS OF UMBILICAL ____ x 25' ____ x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	Imp. Temp. °C/°F	Hot Box °F	Comments
48"	1220	287.554	.16	.75	.75	89	88	8.0	590	250	<68 Ice Array	250	one Hour
	12:25		.14	.75	.75	95	85	10.0	588				
	12:30		.16	.75	.75	101	89	13.0	578				
	12:35		.10	.75	.50	103	93	19.0	583				
	12:40	296.503	.11	.75	.75	101	95	23.0	591				
	12:45		.13	.50	.50	101	95	23.0	572				
	12:50		.13	.50	.50	101	95	24.0	585				
	12:55		.08	.75	.75	112	95	7.0	583				
	13:00	309.262	.11	.75	.75	115	95	10.0	580				
	13:05		.10	.75	.75	113	105	4.0	577				
	13:10		.13	.75	.75	115	105	4.0	575				
	13:15	315.906	.14	.75	.75	115	105	4.0	573				

LEAK CHECK

	in. Hg.	Rate
Before	8.0	<.02
After	20.0	<.02

ORSAT

	1	2
CO_2	7.0	
O_2	12.0	
CO		
N		

PITOT LEAK CHECK

POS.	NEG.
ok 15sec	ok 15sec

Impinger No.	Final	Initial	Difference
1 100ml	632.3	547.1	
2 100ml	484.8	476.7	
3 Dry	463.9	463.1	
4 Silgel	661.3	641.2	

17.4% H_2O

STACK GAS SAMPLING
GAS VELOCITY SHEET

PLANT	L.T.V	DATE	08/17/93	PAGE #	
LOCATION	Battery Stack	TEST #	Flow	STK DIA.(in.)	128"
ACTIVITY NO#		PROBE #		STK WIDTH (in.)	
TESTERS	MG, TD	B.P.	29.00	COMMENTS	

TIME: 0920

PORT	POINT	VELOCITY ΔP in. H2O	TEMP. F	STATIC PRESSURE
SE	12	.13	590	-.92
	11	.15		
	10	.14		
	9	.15		
	8	.16		
	7	.14		
	6	.13		
	5	.11		
	4	.10		
	3	.08		
	2	.10		
	1	.09		
		0.122		

TIME: 0930

PORT	POINT	VELOCITY ΔP in. H2O	TEMP. F	STATIC PRESSURE
SW	12	.15	570	-0.93
	11	.16		
	10	.17		
	9	.17		
	8	.18		
	7	.19		
	6	.20		
	5	.17		
	4	.14		
	3	.10		
	2	.10		
	1	.09		
		0.149		

AVG = 0.135

A. Ave. ΔP – in/H2O
B. Average Stack Temperature – F
C. Average Stack Temperature (F + 460) – R
D. Ave. Molecular Weight – (g/mol) — 27.54
E. Stack Pressure (in. Hg), B.P. + (static P/13.6)
F. Pitot Correction Factor
G. Velocity (ft/sec), 85.49 x F x ((A x C)/(D x E))^1/2 — 30.1
H. Stack Area – sqr. ft. Round: 3.14 x (STK DIA)^2/(4 x 144)
Rectangular: (L x W)/144
Flow Rate, G x H x 60 – ACFM — 161,537
J. Flow Rate, (528 x E x I)/(29.92 x C) – SCFM — 79,304

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

Page of

CLIENT L.I.V	TEST DATE 9/03/93	ORIFICE CORRECTION (ΔH@) 1.802	HOT/COLD BOX NO. 2
TEST UNIT Power Boiler #2	TEST NO. Moisture Boiler #2	METER CORRECTION (Y) 0.9619	PROBE NO. 2
PROJECT NO.	NOZZLE (SIZE,#) 3/8	CALIBRATION DATE 05-17-93	FILTER NO. 3-1
TEST CREW	STATIC PRESSURE -.30	PITOT CORRECTION	STACK DIA. 96
BAROMETRIC PRESSURE 29.25	PORT DIRECTION NORTH	CONTROL BOX NO. ~~5~~ 7	PORT SIZE 3" Nipple

Traverse Point (inches)	Time	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
	1310	243077		.85	.85	118	109	2.0	252	250	Iced Down 60	250	60 min./point
				.85	.85	123	109	2.0	251				
				.85	.85	127	110	2.0	251				
				.85	.85	130	110	2.0	250				
				.85	.85	133	111	2.0	251				
				.85	.85	135	112	2.0	249				
				.85	.85	140	113	2.0	250				
				.85	.85	140	114	2.0	248				
				.85	.85	140	115	2.0	249				
				.85	.85	141	115	2.0	243				
				.85	.85	142	115	2.0	247				
				.85	.85	142	115	2.0	246				
	1310	278.126		.85	.85	143	115	2.0	245				
													Estimates:
													MW=
		[illegible]			0.85		123.73	2.0	248.62				%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<.02
After	5.0	<.02

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	3.5	3.5
O2	16.5	16.5
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml H2O	603.8	534.7	[illegible]
2.	100ml H2O	556.3	545.3	[illegible]
3.	Dry	457.8	454.5	3.3
4.	Gel Gel	671.7	662.2	9.5
5.				
6.				
7.				
8.				[illegible]

CHESTER ENVIRONMENTAL

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT L.T.V | TEST DATE 09/23/93 | PAGE 1 of 2
PLANT LOCATION Power Boiler #2 | TEST NO. Flow Before | STACK DIAMETER (in.) 96"
TEST SITE Boiler #2 | PROBE TYPE S5 | STACK LENGTH (in.) —
PROJECT NO. | PROBE NO. 15-1 | STACK WIDTH (in.) —
TEST CREW MG TD | B.P. (in. Hg) 29.25 | COMMENTS

TIME: 1200

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
W	94.0	.30	255	-.30
	89.6	.35		
	84.7	.27		
	79.0	.28		
	72.0	.25		
	61.9	.26		
	34.1	.18		
	24.0	.14		
	17.0	.12		
	11.3	.13		
	6.4	.12		
	2.0	.11		

TIME: 1210

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
N	94.0	.25	255	-.30
	89.6	.30		
	84.7	.32		
79	~~84.7~~	.34		
72.0	~~79.0~~	.30		
61.9	~~72.0~~	.24		
	34.9	.16		
	34.1	.17		
	17.0	.22		
	11.3	.18		
	6.4	.3		
	2.0	.14		

A. Barometric Pressure		in. Hg	
B. Static Pressure		in. H2O	
C. Average ΔP		in. H2O	
D. Average Stack Temperature		°F	
E. Average Stack Temperature		°R	(D+460)
F. Average Molecular Weight		lb./lb. mol	
G. Stack Pressure		in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor			
I. Average Stack Velocity		fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round		ft²	(0.00545*DIAMETER²)
Rectangular		ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate		acfm	(I*J*60)
L. Standard Flow Rate		scfm	[K*(528/E)*(G/29.92)]

/92

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT L.T.V | TEST DATE 09/03/93 | PAGE 2 of 2
PLANT LOCATION Power Boiler #2 | TEST NO. Flow After | STACK DIAMETER (in.) 96.0
TEST SITE Boiler #2 Stack | PROBE TYPE SS | STACK LENGTH (in.) ____
PROJECT NO. ____ | PROBE NO. 15-1 | STACK WIDTH (in.) ____
TEST CREW MG. TO | B.P. (in. Hg) 29.25 | COMMENTS ____

TIME: 1450

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
W	94.0	.32	249	-.33
	11	.33		
	10	.28		
	9	.26		
	8	.20		
	7	.18		
	6	.12		
	5	.11		
	4	.10		
	3	.12		
	2	12		
	2.0	.11		

TIME: 1457

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
N	94.0	.32	247	-.33
	11	.34		
	10	.37		
	9	.38		
	8	.33		
	7	.27		
	6	.13		
	5	.12		
	4	.15		
	3	.13		
	2	.12		
	2.0	.11		

A. Barometric Pressure ____ in. Hg
B. Static Pressure ____ in. H2O
C. Average ΔP ____ in. H2O
D. Average Stack Temperature ____ °F
E. Average Stack Temperature ____ °R (D+460)
F. Average Molecular Weight ____ lb./lb. mol
G. Stack Pressure ____ in. Hg [A+(B/13.6)]
H. Pitot Correction Factor ____
I. Average Stack Velocity ____ fps {85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:
Round ____ ft² (0.00545*DIAMETER²)
Rectangular ____ ft² (LENGTH*WIDTH/144)
K. Average Flow Rate ____ acfm (I*J*60)
L. Standard Flow Rate ____ scfm [K*(528/E)*(G/29.92)]

5/92

Ammonia and Cyanide Data Reduction
Coke Oven Gas
LTV Pittsburgh, Pennsylvania By-Products Plant

Sample Information	Ammonia		Cyanide	
Date	8-18-93	8-19-93	8-18-93	8-19-93
Time Start	1747	1235	1640	1343
Time Finish	1847	1335	1740	1443
Sampling Parameters				
Barametric Pressure, in Hg	28.92	29.12	28.92	29.12
Dry Gas Meter Correction Factor	0.9812	0.9812	0.9812	0.9812
Volume of Gas Sampled, ft3	54.960	55.210	52.714	52.835
Condensed Water, g	81.4	86.4	65.5	71.6
Delta H, in H2O	0.80	0.80	0.80	0.80
Meter Temperature, F	104.1	111.0	103.8	115.7
Calculated Results				
Dry Standard Meter Volume, DSCF	48.87	48.83	46.90	46.35
Flue Gas Moisture, %	7.27	7.69	6.17	6.78
Ammonia				
Raw Data, mg	203	174	38	44
Concentration, mg/m^3	1.18E-01	1.01E-01	2.31E-02	2.71E-02

STACK SAMPLING DATA SHEET

CLIENT [illegible]
TEST UNIT Coke oven gas
PROJECT NO.
TEST CREW T.M.T.D. M.G.
BAROMETRIC PRESSURE 28.92

TEST DATE 08/18/93
TEST NO. LTV-COG-CN-1
NOZZLE (SIZE,#) Teflon tube
STATIC PRESSURE —
PORT DIRECTION — GAS TAP

ORIFICE CORRECTION (ΔH@) 2.0002
METER CORRECTION (Y) 0.9812
CALIBRATION DATE 06-09-93
PITOT CORRECTION
CONTROL BOX NO. 6

Page of
HOT/COLD BOX NO.
PROBE NO.
FILTER NO. —
STACK DIA.
PORT SIZE

Traverse Point (inches)	Time	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
	1640	315.469		.80	.80	95	85	10.0	100	—	Feed Down	—	60 min./point
				.80	.80	98	88	10.0	100		269		
				.80	.80	99	90	10.0	100				
				.80	.80	102	92	10.0	100				
				.80	.80	113	94	10.0	100				
				.80	.80	112	95	10	100				
				.80	.80	115	97	10	100				
				.80	.80	115	95	10.0	100				
				.80	.80	116	95	10	100				
				.80	.80	116	98	10	100				
	1740	368.183		.80	.80	117	100	10.0	100				
		52.714		.80	.80	117	100	10.0	100				
				.80	.80	117	101	10.0	100				
		51.723											
				(.80)		(103.8)							
								100					

Estimates:
MW=
%H2O=

STEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
fore	5.0	2.0
er	10.0	.013 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2		
O2		
CO		
N2		

Coke oven gas

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml UNNAH	559.0	535.9	23.1
2.	100ml UNNAH	564.0	554.1	[illegible]
3.	Dry	386.1	[illegible]	
4.	Silica			
5.				

CHESTER ENVIRONMENTAL

STACK SAMPLING DATA SHEET

Page . of

CLIENT L.T.V	TEST DATE 08/18/93	ORIFICE CORRECTION (ΔH@) 2.002	HOT/COLD BOX NO.
TEST UNIT [illegible] GAS LINE	TEST NO. LTV-COG-[illegible]-1	METER CORRECTION (Y) 0.9812	PROBE NO.
PROJECT NO.	NOZZLE (SIZE,#)	CALIBRATION DATE 08-09-93	FILTER NO.
TEST CREW MO TM TD	STATIC PRESSURE ≈ 10" H2O	PITOT CORRECTION 1	STACK DIA.
BAROMETRIC PRESSURE 28.92	PORT DIRECTION GAS TAP	CONTROL BOX NO. 6	PORT SIZE

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H20)	Orifice ΔH Actual (in. H20)	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
	1947	369.242		.80	.80	115	102	10.0	100	—	[illegible]	—	60 min./point
				.80	.80	115	102	10.0	100		268		
				.80	.80	117	103	10	100				
				.80	.80	120	103	10	100				
				.80	.80	123	104	10	100				
				.80	.80	123	104	10	100				
				.80	.80	123	105	10	100				
				.80	.80	123	105	10	100				
				.80	.80	123	105	10	100				
				.80	.80	123	105	10.0	100				
				.80	.80	123	105	10.0	100				
				.80	.80	122	105	10.0	100				
	1947	424.202		.80	.80	121	105	10.0	100				
		54.960											
		53.927		(.80)		104.1			100				Estimates:
													MW=
													%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	2.01
After	10.0	2.01

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2		
O2	COKE	
CO	OVEN	
N2	GAS	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml, 1N H2SO4	530.5	484.1	46.4
2.	100ml, 1N H2SO4	565.1	555.2	9.9
3.	Dry	378.5	375.5	3.0
4.	Sil Gel	663.1	641.0	22.1
5.				
6.				81.4
7.				
8.				

~~8H~~

7.29% H2O

CHESTER ENVIRONMENTAL

STACK SAMPLING DATA SHEET

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CLIENT L.T.V.	TEST DATE 09/19/93	ORIFICE CORRECTION (ΔH@) 2.002	HOT/COLD BOX NO.
TEST UNIT NEW COKE OVEN GAS LINE	TEST NO. LTV-206-N114-2	METER CORRECTION (Y) 0.9812	PROBE NO.
PROJECT NO.	NOZZLE (SIZE,#)	CALIBRATION DATE 06/09/93	FILTER NO.
TEST CREW	STATIC PRESSURE	PITOT CORRECTION	STACK DIA.
BAROMETRIC PRESSURE 29.12	PORT DIRECTION NEW GAS TAP	CONTROL BOX NO. 6	PORT SIZE

Traverse Point (inches)	Time	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
	1235	429.145		.80	.80	106	95	3.0	100	—	Feed Down	—	60 min./point
				.80	.80	113	95	3.0	100		268		
				.80	.80	115	96	3.0	100				
				.80	.80	116	97	3.0	100				
				.80	.80	118	99	3.0	100				
				.80	.80	121	100	3.0	100				
				.80	.80	122	103	3.0	100				
				.80	.80	125	105	3.0	100				
				.80	.80	125	105	3.0	100				
				.80	.80	126	105	3.0	100				
				.80	.80	125	105	3.0	100				
				.80	.80	125	105	3.0	100				
				.80	.80	126	105	3.0	100				
	1325	484.355		.80	.80	125	105	3.0	100				
		55.210											
													Estimates:
		54.170		.80		(111.0)			100				MW=
													%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	4.02
After	5.0	4.02

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	COKE OVEN GAS	OK
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml 1N NaOH	527.1	483.0	44.1
2.	" "	568.7	556.5	12.2
3.	DRY	381.6	377.1	4.5
4.	Silica Gel	657.7	632.1	25.6
5.				
6.				86.4
7.				
8.				

7.71% H2O

CHESTER ENVIRONMENTAL

STACK SAMPLING DATA SHEET

Page of

CLIENT I-I T, I'	TEST DATE 08/14/93	ORIFICE CORRECTION (ΔH@) 2.002	HOT/COLD BOX NO.
TEST UNIT NEW WET OVEN GAS	TEST NO. LTV-COG-CM-2	METER CORRECTION (Y) 0.9812	PROBE NO.
PROJECT NO.	NOZZLE (SIZE,#)	CALIBRATION DATE 06-09-93	FILTER NO.
TEST CREW	STATIC PRESSURE	PITOT CORRECTION	STACK DIA.
BAROMETRIC PRESSURE 29.12	PORT DIRECTION NEW GAS TAP	CONTROL BOX NO. 6	PORT SIZE

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H20)	Orifice ΔH Actual (in. H20)	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
	1343	486.815		.90	.80	125	104	3.0	100	—	[illegible]	—	min./point
				.80	.80	125	104	3.0	100		268		
				.80	.80	126	104	3.0	100				
				.80	.80	126	104	3.0	100				
				.80	.80	127	105	3.0	100				
				.80	.80	127	105	3.0	100				
				.80	.80	127	105	3.0	100				
				.80	.80	127	105	3.0	100				
				.80	.80	128	105	3.0	100				
				.80	.80	127	106	3.0	100				
				.80	.80	128	105	3.0	100				
				.80	.80	127	105	3.0	100				
	1443	539.730		.80	.80	127	105	3.0	100				
		52.835											
				.90		1151			100				
		51.842											Estimates:
													MW=
													%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	2.0	1.0 2
After	2.0	1.0 1

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2		
O2		
CO		
N2		

Impinger

Impinger No.	Contents	Final	Initial	Difference
1.	100ml 1N NaOH	563.2	537.6	25.6
2.	100ml 1N NaOH	574.5	556.2	18.3
3.	Dry	389	381.6	7.4
4.	Silica Gel	692.2	671.9	20.3
5.				
6.				71.6
7.				
8.				

6.79% H2O

CHESTER ENVIRONMENTAL

APPENDIX B

CEM DATA

LTV STEEL COMPANY - HAZELWOOD, PA FACILITY
BATTERY STACK P1 - AUGUST 19, 1993
NOx CONCENTRATIONS - ONE MINUTE AVERAGES (ppmv NO)

Time	NOx	Time	NOx	Time	NOx
1210	264	1252	271	1334	334
1211	265	1253	276	1335	339
1212	268	1254	277	1336	338
1213	268	1255	279	1337	77
1214	276	1256	284	1338	179
1215	280	1257	284	1339	202
1216	287	1258	282	1340	220
1217	292	1259	284	1341	232
1218	296	1300	289	1342	239
1219	298	1301	287	1343	244
1220	297	1302	290	1344	250
1221	300	1303	294	1345	255
1222	303	1304	294	1346	255
1223	308	1305	291	1347	264
1224	309	1306	292	1348	263
1225	312	1307	90	1349	263
1226	302	1308	208	1350	264
1227	310	1309	239	1351	270
1228	308	1310	256	1352	273
1229	308	1311	264	1353	277
1230	309	1312	273	1354	278
1231	316	1313	278	1355	275
1232	314	1314	286	1356	285
1233	311	1315	289	1357	281
1234	311	1316	290	1358	279
1235	315	1317	299	1359	285
1236	282	1318	300	1400	286
1237	140	1319	302	1401	261
1238	185	1320	308	1402	263
1239	214	1321	309	1403	267
1240	217	1322	309	1404	266
1241	234	1323	308	1405	267
1242	244	1324	314	1406	264
1243	247	1325	318	1407	79
1244	251	1326	322	1408	197
1245	254	1327	326	1409	227
1246	258	1328	326	1410	240
1247	263	1329	326		
1248	267	1330	325	Average	273
1249	270	1331	332		
1250	270	1332	334		
1251	272	1333	334		

LTV STEEL COMPANY - HAZELWOOD, PA FACILITY
BATTERY STACK P2 - AUGUST 19, 1993
NOx CONCENTRATIONS - ONE MINUTE AVERAGES (ppmv NO)

Time	NOx	Time	NOx	Time	NOx
800	232	842	110	924	266
801	230	843	197	925	269
802	244	844	205	926	271
803	242	845	219	927	274
804	238	846	229	928	275
805	240	847	235	929	279
806	242	848	236	930	280
807	247	849	237	931	283
808	246	850	241	932	285
809	248	851	242	933	286
810	252	852	242	934	283
811	261	853	246	935	284
812	153	854	255	936	284
813	170	855	259	937	286
814	200	856	256	938	280
815	220	857	256	939	285
816	226	858	254	940	289
817	231	859	253	941	288
818	242	900	250	942	94
819	250	901	253	943	190
820	261	902	257	944	202
821	267	903	256	945	203
822	271	904	266	946	208
823	272	905	265	947	212
824	275	906	258	948	221
825	276	907	256	949	226
826	276	908	254	950	236
827	282	909	255	951	234
828	283	910	250	952	235
829	282	911	237	953	238
830	283	912	88	954	237
831	286	913	183	955	232
832	287	914	200	956	241
833	284	915	215	957	248
834	290	916	229	958	248
835	290	917	235	959	243
836	290	918	244		
837	291	919	246	Average	246
838	290	920	253		
839	293	921	258		
840	294	922	261		
841	67	923	263		

LTV STEEL COMPANY – HAZELWOOD, PA FACILITY
BATTERY STACK P3N – AUGUST 18, 1993
NOx CONCENTRATIONS – ONE MINUTE AVERAGES (ppmv NO)

Time	NOx	Time	NOx	Time	NOx
1325	234	1407	301	1449	193
1326	245	1408	293	1450	216
1327	257	1409	296	1451	228
1328	269	1410	298	1452	240
1329	279	1411	302	1453	256
1330	276	1412	295	1454	256
1331	260	1413	312	1455	251
1332	257	1414	323	1456	258
1333	273	1415	320	1457	277
1334	277	1416		1458	292
1335	283	1417		1459	289
1336	290	1418		1500	287
1337	275	1419		1501	
1338	276	1420		1502	
1339	282	1421		1503	
1340	287	1422	237	1504	
1341	285	1423	246	1505	
1342	296	1424	240	1506	
1343	297	1425	233	1507	
1344	299	1426	229	1508	
1345		1427	230	1509	
1346		1428	236	1510	
1347	276	1429	238	1511	321
1348	165	1430	241	1512	325
1349	207	1431	247	1513	325
1350	220	1432	249	1514	317
1351	245	1433	246	1515	320
1352	269	1434	251	1516	319
1353	271	1435	260	1517	317
1354	271	1436	261	1518	295
1355	262	1437	271	1519	197
1356	258	1438	277	1520	224
1357	249	1439	270	1521	243
1358	286	1440	279	1522	259
1359	292	1441	286	1523	
1400	291	1442	279	1524	
1401	300	1443	281	1525	268
1402	299	1444	278		
1403	291	1445	274	Average	268
1404	281	1446	269		
1405	281	1447	255		
1406	303	1448	91		

LTV STEEL COMPANY – HAZELWOOD, PA FACILITY
BATTERY STACK P3S – AUGUST 18, 1993
NOx CONCENTRATIONS – ONE MINUTE AVERAGES (ppmv NO)

Time	NOx	Time	NOx	Time	NOx
900	469	946	364	1032	389
901	456	947	372	1033	380
902		948	175	1034	361
903		949	319	1035	355
904		950	355	1036	350
905		951	370	1037	344
906	471	952	377	1038	330
907	478	953	376	1039	325
908	489	954	379	1040	342
909	479	955	403	1041	344
910	478	956	432	1042	356
911	482	957	434	1043	359
912	487	958	427	1044	345
913	480	959	430	1045	340
914	481	1000	449	1046	339
915	502	1001	457	1047	360
916		1002	439	1048	94
917	520	1003	432	1049	311
918	103	1004	449	1050	344
919	304	1005	448	1051	375
920	348	1006	447	1052	
921	351	1007	456	1053	
922	348	1008	460	1054	403
923	336	1009	466	1055	407
924	347	1010	458	1056	410
925	375	1011	455	1057	399
926	383	1012	445	1058	396
927	378	1013	423	1059	421
928	376	1014	437	1100	428
929	375	1015	476	1101	
930	370	1016	477	1102	
931	368	1017	461	1103	458
932	370	1018		1104	466
933	356	1019	275	1105	458
934	349	1020	286	1106	450
935	342	1021	277	1107	446
936	343	1022	296	1108	451
937	362	1023	353	1109	454
938	385	1024		1110	456
939	388	1025		1111	456
940	380	1026		1112	454
941	393	1027	355	1113	454
942	404	1028	358	1114	452
943	394	1029	335	1115	442
944	390	1030	330		
945	385	1031	366	Average	393

LTV STEEL COMPANY – HAZELWOOD, PA FACILITY
BATTERY STACK P4 – AUGUST 17, 1993
NOx CONCENTRATIONS – ONE MINUTE AVERAGES (ppmv NO)

Time	NOx	Time	NOx	Time	NOx	Time	NOx
1205	141	1247	177	1329	183	1411	
1206	150	1248	174	1330	184	1412	
1207	151	1249	173	1331	106	1413	
1208	163	1250	176	1332	122	1414	
1209	170	1251	179	1333	128	1415	
1210	169	1252	180	1334	141	1416	
1211	169	1253	183	1335	145	1417	
1212	173	1254	190	1336	148	1418	
1213	175	1255	194	1337	146	1419	
1214	177	1256	191	1338	150	1420	193
1215	177	1257	187	1339	157	1421	193
1216	174	1258	185	1340	165	1422	191
1217	172	1259	187	1341	169	1423	191
1218	175	1300	75	1342	170	1424	192
1219	174	1301	111	1343	173	1425	196
1220	175	1302	127	1344	174	1426	199
1221	181	1303	134	1345	176	1427	203
1222	190	1304	144	1346	178	1428	206
1223	191	1305	151	1347	179	1429	207
1224	180	1306	156	1348		1430	38
1225	179	1307	161	1349		1431	111
1226	184	1308	161	1350		1432	133
1227	184	1309	161	1351		1433	139
1228	186	1310	160	1352	189	1434	146
1229	192	1311	168	1353	190	1435	149
1230	32	1312	167	1354	190	1436	153
1231	109	1313	173	1355	190	1437	159
1232	126	1314	176	1356	194	1438	166
1233	134	1315	184	1357	192	1439	171
1234	141	1316	181	1358	190	1440	176
1235	148	1317		1359	192		
1236	151	1318		1400	193	Average	165
1237	154	1319		1401	110		
1238	160	1320		1402	122		
1239	160	1321	169	1403	135		
1240	162	1322	168	1404	143		
1241	163	1323	169	1405	148		
1242	163	1324	168	1406			
1243	165	1325	167	1407			
1244	170	1326	173	1408			
1245	174	1327	177	1409			
1246	177	1328	179	1410			

LTV STEEL COMPANY - HAZELWOOD, PA FACILITY
BOILERHOUSE - SEPTEMBER 3, 1993
NOx CONCENTRATIONS - ONE MINUTE AVERAGES (ppmv NO)

Time	NOx	Time	NOx	Time	NOx	Time	NOx
1230	45	1312	82	1354	67	1436	63
1231	45	1313	78	1355	50	1437	58
1232	59	1314	77	1356	53	1438	57
1233	60	1315	63	1357	58	1439	55
1234	60	1316	72	1358	66	1440	56
1235	62	1317	77	1359	65		
1236	63	1318	72	1400	65	Average	61
1237	68	1319	70	1401	65		
1238		1320	69	1402	57		
1239		1321	55	1403	47		
1240	71	1322	49	1404	61		
1241	69	1323	49	1405	68		
1242	74	1324	49	1406	34		
1243	79	1325	55	1407	49		
1244	74	1326	73	1408	53		
1245	72	1327	34	1409	50		
1246	70	1328	57	1410	60		
1247	66	1329	52	1411	34		
1248	63	1330	50	1412	54		
1249	70	1331	53	1413	62		
1250	75	1332	60	1414	41		
1251	66	1333	64	1415	49		
1252	72	1334	66	1416	55		
1253	74	1335	68	1417	59		
1254	75	1336	68	1418	60		
1255	59	1337	69	1419	59		
1256	62	1338	68	1420	60		
1257	71	1339	69	1421	55		
1258	54	1340	70	1422	56		
1259	56	1341	70	1423	57		
1300	70	1342	50	1424	60		
1301	73	1343	50	1425	60		
1302	73	1344	51	1426	63		
1303	73	1345	57	1427			
1304	74	1346	60	1428	60		
1305	74	1347	65	1429	40		
1306	74	1348	67	1430	43		
1307	73	1349	48	1431	45		
1308	75	1350	52	1432	46		
1309	78	1351	57	1433	45		
1310	78	1352	66	1434	59		
1311	78	1353	67	1435	61		

LTV STEEL COMPANY – HAZELWOOD, PA FACILITY
KEELER BOILER #5 – NOVEMBER 9, 1993
NOx CONCENTRATIONS – ONE MINUTE AVERAGES (ppmv NO)
O2 CONCENTRATIONS – ONE MINUTE AVERAGES (% O2)

Time	NOx	O2	Time	NOx	O2	Time	NOx	O2
10:47	232.2	11.3	11:31	248.4	9.5	12:15	231.3	11.8
10:48	233.8	11.2	11:32	237.4	9.5	12:16	223.3	11.8
10:49	241.6	11.1	11:33	238.9	9.5	12:17	212.3	12.1
10:50	255.7	11.2	11:34	246.6	9.7	12:18	214.6	11.8
10:51	256.9	11.1	11:35	244.9	9.8	12:19	210.8	11.8
10:52	253.0	11.0	11:36	235.4	9.8	12:20	203.4	11.9
10:53	252.5	10.4	11:37	238.2	9.8	12:21	198.7	11.8
10:54	260.6	10.0	11:38	247.1	9.8	12:22	202.5	11.8
10:55	268.1	9.7	11:39	256.7	10.1	12:23	213.3	12.0
10:56	267.7	9.6	11:40	260.2	10.2	12:24	221.9	12.0
10:57	254.9	9.2	11:41	266.3	10.4	12:25	217.9	12.0
10:58	241.7	8.7	11:42	271.7	10.5	12:26	211.9	12.2
10:59	234.3	8.5	11:43	274.5	10.7	12:27	207.0	12.2
11:00	234.0	8.4	11:44	267.0	10.9	12:28	212.9	12.1
11:01	240.6	8.2	11:45	265.8	10.7	12:29	222.5	12.4
11:02	238.3	8.0	11:46	264.5	10.8	12:30	225.6	12.6
11:03	240.5	8.0	11:47	256.3	10.7	12:31	222.2	12.5
11:04	264.4	8.0	11:48	254.6	10.7	12:32	214.1	12.6
11:05	276.6	8.0	11:49	255.9	10.8	12:33	210.9	12.5
11:06	273.5	8.0	11:50	247.1	10.8	12:34	204.5	12.6
11:07	266.4	7.9	11:51	245.8	10.8	12:35	211.2	12.7
11:08	266.6	7.9	11:52	246.3	10.9	12:36	213.6	12.8
11:09	261.7	7.9	11:53	252.2	10.9	12:37	225.4	12.9
11:10	264.1	7.7	11:54	255.9	11.1	12:38	248.4	13.2
11:11	263.9	7.8	11:55	248.2	11.2	12:39	251.7	13.6
11:12	267.6	7.9	11:56	247.7	11.2	12:40	253.6	13.7
11:13	272.3	8.0	11:57	248.7	11.2	12:41	251.6	13.6
11:14	266.1	8.0	11:58	249.6	11.2	12:42	246.5	13.7
11:15	259.2	8.1	11:59	251.0	11.3	12:43	254.2	14.0
11:16	251.1	8.1	12:00	244.3	11.3	12:44	254.5	13.9
11:17	257.7	8.1	12:01	236.6	11.2	12:45	248.4	13.7
11:18	262.3	8.3	12:02	248.2	11.4	12:46	248.1	13.5
11:19	261.3	8.6	12:03	259.6	11.5	12:47	247.0	13.[illegible]
11:20	254.3	8.6	12:04	254.9	11.6	12:48	253.8	13.[illegible]
11:21	255.4	8.6	12:05	255.1	11.7	12:49	258.1	13.8
11:22	250.7	8.6	12:06	253.2	11.6	12:50	256.5	14.[illegible]
11:23	254.2	8.8	12:07	246.6	11.6	12:51	258.5	14.[illegible]
11:24	255.0	8.9	12:08	243.8	11.6	12:52	254.4	13.9
11:25	239.5	9.0	12:09	238.5	11.6	12:53	250.0	14.2
11:26	238.1	8.9	12:10	234.6	11.7	12:54	246.2	14.0
11:27	254.2	9.1	12:11	224.9	11.8	12:55	244.2	14.0
11:28	256.5	9.2	12:12	228.1	11.7	12:56	244.3	14.0
11:29	253.5	9.4	12:13	237.0	11.8	12:57	231.0	14.2
11:30	248.9	9.4	12:14	235.1	11.7			
						Average	245.0	10.9

CONTINUOUS INSTRUMENT CALIBRATION DATA

PLANT LTV
LOCATION Battery Stack P1
PROJ. NO#
TESTERS
COMMENTS:

DATE 8/19/93
TEST #
PRE/POST TEST
REGULATORS

GAS ANALYZED NO
INSTRUMENT
SERIAL #
CALIBRATOR

	CYLINDER #	CONCENTRATION ~~% OR~~ PPM	ANALYZER RESPONSE	RECORDER OUTPUT	ADJUSTED VALUE	PERCENT DEVIATION
	UNITS	NO				
TIME:						
	10:25	920	920			
	10:30	479	479			
	10:40	53	52			
	14:15	920	918			
	14:20	479	479			
	14:25	53	53			
TIME:						
TIME:						

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

CONTINUOUS INSTRUMENT CALIBRATION DATA

PLANT CTV
LOCATION Bulky Stack P2
PROJ. NO# 1
TESTERS
COMMENTS:

DATE 8/19/93
TEST #
PRE/POST TEST
REGULATORS

GAS ANALYZED NO
INSTRUMENT
SERIAL #
CALIBRATOR

	CYLINDER #	CONCENTRATION ~~% OR~~ PPM	ANALYZER RESPONSE	RECORDER OUTPUT	ADJUSTED VALUE	PERCENT DEVIATION
	UNITS	NO				
TIME:						
	07:25	920	920	929o		
	07:30	479	479	489o		
	07:35	53	52	57o		
	10:25	920	920			
	10:30	479	479			
	10:40	53	52			
TIME:						
TIME:						

KEYSTONE ENVIRONMENTAL RESOURCES INC.

CONTINUOUS INSTRUMENT CALIBRATION DATA

PLANT LTV
LOCATION Rotary Stack P3N
PROJ. NO#
TESTERS
COMMENTS:

DATE 8/18/93
TEST #
PRE/POST TEST
REGULATORS

GAS ANALYZED NO
INSTRUMENT
SERIAL #
CALIBRATOR

	CYLINDER #	CONCENTRATION ~~% OR~~ PPM	ANALYZER RESPONSE	RECORDER OUTPUT	ADJUSTED VALUE	PERCENT DEVIATION
	UNITS	NO				
TIME:						
	11:45	920	920	92%		
	11:55	479	479	48%		
	12:00	53	53	5.2%		
	13:00	920	920			
	15:40	920	915			
	15:50	479	478			
TIME:						
TIME:						

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

CONTINUOUS INSTRUMENT CALIBRATION DATA

PLANT LTY
LOCATION Batting Stack P35
PROJ. NO# _____
TESTERS _____
COMMENTS: _____

DATE 8/16/93
TEST # _____
PRE/POST TEST _____
REGULATORS _____

GAS ANALYZED NO
INSTRUMENT _____
SERIAL # _____
CALIBRATOR _____

	CYLINDER #	CONCENTRATION ~~% OR~~ PPM	ANALYZER RESPONSE	RECORDER OUTPUT	ADJUSTED VALUE	PERCENT DEVIATION
	UNITS	NO				
TIME:						
	08:15	920	920	92%		
	08:25	479	480	48%		
	09:30	53	54	5%		
SYS CHECK	08:40					
TIME:						
TIME:						

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

CONTINUOUS INSTRUMENT CALIBRATION DATA

PLANT LTV
LOCATION Battery Stack #4
PROJ. NO# 1
TESTERS
COMMENTS:

DATE 8/17/93
TEST # Run #1
PRE/POST TEST
REGULATORS

GAS ANALYZED NO
INSTRUMENT
SERIAL #
CALIBRATOR

	CYLINDER #	CONCENTRATION ~~% OR~~ PPM	ANALYZER RESPONSE	RECORDER OUTPUT	ADJUSTED VALUE	PERCENT DEVIATION
	UNITS	NO				
TIME:						
	1035	920	910	92% FS	—	
	1055	479	484	48.5% FS	—	
	1115	53	52	5% FS	—	
SYS CHECK	1140	479	456			
	1415	920	851			
	1450	920	916			
TIME:						
SYS CHECK	1500	479	464			
	1505	479	479			
	1515	53	53			
TIME:						

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

CONTINUOUS INSTRUMENT CALIBRATION DATA

PLANT LTV
LOCATION Boiler House
PROJ. NO#
TESTERS
COMMENTS:

DATE 9/3/93
TEST #
PRE/POST TEST
REGULATORS

GAS ANALYZED NO
INSTRUMENT
SERIAL #
CALIBRATOR

	CYLINDER #	CONCENTRATION ~~% OR~~ PPM	ANALYZER RESPONSE	RECORDER OUTPUT	ADJUSTED VALUE	PERCENT DEVIATION
	UNITS	NO				
TIME:						
	11:30	920	920	92%		
	11:40	479	480	48%		
	11:50	53	53	5%		
	13:00	53	53	5%		
	14:45	53	51	5%		
	14:47	479	480	48%		
TIME:						
TIME:						

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

Page of

CLIENT L.T.V	TEST DATE 11-9-93	ORIFICE CORRECTION (ΔH@) 1.57	HOT/COLD BOX NO.
TEST UNIT Keeler Boiler #5	TEST NO. H2O TEST	METER CORRECTION (Y) 1.0151	PROBE NO. 3-
PROJECT NO. TD#MG	NOZZLE (SIZE,#)	CALIBRATION DATE 7-2-93	FILTER NO. BYPASS
TEST CREW	STATIC PRESSURE -0.25	PITOT CORRECTION 0.84	STACK DIA. 52.0
BAROMETRIC PRESSURE 29.75	PORT DIRECTION 2	CONTROL BOX NO. 3	PORT SIZE 3" nipple

Traverse Point (inches)	Time	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
130	1120	830.169	.20	1.0	1.0	117	108	2.0	253	250	Iced Down	255	60 min./point
			.20	1.0	1.0	124	110	2.0	253				
			.20	1.0	1.0	127	113	2.0	254				
			.20	1.0	1.0	130	115	2.0	254				
			.20	1.0	1.0	135	119	2.0	253				
			.20	1.0	1.0	137	122	2.0	255				
			.20	1.0	1.0	140	124	2.0	254				
			.20	1.0	1.0	142	126	2.0	255				
			.20	1.0	1.0	143	126	2.0	256				
			.20	1.0	1.0	144	128	2.0	256				
			.20	1.0	1.0	145	130	2.0	255				
			.20	1.0	1.0	146	131	2.0	255				
	1220		.20	1.0	1.0	147	132	2.0	256				
		865.365											
			See										
			Flow Sheet	1.0			129.3		254.5				Estimates:
		865.548											MW=
													%H2O= 17.85

17.85% H2O

SYSTEM LEAK CHECK 35.379

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	6	.001
After		

PITOT LEAK CHECK 15 SEC

	Positive	Negative
Before	OK	OK
After		

GAS	1	2
CO2	~~10.5~~	7.5
O2	~~7.5~~	10.5
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml H2O	681.9	570.7	111.2
2.	100ml H2O	609.9	585.7	24.2
3.	Dry	433.6	430.0	3.6
4.	Sil Gel	617.9	609.4	8.5
5.				
6.				
7.				
8.				147.5

CHESTER ENVIRONMENTAL

Before Test

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT L.T.V | TEST DATE 11/9/93 | PAGE 1 of 2
PLANT LOCATION _____ | TEST NO. Flow #1 | STACK DIAMETER (in.) 53.0
TEST SITE Keeler Boiler #5 | PROBE TYPE _____ | STACK LENGTH (in.) —
PROJECT NO. _____ | PROBE NO. PS-1 | STACK WIDTH (in.) —
TEST CREW TDEMG | B.P. (in. Hg) 29.75 | COMMENTS _____

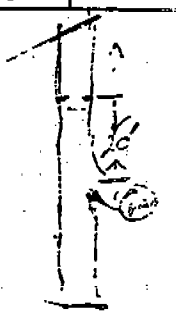
TIME: 10:30

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
1	57.9	.35		-0.25
	48.5	.42		
	45.9	.40		
	42.5	.36		
	39.0	.33		
	33.5	.30		
	15.5	.22		
	13.0	.25		
	9.2	.28		
	6.1	.42		
	3.5	.42		
	1.1	.38	250	
		0.5838	250	-0.25

TIME: 10:40

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
2	50.9	.46		
		.48		
		.46		
		.48		
		.32		
		.26		
		.16		
		.14		
		.15		
		.14		
		.20		
	1.1	.20	240	
		0.5156	240	

A. Barometric Pressure _____ in. Hg
B. Static Pressure _____ in. H2O
C. Average ΔP (0.3022) in. H2O
D. Average Stack Temperature 245 ~~246~~ °F 245 AVG
E. Average Stack Temperature _____ °R (D+460)
F. Average Molecular Weight _____ lb./lb. mol
G. Stack Pressure _____ in. Hg [A+(B/13.6)]
H. Pitot Correction Factor _____
I. Average Stack Velocity _____ fps {85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:
Round _____ ft² (0.00545*DIAMETER²)
Rectangular _____ ft² (LENGTH*WIDTH/144)
K. Average Flow Rate _____ acfm (I*J*60)
L. Standard Flow Rate _____ scfm [K*(528/E)*(G/29.92)]



AFTER TEST

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT L.T.V. | TEST DATE 1-9-93 | PAGE 2 of 2
PLANT LOCATION _____ | TEST NO. Final-2 | STACK DIAMETER (in.) 52.0
TEST SITE Cooler Baghouse | PROBE TYPE _____ | STACK LENGTH (in.) _____
PROJECT NO. _____ | PROBE NO. PS-1 | STACK WIDTH (in.) _____
TEST CREW TDimG | B.P. (in. Hg) 29.75 | COMMENTS _____

TIME:

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
1	50.9	.38	255	-0.25
	48.5	.42		
	45.9	.45		
	42.6	.38		
	39.0	.32		
	33.5	.25		
	28.5	.24		
	23.0	.30		
	17.2	.30		
	12.1	.38		
	7.5	.45		
	2.9	.36		
		0.5908	255	-0.25

TIME:

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
2	50.9	.48	255	-0.25
		.53		
		.50		
		.45		
		.36		
		.28		
		.20		
		.18		
		.18		
		.20		
		.21		
	1.1	.22		
		0.5498	255	-0.25

A. Barometric Pressure	_____	in. Hg	
B. Static Pressure	_____	in. H2O	
C. Average ΔP	(0.3253)	in. H2O	
D. Average Stack Temperature	_____	°F	
E. Average Stack Temperature	_____	°R	(D+460)
F. Average Molecular Weight	_____	lb./lb. mol	
G. Stack Pressure	_____	in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor	_____		
I. Average Stack Velocity	_____	fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round	_____	ft²	(0.00545*DIAMETER²)
Rectangular	_____	ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate	_____	acfm	(I*J*60)
L. Standard Flow Rate	_____	scfm	[K*(528/E)*(G/29.92)]

Average
ΔP = 0.5600
T_s = 255
Static Press = -0.25

5/92

CONTINUOUS INSTRUMENT CALIBRATION DATA

PLANT LTV
LOCATION Boiler House
PROJ. NO#
TESTERS
COMMENTS:

DATE 11/9/93
TEST #
PRE/POST TEST
REGULATORS

GAS ANALYZED NOX
INSTRUMENT Model 10
SERIAL #
CALIBRATOR

	CYLINDER #	CONCENTRATION ~~% OR~~ PPM	ANALYZER RESPONSE	RECORDER OUTPUT	ADJUSTED VALUE	PERCENT DEVIATION
	UNITS	NO/N2				
TIME:						
	7:20	920	920	95%		
	8:25	920	920	92%		
	8:30	479	479	47%		
	8:37	53	53	5.2%		
	13:05	53	54	5.5%		
	13:10	479	45C	45%		
TIME:						
	13:25	920	928	95%		
TIME:						

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

CONTINUOUS INSTRUMENT CALIBRATION DATA

PLANT LTV
LOCATION Boiler House
PROJ. NO#
TESTERS
COMMENTS:

DATE 11/9/93
TEST #
PRE/POST TEST
REGULATORS

GAS ANALYZED O2
INSTRUMENT Combustion Eng.
SERIAL #
CALIBRATOR

CYLINDER #	CONCENTRATION % ~~OR PPM~~	ANALYZER RESPONSE	RECORDER OUTPUT	ADJUSTED VALUE	PERCENT DEVIATION
UNITS					
TIME:					
7:20	21%	21%	83%		
8:25	11.5%	12%	47%		
13:05	11.5%	12.2%	47%		
TIME:					
TIME:					

KEYSTONE ENVIRONMENTAL RESOURCES, INC

APPENDIX C

ANALYTICAL DATA

CHESTER LAB - MONROEVILLE

Summary of Analytical Results

Date received: 24-AUG-1993 Customer: Chester Environmental Job name: M93-08-95

		Samples					
Keystone ID		95-001	95-002	95-003	95-004	95-005	95-006
Date Sampled		18-AUG-1993	19-AUG-1993	19-AUG-1993	18-AUG-1993	19-AUG-1993	19-AUG-1993
Customer ID		LHV-COG-NH4-1	LHV-COG-NH4-2	LHV-COG-NH4-BLANK	LHV-COG-CN-1	LHV-COG-CN-2	LHV-COG-CN-BLANK
Parameters	Units						
Ammonia Nitrogen as N	mg/L	581	497	<0.1	NR	NR	NR
Cyanide	mg/L	NR	NR	NR	116	125	<0.005

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

CHAIN OF CUSTODY RECORD

PROJECT NUMBER	300240-01
PROJECT NAME	LTV Steel
ANALYTICAL LAB	Chester Labnet - Monroeville
DELIVER TO	Linda Bordone
COMMENTS	Need lab to record Total Volumes of the samples submitted

SAMPLE IDENTIFICATION NUMBER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	COMP	GRAB	NO. OF CONTAINERS	ANALYSES TO BE CONDUCTED: Total NH4	Total CN	REMARKS OR OBSERVATIONS
LTV-COG-NH4-1	8/18/93		✓		1	✓		350 ml
LTV-COG-NH4-2	8/19/93		✓		1	✓		350 ml
LTV-COG-NH4-BLANK	8/19/93		✓		1	✓		346 ml
LTV-COG-CN-1	8/18/93		✓		1		✓	330 ml
LTV-COG-CN-2	8/19/93		✓		1		✓	355 ml
LTV-COG-CN-BLANK	8/19/93		✓		1		✓	335 ml

Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
Patricia J. Hoellen	8/24/93	1030			

COMP = Composite Sample
GRAB = Grab Sample

AQE 7/92

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 708-953-9300 FAX: 708-953-9306

Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 32, CHARLEROI, PA 15022
TEL: (412) 483-3549
FAX: (412) 483-0892

October 5, 1993

CHESTER ENVIRONMENTAL
3000 TECH CENTER DRIVE
MONROEVILLE PA 15146

Sample identification by
CHESTER ENVIRONMENTAL

LTV 8-18

Kind of sample reported to us COAL SAMPLE

Sample taken at --

Sample taken by SUBMITTED

Date sampled ------

Date received September 29, 1993

Analysis Report No. 43-138709

PROXIMATE ANALYSIS	As Received	Dry Basis
% Moisture	7.18	xxxxx
% Ash	5.43	5.85
% Volatile	23.12	24.91
% Fixed Carbon	64.27	69.24
	100.00	100.00
Btu/lb	13597	14649
% Sulfur	1.09	1.17
MAF Btu		15559

ULTIMATE ANALYSIS	As Received	Dry Basis
% Moisture	7.18	xxxxx
% Carbon	77.24	83.21
% Hydrogen	4.39	4.73
% Nitrogen	1.49	1.61
% Sulfur	1.09	1.17
% Ash	5.43	5.85
% Oxygen(diff)	3.18	3.43
	100.00	100.00

OXIDATION INDEX = 97

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Charleroi Laboratory

COMMERCIAL TESTING & ENGINEERING CO.
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October 5, 1993

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TEL: (412) 483-3549
FAX: (412) 483-0892

CHESTER ENVIRONMENTAL
3000 TECH CENTER DRIVE
MONROEVILLE PA 15146

Sample identification by
CHESTER ENVIRONMENTAL

LTV 8-19

Kind of sample reported to us: COAL SAMPLE

Sample taken at: --

Sample taken by: SUBMITTED

Date sampled: ------

Date received: September 29, 1993

Analysis Report No. 43-138710

PROXIMATE ANALYSIS	As Received	Dry Basis
% Moisture	6.98	XXXXX
% Ash	4.90	5.27
% Volatile	23.89	25.68
% Fixed Carbon	64.23	69.05
	100.00	100.00
Btu/lb	13745	14776
% Sulfur	1.08	1.16
MAF Btu		15598

ULTIMATE ANALYSIS	As Received	Dry Basis
% Moisture	6.98	XXXXX
% Carbon	77.63	83.46
% Hydrogen	4.41	4.74
% Nitrogen	1.51	1.62
% Sulfur	1.08	1.16
% Ash	4.90	5.27
% Oxygen(diff)	3.49	3.75
	100.00	100.00

OXIDATION INDEX = 97

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Charleroi Laboratory

TERMS AND CONDITIONS ON REVERSE

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 708-953-9300 FAX: 708-953-9306

SINCE 1908

Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 32, CHARLEROI, PA 15022
TEL: (412) 483-3549
FAX: (412) 483-0892

October 5, 1993

CHESTER ENVIRONMENTAL
3000 TECH CENTER DRIVE
MONROEVILLE PA 15146

Sample identification by
CHESTER ENVIRONMENTAL

LTV 8-13

Kind of sample reported to us: COAL SAMPLE

Sample taken at: --

Sample taken by: SUBMITTED

Date sampled: ------

Date received: September 29, 1993

Analysis Report No. 43-138708

PROXIMATE ANALYSIS	As Received	Dry Basis
% Moisture	0.53	xxxxx
% Ash	5.72	5.75
% Volatile	25.55	25.69
% Fixed Carbon	68.20	68.56
	100.00	100.00
Btu/lb	14577	14655
% Sulfur	1.11	1.12
MAF Btu	--	15549

ULTIMATE ANALYSIS	As Received	Dry Basis
% Moisture	0.53	xxxxx
% Carbon	83.44	83.88
% Hydrogen	4.71	4.74
% Nitrogen	1.59	1.60
% Sulfur	1.11	1.12
% Ash	5.72	5.75
% Oxygen(diff)	2.90	2.91
	100.00	100.00

OXIDATION INDEX = 98

Respectfully submitted.
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Charleroi Laboratory

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 32, CHARLEROI, PA 15022
TEL: (412) 483-3549
FAX: (412) 483-0892

October 5, 1993

CHESTER ENVIRONMENTAL
3000 TECH CENTER DRIVE
MONROEVILLE PA 15146

Sample identification by
CHESTER ENVIRONMENTAL

LTV 8-12

Kind of sample reported to us: COAL SAMPLE

Sample taken at: --

Sample taken by: SUBMITTED

Date sampled: ------

Date received: September 29, 1993

Analysis Report No. 43-138707

PROXIMATE ANALYSIS	As Received	Dry Basis
% Moisture	0.65	XXXXX
% Ash	5.01	5.04
% Volatile	24.35	24.51
% Fixed Carbon	69.99	70.45
	100.00	100.00
Btu/lb	14720	14816
% Sulfur	1.02	1.03
MAF Btu		15602

ULTIMATE ANALYSIS	As Received	Dry Basis
% Moisture	0.65	XXXXX
% Carbon	83.82	84.37
% Hydrogen	4.71	4.74
% Nitrogen	1.60	1.61
% Sulfur	1.02	1.03
% Ash	5.01	5.04
% Oxygen(diff)	3.19	3.21
	100.00	100.00

OXIDATION INDEX = 98

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Charleroi Laboratory

TERMS AND CONDITIONS ON REVERSE

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

CHAIN OF CUSTODY RECORD

Page of

PROJECT NUMBER	300240
PROJECT NAME	LTV
ANALYTICAL LAB	Commercial Testing & Engineering Company
DELIVER TO	Bill Smith
COMMENTS	

SAMPLE IDENTIFICATION NUMBER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	COMP	GRAB	NO. OF CONTAINERS	ANALYSES TO BE CONDUCTED: Proximate Analysis including Moisture	Ultimate Analysis	% Light Transmittance for Oxidation					REMARKS OR OBSERVATIONS
LTV - 8/12	8/12/93	—		X	1	X	X	X					
LTV - 8/13	8/13/93	—		↓	↓	X	X	X					
LTV - 8/18	8/18/93	—				X	X	X					
LTV - 8/19	8/19/93	—				X	X	X					

Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
	8/28/93	1630			

COMP = Composite Sample
GRAB = Grab Sample

AQE 7/92

LABORATORY REPORT
JL 17515 (R 5-71)

Works

Date 8-20-93

WINDBOX SAMPLES 8-19-93

	O_2	N_2	CO_2
P-1 WINDBOX 1355 hrs	5.7	68.5	3.9
P-2 WINDBOX 1325 hrs	8.3	63.7	3.5
P-3 SOUTH WINDBOX 0950 hrs	6.6	71.4	5.0
P-3 NORTH WINDBOX 1250 hrs.	6.6	72.6	5.1
P-4 WINDBOX 0935	6.8	62.7	4.3

P-3 UNDERFIRE GAS ANALYSIS:

	CO_2	IL.	O_2	CO	H_2	CH_4	N_2	B.T.U. GROSS	B.T.U. NET	Sp Gr.
	0.4	2.8	0.4	4.1	55.6	22.5	3.6	474	420	.28

J. & L. Pittsburgh

GAS ANALYSES

93 DATE	TIME - PLACE SAMPLED	$\%CO_2$	%Ill.	$\%O_2$	%CO	$\%H_2$	$\%CH_4$	$\%N_2$	B.T.U. Gross	B.T.U. Net	Sp. Gr.
7/20	AM. - P-3 UF.	0.7	2.8	0.5	4.3	56.5	23.6	6.2	488	439	.320
7/21	"	0.6	2.8	0.4	4.2	56.3	24.2	5.0	494	438	.308
7/22	"	0.7	2.7	0.5	4.1	56.9	23.9	5.2	490	435	.309
7/23	"	0.6	2.7	0.7	4.6	55.7	23.2	7.1	481	427	0.328
7-26	"	0.5	2.5	1.0	4.2	56.5	23.5	6.0	482	427	.316
7-27	"	0.5	2.6	0.8	4.4	58.3	23.7	7.3	492	436	.331
7-28	P-4 R. Rm	0.6	2.5	1.0	4.3	57.8	23.8	8.4	489	434	.344
7-29	" "	0.6	2.6	0.3	4.6	57.7	23.5	5.9	509	452	.325
7/29	P-3 Underfiring	0.7	2.6	0.9	4.3	55.8	22.6	6.9	472	419	0.323
8/3/93	" " "	0.7	2.5	1.0	4.3	55.5	22.2	8.4	465	413	0.335
8/4/93	" "	0.4	2.7	0.7	4.3	56.9	24.0	4.3	492	436	0.301
8/5/93	" "	0.6	2.6	1.0	3.9	54.8	22.2	9.64	464	411	0.340
8/6/93	" "	0.5	2.5	0.9	4.2	56.1	22.3	6.5	468	415	0.312
8/9	" "	0.5	2.6	0.4	4.2	56.5	23.2	4.2	480	426	.291
8/10	" "	0.7	2.6	0.4	4.4	56.2	23.6	6.7	484	429	.322
8/11	" "	0.5	2.6	0.5	4.2	58.9	24.2	5.5	498	441	0.312
8/12	" "	0.5	2.5	0.8	4.0	56.4	23.2	7.6	478	423	.325
8/13	" "	0.6	2.4	0.7	4.2	55.9	23.0	6.5	473	419	.314
8-16	" "	0.4	2.7	0.8	4.0	56.3	23.6	5.2	485	430	.305
8-17	" "	0.4	2.8	0.8	4.1	58.5	23.1	5.5	489	434	.313
8-18	" "	0.5	2.7	0.9	4.3	55.8	22.9	6.6	477	423	.320

APPENDIX D

CALIBRATION DATA

CONTROL BOX CALIBRATION
SIX POINT CALIBRATION

BOX # 1 BP 29.05 In. Hg
DATE 07-16-93 OPERATOR RPC

	WET TEST METER				DRY TEST METER					METER COEFFICIENT Y	ORIFICE COEFFICIENT ΔH@
	TIME (min)	TEMP TW	VOLUME VM	PRESSURE PW	TEMP IN TI	TEMP OUT TO	TEMP AVG TA	ORIFICE PD	VOLUME VD		
START			0.000	29.05				0.50	574.400		
HALF		80.0			94.0	82.0	88.0				
STOP	12.88		5.000						579.395		
CALCULATION	12.88	540.0	5.013	29.05			548.0	29.09	4.995	1.0171	1.917
START			0.000	29.05				1.00	579.500		
HALF		80.0			102.0	86.0	94.0				
STOP	9.00		5.000						584.390		
CALCULATION	9.00	540.0	5.013	29.05			554.0	29.12	4.890	1.0490	1.852
START			0.000	29.05				1.50	584.600		
HALF		80.0			107.0	89.0	98.0				
STOP	14.67		10.000						594.616		
CALCULATION	14.67	540.0	10.025	29.05			558.0	29.16	10.016	1.0303	1.832
START			0.000	29.05				2.00	594.900		
HALF		80.0			111.0	92.0	101.5				
STOP	12.82		10.000						604.939		
CALCULATION	12.82	540.0	10.025	29.05			561.5	29.20	10.039	1.0331	1.853
START			0.000	29.05				3.00	605.300		
HALF		80.0			114.0	93.0	103.5				
STOP	10.65		10.000						615.309		
CALCULATION	10.65	540.0	10.025	29.05			563.5	29.27	10.009	1.0373	1.912
START			0.000	29.05				4.00	615.700		
HALF		81.0			115.0	94.0	104.5				
STOP	9.27		10.000						625.698		
CALCULATION	9.27	541.0	10.025	29.05			564.5	29.34	9.998	1.0358	1.935
AVERAGE										1.0338	1.883

PRE-TEST MAGNEHELIC CALIBRATION
BOX # 1
DATE 07-16-93
OPERATOR RPC

0 to 10" H2O RANGE

MAGNEHELIC

Δ P	MANOMETER
0.50	0.50
1.00	1.00
2.00	2.00
4.00	4.00
6.00	6.00
8.00	8.00

0 to 0.50" H2O RANGE

MAGNEHELIC

Δ P	MANOMETER
0.50	0.49
0.40	0.40
0.30	0.30
0.20	0.20
0.10	0.10

0 to 5" H2O RANGE

MAGNEHELIC

Δ H	MANOMETER
4.00	4.00
3.00	3.00
2.00	2.00
1.00	1.00
0.50	0.50

PRE-TEST LEAK CHECK
DATE 071693
OPERATOR RPC

	START CF	STOP CF	VOLUME CF	TIME (min)	LEAK RATE
DRY	574.060	574.250	0.190	10.000	0.004
WET	0.000	0.230	0.230		

PYROMETER CALIBRATION
DATE 04-28-88
OPERATOR AGL

VOLTAGE INPUT (mV)	ARGE TEMP (°F)	TEMP READING (°F)
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	150.0
3.82	200	200.0
6.09	300	301.0
8.31	400	400.0
10.57	500	500.0

PRE-TEST PYROMETER CHECK
DATE 07-16-93
OPERATOR RPC

VOLTAGE INPUT (mV)	TARGET TEMP (°F)	TEMP READING (°F)
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	91.0
1.74	110	110.0
2.66	150	151.0
3.82	200	202.0
6.09	300	302.0
8.31	400	402.0
10.57	500	502.0

CONTROL BOX CALIBRATION

THREE POINT CALIBRATION

BOX # 3 BP 28.9 In. Hg
DATE 07-02-93 OPERATOR RPC

	WET TEST METER				DRY TEST METER					METER COEFFICIENT Y	ORIFICE COEFFICIENT ΔH@
	TIME (min)	TEMP TW	VOLUME VM	PRESSURE PW	TEMP IN TI	TEMP OUT TO	TEMP AVG TA	ORIFICE PD	VOLUME VD		
START			0.000	28.90				0.50	74.200		
HALF		78.0			104.0	92.0	98.0				
STOP	11.48		5.000						79.348		
CALCULATION	11.48	538.0	5.013	28.90			558.0	28.94	5.148	1.0086	1.492
START			0.000	28.90				1.00	79.700		
HALF		78.0			108.0	94.0	101.0				
STOP	8.43		5.000						84.836		
CALCULATION	8.43	538.0	5.013	28.90			561.0	28.97	5.136	1.0151	1.601
START			0.000	28.90				2.00	96.600		
HALF		79.0			117.0	98.0	107.5				
STOP	12.05		10.000						106.880		
CALCULATION	12.05	539.0	10.025	28.90			567.5	29.05	10.280	1.0216	1.623
AVERAGE										1.0151	1.572

PRE-TEST MAGNEHELIC CALIBRATION
BOX# 3
DATE 07-02-93
OPERATOR RPC

0 to 10" H2O RANGE

MAGNEHELIC Δ P	MANOMETER
0.50	0.50
1.00	1.00
2.00	2.00
4.00	4.00
6.00	6.00
8.00	8.00

0 to 0.50" H2O RANGE

MAGNEHELIC Δ P	MANOMETER
0.50	0.50
0.40	0.40
0.30	0.30
0.20	0.20
0.10	0.10

0 to 5" H2O RANGE

MAGNEHELIC ΔH	MANOMETER
4.00	4.00
3.00	3.00
2.00	2.00
1.00	1.00
0.50	0.50

PRE-TEST LEAK CHECK
DATE 07-02-93
OPERATOR RPC

	START CF	STOP CF	VOLUME CF	TIME (min)	LEAK RATE
DRY	73.610	73.795	0.185	10.000	0.004
WET	0.000	0.230	0.230		

PYROMETER CALIBRATION
DATE 04-28-88
OPERATOR AGL

VOLTAGE INPUT (mV)	ARGE TEMP (°F)	TEMP READING (°F)
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	150.0
3.82	200	200.0
6.09	300	301.0
8.31	400	400.0
10.57	500	500.0

PRE-TEST PYROMETER CHECK
DATE 07-02-93
OPERATOR RPC

VOLTAGE INPUT (mV)	TARGET TEMP (°F)	TEMP READING (°F)
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	150.0
3.82	200	201.0
6.09	300	300.0
8.31	400	402.0
10.57	500	502.0

CONTROL BOX CALIBRATION

THREE POINT CALIBRATION

BOX # 6 BP 28.95 in. Hg
DATE 06-09-93 OPERATOR RPC

	WET TEST METER				DRY TEST METER					METER COEFFICIENT	ORIFICE COEFFICIENT
	TIME (min)	TEMP TW	VOLUME VM	PRESSURE PW	TEMP IN TI	TEMP OUT TO	TEMP AVG TA	ORIFICE PD	VOLUME VD	Y	ΔH@
START			0.000	28.95				0.50	665.100		
HALF		84			98	90	94				
STOP	13.18		5.000						670.360		
CALCULATION	13.18	544	5.013	28.95			554	28.99	5.260	0.9692	2.022
START			0.000	28.95				1.00	670.800		
HALF		84			111	95	103				
STOP	9.33		5.000						676.100		
CALCULATION	9.33	544	5.013	28.95			563	29.02	5.300	0.9763	1.994
START			0.000	28.95				2.00	676.700		
HALF		84			120	99	110				
STOP	6.63		5.000						681.931		
CALCULATION	6.63	544	5.013	28.95			570	29.10	5.231	0.9981	1.991
AVERAGE										0.9812	2.002

PRE-TEST MAGNEHELIC CALIBRATION
BOX# 6
DATE 06-09-93
OPERATOR RPC

0 to 10" H2O RANGE

MAGNEHELIC Δ P	MANOMETER
0.50	0.50
1.00	1.00
2.00	2.00
4.00	4.00
6.00	6.00
8.00	8.00

0 to 0.50" H2O RANGE

MAGNEHELIC Δ P	MANOMETER
0.50	---
0.40	---
0.30	---
0.20	---
0.10	---

Calibration not necessary.
Primary standard on control box.

0 to 5" H2O RANGE

MAGNEHELIC Δ H	MANOMETER
4.00	4.00
3.00	3.00
2.00	2.00
1.00	1.00
0.50	0.50

PRE-TEST LEAK CHECK
DATE 06-09-03
OPERATOR RPC

	START CF	STOP CF	VOLUME CF	TIME (min)	LEAK RATE
DRY	664.505	664.735	0.230	10.000	-0.001
WET	0.000	0.220	0.220		

PYROMETER CALIBRATION
DATE 04-28-88
OPERATOR AGL

VOLTAGE INPUT (mV)	ARGE TEMP (°F)	TEMP READING (°F)
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	150.0
3.82	200	200.0
6.09	300	301.0
8.31	400	400.0
10.57	500	500.0

PRE-TEST PYROMETER CHECK
DATE 06-09-93
OPERATOR RPC

VOLTAGE INPUT (mV)	TARGET TEMP (°F)	TEMP READING (°F)
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	151.0
3.82	200	201.0
6.09	300	303.0
8.31	400	403.0
10.57	500	503.0

CONTROL BOX CALIBRATION

THREE POINT CALIBRATION

BOX # 7 BP 28.95 In. Hg
DATE 05-17-93 OPERATOR RPC

	WET TEST METER				DRY TEST METER					METER COEFFICIENT Y	ORIFICE COEFFICIENT ΔH@
	TIME (min)	TEMP TW	VOLUME VM	PRESSURE PW	TEMP IN TI	TEMP OUT TO	TEMP AVG TA	ORIFICE PD	VOLUME VD		
START			0.000	28.95				0.50	39.300		
HALF		72			104	78	91				
STOP	12.70		5.000						44.700		
CALCULATION	12.70	532	5.013	28.95			551	28.99	5.400	0.9602	1.805
START			0.000	28.95				1.00	45.200		
HALF		73			107	81	94				
STOP	9.00		5.000						50.606		
CALCULATION	9.00	533	5.013	28.95			554	29.02	5.406	0.9613	1.810
START			0.000	28.95				2.00	51.800		
HALF		74			110	83	97				
STOP	6.33		5.000						57.190		
CALCULATION	6.33	534	5.013	28.95			557	29.10	5.390	0.9642	1.790
AVERAGE										0.9619	1.802

PRE-TEST MAGNEHELIC CALIBRATION
BOX# 7
DATE 05-17-93
OPERATOR RPC

0 to 10" H2O RANGE

MAGNEHELIC ΔP	MANOMETER
0.50	0.50
1.00	1.00
2.00	2.00
4.00	4.00
6.00	6.00
8.00	8.00

0 to 0.50" H2O RANGE

MAGNEHELIC ΔP	MANOMETER
0.50	---
0.40	---
0.30	---
0.20	---
0.10	---

Calibration not necessary.
Primary standard on control box.

0 to 3" H2O RANGE

MAGNEHELIC ΔH	MANOMETER
3.00	3.00
2.00	2.00
1.00	1.00
0.50	0.50

PRE-TEST LEAK CHECK
DATE 05-17-93
OPERATOR RPC

	START CF	STOP CF	VOLUME CF	TIME (min)	LEAK RATE
DRY	38.650	38.878	0.228	10.000	-0.003
WET	0.000	0.202	0.202		

PYROMETER CALIBRATION
DATE 04-28-88
OPERATOR AGL

VOLTAGE INPUT (mV)	ARGE TEMP (°F)	TEMP READING (°F)
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	150.0
3.82	200	200.0
6.09	300	301.0
8.31	400	400.0
10.57	500	500.0

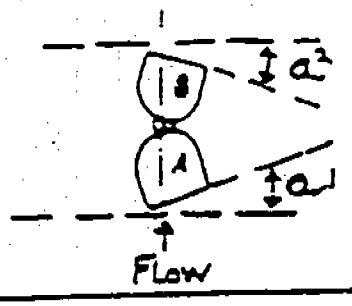
PRE-TEST PYROMETER CHECK
DATE 05-17-93
OPERATOR RPC

VOLTAGE INPUT (mV)	TARGET TEMP (°F)	TEMP READING (°F)
0.18	40	41.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	150.0
3.82	200	200.0
6.09	300	299.0
8.31	400	399.0
10.57	500	498.0

GEOMETRIC PITOT CALIBRATION

Caliper # XSF-59
Precheck
Post Check ✓

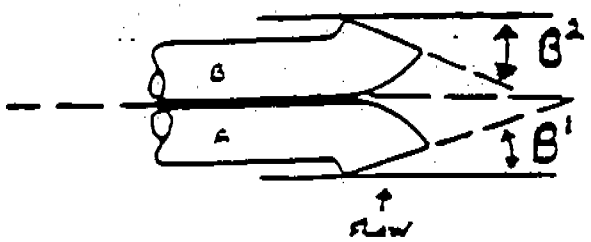
Probe #: 15-1
Date: 06-07-93
Initials: RPC

① 

a^2 = 0°
a^1 = 1°
a^1, a^2 = <10°

B^1 = 0°
B^2 = 1°
B^1, B^2 = <5°

F = .910"

② 

μ = .0158 — μ = ≤ 0.1250" ($\mu = F \tan \gamma$)

V = 0 — V = ≤0.03125" ($V = F \tan \theta$)

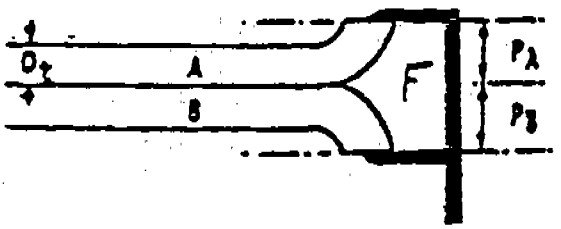
W = .755 — W ≥ 0"

X = .760 — X ≥ 0.750" (3/4" using 1/2" nozzle)

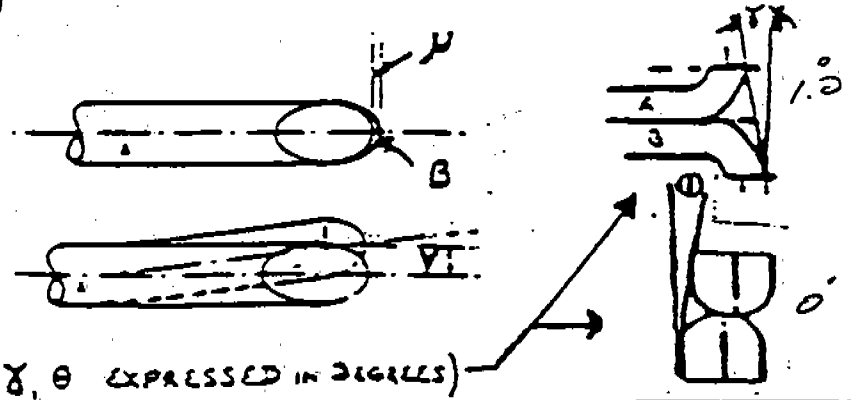
Y = 6.10 — Y ≥ 3.0"

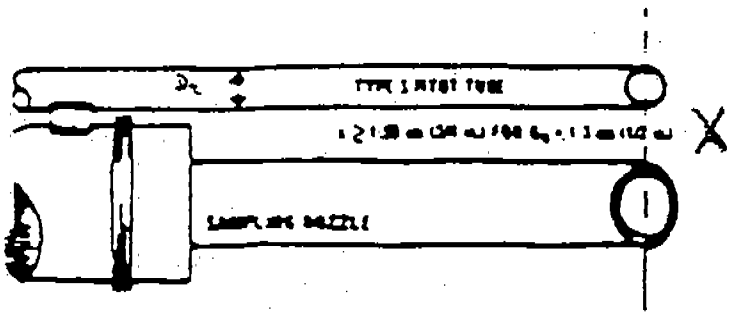
Z = 2.10 — Z > 2.0"

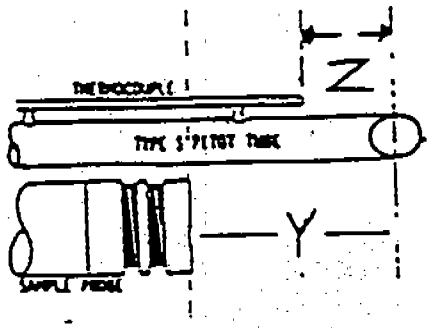
D_t = .375 — D_t > .1875"

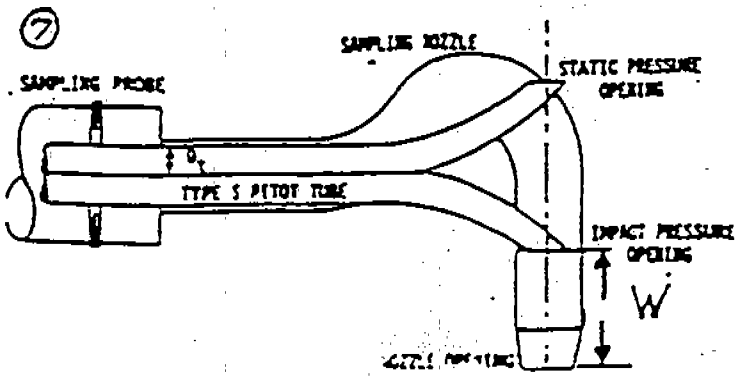
③ 

1.05 D_t < A < 1.50 D_t
$P_A = P_B$
2.10 D_t < A < 3.00 D_t

④ 

⑤ 

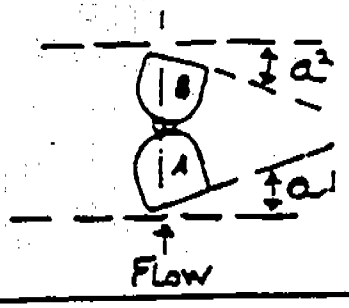
⑥ 

⑦ 

GEOMETRIC PITOT CALIBRATION

Caliper # XCF-59
Precheck
Post Check ✓

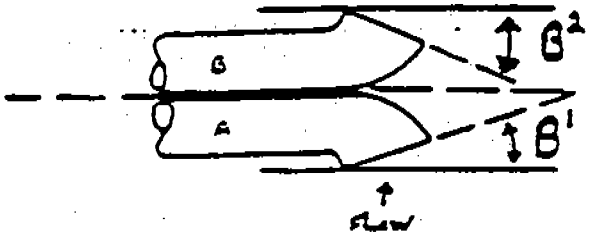
Probe #: S-1
Date: 10-25-93
Initials: [illegible]

① 

a¹ = 2.0 "
a² = 5.0 " → a¹, a² = <10°

B¹ = 4.0 "
B² = 3.0 " → B¹, B² = <5°

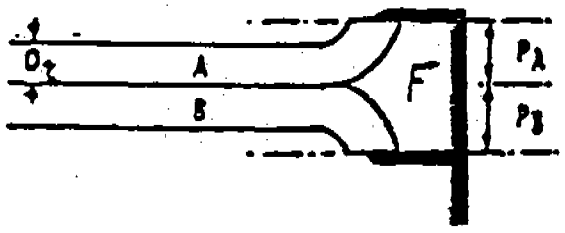
F = 1.022 "

② 

μ = 0.0524 μ = ≤ 0.1250" (μ = F TAN γ)

V = 0.0262 V = ≤0.03125" (V = F TAN θ)

W = 0.418 W ≥ 0"

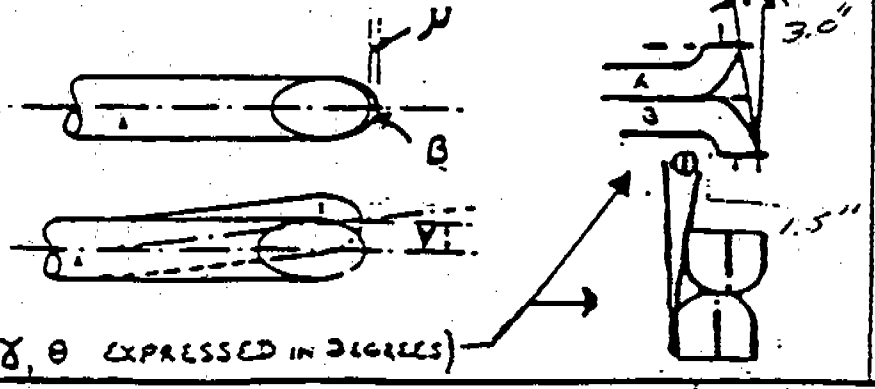
③ 

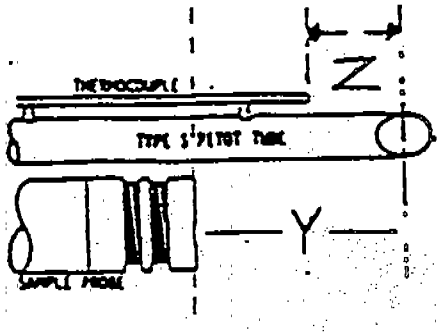
X = 1.082 X ≥ 0.750" (3/4" using 1/2" nozzle)

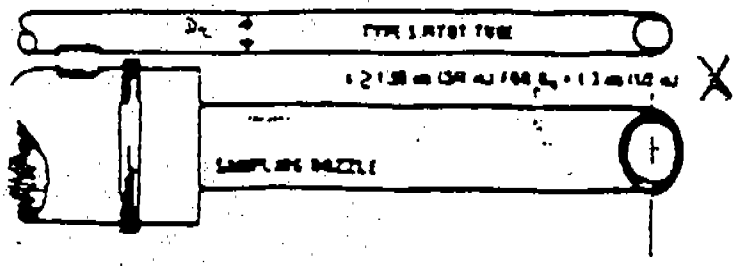
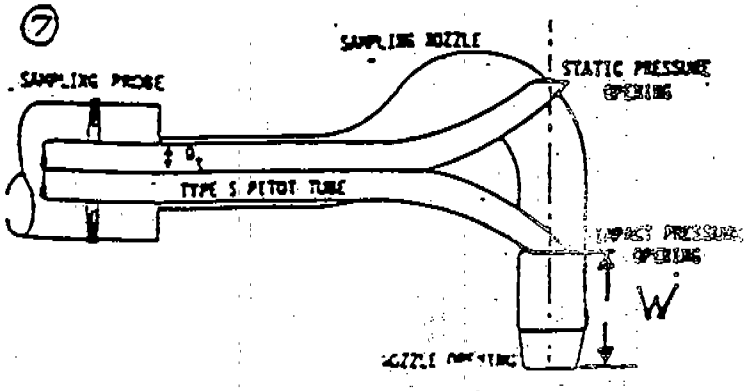
Y = 6.000 Y ≥ 3.0"

Z = 3.495 Z > 2.0"

D_t = .375 D_t > .1875"

④ 

⑥ 

⑤ 

⑦