639 Alpha Drive
Pittsburgh, Pennsylvania 15238
Telephone (412) 967-1900
FAX (412) 967-1911

ADVANCED TECHNOLOGY SYSTEMS, INC.

ATS Project No. 00-016-P

September 13, 2000

Mr. William C. Graeser
Manager – Environmental and Quality Assurance
U.S. Steel Clairton Works
400 State Street
Clairton, PA 15025

RE: LETTER REPORT – HYDROCHLORIC ACID AND CHLORINE GAS EMISISONS TESTING CONDUCTED AT B-BATTERY COMBUSTION STACK ON MARCH 8, 2000

Dear Mr. Graeser:

This letter, with attachments, constitutes the report that summarizes the results of the hydrochloric acid (HCl) and chlorine gas (Cl_2) emissions testing conducted at B-Battery Combustion Stack by Advanced Technology Systems, Inc. (ATS). Three two-hour test runs were conducted on March 8, 2000 simultaneous with the compliance test program at this stack (particulate matter and visible emissions were measured as part of the compliance test program).

The test results have been summarized in the attached Table 1. Hydrochloric acid and chlorine gas concentrations are listed in units of milligrams per dry standard cubic meter (mg/dscm). Hydrochloric acid and chlorine gas mass emission rates are listed in units of pounds per hour (lb/hr). Table 1 also presents pertinent exhaust gas and sampling parameters including exhaust gas flow rates in units of actual cubic feet per minute (acfm), standard cubic feet per minute (scfm), and dry standard cubic feet per minute (dscfm), exhaust gas temperature (^{O}F), and moisture content of the exhaust gas (percent by volume), gas volume sampled for each test run in units of dry standard cubic feet (dscf) and the isokinetic variation value for each test run. The isokinetic variation value is equal to the ratio of the average linear gas velocity sampled through the probe nozzle to the average exhaust gas velocity. All isokinetic variation values are between 90 percent and 110 percent, which is the acceptable range of values. Actual test sampling times have also been included in Table 1.

Hydrochloric acid and chlorine gas emission testing was performed in accordance with U.S. EPA Reference Methods 1 through 4 and 26A and the requirements of the Pennsylvania Department of Environmental Protection (PA DEP) Source Testing Manual (Draft Revision 3.1, May 3, 1999). Detailed information regarding the procedures used to measure the exhaust gas stream velocity and volumetric flow rate (i.e., U.S. EPA Reference Methods 1 through 4) can be found in the summary report for the compliance test program. Hydrochloric acid and chlorine gas sampling was performed in accordance with U.S. EPA Reference Method 26A. Process gas samples were withdrawn

isokinetically from the stack, with particulate matter collected in a glass nozzle, a heated glass-lined probe, and on a heated quartz filter. Vapor phase hydrochloric acid and chlorine gas were collected in a series of chilled impingers. The impinger type and sequence is listed below:

No.	Impinger Type	Contents
1.	Modified Greenburg-Smith	50 mL 0.1 N sulfuric acid (for HCl collection)
2.	Greenburg-Smith	100 mL 0.1 N sulfuric acid (for HCl collection)
3.	Greenburg-Smith	100 mL 0.1 N sulfuric acid (for HCl collection)
4.	Modified Greenburg-Smith	100 mL 0.1 N sodium hydroxide (for Cl_2 collection)
5.	Modified Greenburg-Smith	100 mL 0.1 N sodium hydroxide (for Cl_2 collection)
6.	Modified Greenburg-Smith	200 g Silica Gel

A gas volume greater than 50 dry standard cubic feet (dscf) – the minimum gas volume required by the PA DEP for the compliance test program - was sampled for each test run. The flow rate through each sample train was less than 1 dry standard cubic foot per minute as required by U.S. EPA Reference Method 26A.

Following each test run, the sample trains were processed in accordance with PA DEP requirements. Detailed information regarding the procedures used to recover the particulate matter catch (essentially U.S. EPA Reference Method 5 procedures) can be found in the summary report for the compliance test program. Following the gravimetric analysis of the impingers for moisture gain, the following four samples fractions were generated for each sample train:

Fraction	Description
A	Contents of Impinger Nos. 1 & 2 plus applicable distilled deionized water rinses (for HCl)
B	Contents of Impinger No. 3 plus applicable distilled deionized water rinses (for HCl)
C	Contents of Impinger No. 4 plus applicable distilled deionized water rinses (for Cl_2)
D	Contents of Impinger No. 5 plus applicable distilled deionized water rinses (for Cl_2)

For each sample train, each of the four fractions were analyzed separately as required by the PA DEP to allow for the calculation of the collection efficiency of the sample train for HCl and Cl_2 collection. The contents of Impinger No. 6 were discarded.

The actual test samples plus field blanks of the impinger scrubbing solutions (0.1 N sulfuric acid and 0.1 N sodium hydroxide) were submitted to the subcontract analytical laboratory for chloride ion analyses using ion chromatographic techniques in accordance with U.S. EPA Reference Method 26A. The analytical laboratory results showed the following:

- The chloride ion concentrations of the field blanks were less than the analytical detection limit;

- For all three test runs, the HCl collection efficiency of the sample train was calculated to be greater than the minimum collection efficiency specified by the PA DEP (i.e., the chloride catch of the Sample Fraction B was at most 10 percent of the chloride catch from Sample Fraction A plus Sample Fraction B); and

- For the first test run, the Cl_2 collection efficiency of the sample train was calculated to be greater than the minimum collection efficiency specified by the PA DEP (i.e., the chloride catch of the Sample Fraction D was at most 10 percent of the chloride catch from Sample Fraction C plus Sample Fraction D). The Cl_2 collection efficiency of the sample train for the second and third test runs could not be calculated since the chloride catches in Sample Fractions C and D were less than the analytical detection limit.

Copies of the field data sheets, equipment calibration data, analytical laboratory results and emissions calculations are included in the appendix.

ATS appreciates the opportunity to provide U.S. Steel with process gas testing services. If you have any questions regarding this letter report, please call Dr. Robinson Khosah or me at (412) 967-1900 or e-mail me at the following address: jshimshock@atsengineers.com.

Very truly yours,

John P. Shimshock

John P. Shimshock, Ph.D.
Senior Project Scientist

Approved by:

Robinson P. Khosah, Ph.D.
Vice President
Science and Technology Division

JPS/blc
Enclosures

U.S. STEEL CLAIRTON WORKS
CLAIRTON, PENNSYLVANIA

TABLE 1

B-BATTERY COMBUSTION STACK
HYDROCHLORIC ACID AND CHLORINE GAS EMISSIONS DATA
MARCH 8, 2000

		Run 1	Run 2	Run 3	Average
Emissions Data					
Hydrochloric Acid (HCl)					
Concentration	(mg/dscm)	1.29E+01	1.12E+01	1.09E+01	1.17E+01
Mass Emission Rate	(lb/hr)	2.60E+00	2.31E+00	2.22E+00	2.38E+00
Chlorine Gas (Cl_2)					
Concentration	(mg/dscm)	4.83E-01	< 1.93E-02	< 2.09E-02	< 1.74E-01
Mass Emission Rate	(lb/hr)	9.72E-02	< 3.98E-03	< 4.26E-03	< 3.51E-02
Exhaust Stack Conditions					
Volumetric Flow Rate	(acfm)	1.13E+05	1.15E+05	1.10E+05	1.13E+05
	(scfm)	6.30E+04	6.40E+04	6.26E+04	6.32E+04
	(dscfm)	5.37E+04	5.51E+04	5.44E+04	5.44E+04
Temperature	(°F)	473	472	455	467
Moisture Content	(%)	14.8	14.0	13.1	14.0
Sampling Conditions					
Test Times	(EST)	0805 to 1020	1053 to 1309	1350 to 1605	
Sampling Time - *	(minutes)	120	120	120	
Sample Volume - **	(dscf)	55.359	56.288	53.894	
Isokinetic Variation - ***	(%)	107.9	107.0	103.7	

mg / dscm = milligrams per dry standard cubic meter
*: Minimum required sampling time is 2 hours (120 minutes)
**: Minimum required sample volume is 50 dscf
***: Acceptable range of values is 90.0% <= Isokinetic Variation < = 110.0%

U.S. STEEL CLAIRTON WORKS
CLAIRTON, PENNSYLVANIA

Hydrochloric Acid and Chlorine Gas Emissions Testing Conducted at B-Battery Combustion Stack on March 8, 2000

September 2000

APPENDIX

Field Data Sheets, Equipment Calibration Data, Analytical Laboratory Results and Emissions Calculations

ATS
ADVANCED TECHNOLOGY SYSTEMS, INC.

HIGH FLOW SOURCE SAMPLING DATA SHEET

Page 1 of 2

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	7
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 1	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	467 QTZ
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10 - 1
TEST CREW	JS, KA, RS.	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 016 - P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
A	55.5	0805	714.685	0.04	0.82	0.82	4.0	241	468	73	71	245	63	5 min./pt.
	39.0			0.04	0.82	0.82	4.0	241	480	77	72	245	63	
	27.7			0.04	0.81	0.81	4.0	242	490	81	72	245	58	
	18.4			0.04	0.81	0.81	4.0	242	500	83	73	245	59	
	10.5			0.03	0.61	0.61	3.0	242	500	85	74	244	59	
	3.3	0835	729.141	0.03	0.60	0.60	3.0	242	468	86	74	243	59	
B	55.5	0840	729.141	0.03	0.61	0.61	3.0	242	444	81	76	243	61	
	39.0			0.03	0.61	0.61	3.0	242	451	85	76	243	60	
	27.7			0.03	0.63	0.63	3.0	241	457	87	77	243	60	
	18.4			0.04	0.84	0.84	5.0	241	466	90	78	243	59	
	10.5			0.02	0.42	0.42	2.0	241	466	89	79	243	58	
	3.3	0910	742.181	0.02	0.42	0.42	2.0	242	471	89	79	243	58	
	Page 1	Δ = 60	Δ = 27.496	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.032		0.66			472 (°F)		79 (°F)			Estimates:
	Test	Δ = 120	Δ = 57.614	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.034		0.71			473 (°F)		84 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4.0%	
O2	11.0%	
CO	—	
N2	85.0%	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.010	< 0.02
After	7.00	0.006	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	613.4	489.6	123.8
2.	100 mL 0.1 N H2SO4	612.8	553.5	59.3
3.	100 mL 0.1 N H2SO4	528.5	523.9	4.6
4.	100 mL 0.1 N NaOH	537.8	537.4	0.4
5.	100 mL 0.1 N NaOH	554.6	553.0	1.6
6.	~ 200 g Silica Gel	591.6	578.0	13.6
7.				
8.				total = 203.39

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	7
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 1	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	467 QTZ
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10 - 1
TEST CREW	JS. KA, RS.	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 016 - P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
	55.5	0915	742.181	0.05	1.05	1.05	6.0	242	462	86	81	243	58	5 min./pt.
	39.0			0.06	1.26	1.26	7.0	242	503	92	81	242	58	
	27.7			0.05	1.05	1.05	6.0	241	513	94	82	242	58	
	18.4			0.04	0.84	0.84	5.0	241	522	94	83	242	58	
	10.5			0.03	0.63	0.63	4.0	241	444	94	83	243	62	
	3.3	0945	758.418	0.02	0.42	0.42	2.0	242	446	93	84	243	60	
	55.5	0950	758.418	0.04	0.86	0.86	5.0	242	456	90	85	243	60	
	39.0			0.03	0.64	0.64	3.0	242	468	92	85	242	58	
	27.7			0.03	0.64	0.64	3.0	243	475	93	85	243	58	
	18.4			0.04	0.86	0.86	5.0	243	469	94	85	242	57	
	10.5			0.03	0.64	0.64	3.0	243	476	95	85	242	57	
	3.3	1020	772.299	0.02	0.43	0.43	2.0	242	460	94	86	242	57	
	Page 2	Δ = 60	Δ = 29.118	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.036		0.76			474 (°F)		88 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before			< 0.02
After			< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before		
After		

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4			
2.	100 mL 0.1 N H2SO4			
3.	100 mL 0.1 N H2SO4	946	= 14.8%	
4.	100 mL 0.1 N NaOH			
5.	100 mL 0.1 N NaOH	150.	= 14.8%	
6.	~ 200 g Silica Gel			
7.				
8.				

HIGH FLOW SOURCE SAMPLING DATA SHEET

Page 1 of 2

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	469 GTE
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10 - 1
TEST CREW	JS, KA, RLS	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 016 - P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
A	55.5	1053	772.827	0.04	0.85	0.85	4.0	240	456	86	86	243	60	
	39.0			0.03	0.64	0.64	3.0	240	478	90	86	243	60	5 min./pt.
	27.7			0.04	0.85	0.85	4.0	240	473	93	87	243	60	
	18.4			0.04	0.83	0.83	4.0	240	483	95	87	242	59	
	10.5			0.03	0.63	0.63	3.0	241	475	96	88	242	55	
	3.3	1123	787.370	0.03	0.63	0.63	3.0	241	491	96	88	242	55	
B	55.5	1132	787.370	0.04	0.85	0.85	4.0	242	480	92	89	242	55	
	39.0			0.03	0.63	0.63	3.0	242	445	96	89	242	52	
	27.7			0.03	0.63	0.63	3.0	241	447	96	89	243	52	
	18.4			0.03	0.63	0.63	3.0	241	455	97	90	243	52	
	10.5			0.02	0.43	0.43	2.0	241	460	97	90	243	52	
	3.3		800.842	0.02	0.43	0.43	2.0	242	462	97	90	243	52	
	Page 1	Δ = 60	Δ = 28.015	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.031		0.66			467 (°F)		91 (°F)			Estimates:
	Test	Δ = 120	Δ = 59.544	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.035		0.75			472 (°F)		93 (°F)			%H2O = 13

Dry Gas Composition 27.35

	Run 1	Run 2
CO2	30 %	
O2	12.0 %	
CO	—	
N2	85.0 %	

$= \frac{\Sigma \sqrt{\Delta p}}{n}$

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.004	< 0.02
After	5.00	0.005	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	637.1	512.8	124.3
2.	100 mL 0.1 N H2SO4	618.8	568.9	49.9
3.	100 mL 0.1 N H2SO4	569.4	566.0	3.4
4.	100 mL 0.1 N NaOH	553.1	551.5	1.6
5.	100 mL 0.1 N NaOH	535.3	533.8	1.5
6.	~200 g Silica Gel	661.9	648.6	13.3
7.				
8.		total =	193.6	

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX- 4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	469 QTZ
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10 - 1
TEST CREW	JS, KA, RS.	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 016 - P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
C	55.5	1205	800.842	0.04	0.86	0.86	4.0	241	455	92	90	243	54	
	39.0			0.05	1.08	1.08	5.0	241	485	97	90	243	54	5 min./pt.
	27.7			0.05	1.08	1.08	5.0	242	497	98	90	242	54	
	18.4			0.05	1.02	1.02	5.0	242	506	99	90	242	54	
	10.5			0.04	0.82	0.82	4.0	242	597	99	91	243	55	
	3.3	1235	816.751	0.03	0.61	0.61	2.0	243	461	98	91	243	55	
D	55.5	1239	816.751	0.04	0.86	0.86	4.0	242	452	96	91	243	55	
	39.0			0.04	0.86	0.86	4.0	242	454	96	91	243	55	
	27.7			0.04	0.86	0.86	4.0	242	464	98	91	243	54	
	18.4			0.04	0.86	0.86	4.0	242	467	99	91	243	54	
	10.5			0.03	0.65	0.65	3.0	242	455	99	91	243	54	
	3.3	1309	832.371	0.03	0.65	0.65	3.0	242	451	99	91	243	54	
	Page 2	Δ = 60	Δ = 31.529	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.04		0.844			478 (°F)		94 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

$= \frac{\Sigma \sqrt{\Delta P}}{n}$

System Leak Check (60 sec)

2	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before			< 0.02
After			< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before		
After		

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4			
2.	100 mL 0.1 N H2SO4			
3.	100 mL 0.1 N H2SO4	%H2O = 14.0%		
4.	100 mL 0.1 N NaOH			
5.	100 mL 0.1 N NaOH			
6.	~200 g Silica Gel	Iso. = 107%		
7.				
8.				

HIGH FLOW SOURCE SAMPLING DATA SHEET

Page 1 of 2

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	1
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	470 QTZ
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10 - 1
TEST CREW	JS, KA, RS.	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 016 - P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
A	55.5	1350	833.350	0.03	0.65	0.65	2.0	241	449	89	89	242	59	
	39.0			0.03	0.65	0.65	2.0	241	460	93	89	242	56	5 min./pt.
	27.7			0.03	0.65	0.65	2.0	241	464	95	89	242	56	
	18.4			0.03	0.65	0.65	2.0	242	465	96	90	242	56	
	10.5			0.02	0.43	0.43	2.0	242	470	96	90	242	56	
	3.3	1420	846.294	0.02	0.43	0.43	2.0	242	477	96	90	243	54	
B	55.5	1427	846.294	0.04	0.85	0.85	4.0	241	461	93	90	243	54	
	39.0			0.04	0.85	0.85	4.0	242	509	97	90	243	54	
	27.7			0.03	0.65	0.65	3.0	241	437	98	90	243	54	
	18.4			0.03	0.65	0.65	3.0	241	436	99	90	243	54	
	10.5			0.02	0.43	0.43	2.0	242	440	99	91	243	55	
	3.3	1457	859.875	0.02	0.43	0.43	2.0	241	441	98	91	242	55	
	Page 1	Δ = 60	Δ = 26.525	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.028		0.60			459 (°F)		93 (°F)			
	Test	Δ = 120	Δ = 57.122	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.033		0.70			455 (°F)		94 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition 29.50

	Run 1	Run 2
CO2	3.0	
O2	12.0	
CO	—	
N2	85.0	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.010	<0.02
After	5.00	0.006	<0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	588.1	484.7	103.4
2.	100 mL 0.1 N H2SO4	595.6	546.0	49.6
3.	100 mL 0.1 N H2SO4	568.1	565.9	2.2
4.	100 mL 0.1 N NaOH	524.7	523.4	1.3
5.	100 mL 0.1 N NaOH	545.4	542.9	2.5
6.	~200 g Silica Gel	666.6	653.3	13.3
7.				
8.			Total=	172.39

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX- 4	HOT/COLD BOX NO.	1
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	470 QTZ
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10 - 1
TEST CREW	JS, KA, RS	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 016 - P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
C	55.5	1500	859-875	0.03	0.65	0.65	2.0	242	452	95	92	243	53	5 min./pt.
	39.0			0.05	1.05	1.05	5.0	242	466	99	92	243	53	
	27.7			0.05	1.05	1.05	5.0	242	474	99	92	243	53	
	18.4			0.04	0.85	0.85	4.0	242	480	100	92	243	53	
	10.5			0.04	0.85	0.85	4.0	242	479	99	92	243	54	
	3.3	1530	875.605	0.03	0.65	0.65	4.0	242	431	99	91	243	54	
D	55.5	1535	875.605	0.04	0.86	0.86	4.0	241	430	93	90	242	54	
	39.0			0.04	0.86	0.86	4.0	241	436	97	90	242	54	
	27.7			0.04	0.86	0.86	4.0	242	442	98	90	243	53	
	18.4			0.04	0.86	0.86	4.0	241	446	98	90	243	53	
	10.5			0.03	0.65	0.65	3.0	241	449	98	90	242	53	
	3.3	1605	890.472	0.03	0.65	0.65	3.0	242	445	98	90	241	53	
	Page 2	Δ = 60	Δ = 30.597	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.038		0.81			452 (°F)		95 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	3 %	
O2	12 %	
CO	—	
N2	85 %	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before			< 0.02
After			< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4			
2.	100 mL 0.1 N H2SO4	746.0		= 13.1 %
3.	100 mL 0.1 N H2SO4			
4.	100 mL 0.1 N NaOH			
5.	100 mL 0.1 N NaOH	150.		= 1.4 %
6.	~ 200 g Silica Gel			

APEX GLASS NOZZLE CALIBRATION DATA SHEET

Printed: 02/29/00

Nozzle No.	Size (inches)					Calibrated	
	Avg.		A	B	C	By	Date
1	0.125		0.125	0.125	0.125	KA	03-12-96
2	0.156		0.156	0.156	0.156	KA	03-12-96
3	0.156		0.156	0.156	0.156	KA	09-04-96
44	0.156		0.156	0.156	0.156	KA	09-04-96
11	0.180		0.180	0.180	0.180	KA	07-20-98
5	0.190		0.190	0.190	0.190	KA	02/18/00
27	0.190		0.190	0.190	0.190	KA	05-19-99
28	0.190		0.190	0.190	0.190	KA	05-19-99
29	0.190		0.190	0.190	0.190	KA	01/05/00
31	0.190		0.190	0.190	0.190	KA	05-19-99
4	0.219		0.219	0.219	0.219	KA	10-20-98
6	0.219		0.219	0.219	0.219	KA	03-12-97
7	0.219		0.219	0.219	0.219	KA	03-12-97
15	0.219		0.219	0.219	0.219	KA	05-19-99
42	0.219		0.219	0.219	0.219	KA	01/05/00
40	0.220		0.220	0.220	0.220	KA	05-19-99
10	0.225		0.225	0.225	0.225	KA	05-19-99
8	0.240		0.240	0.240	0.240	KA	01/05/00
9	0.240		0.240	0.240	0.240	KA	01/05/00
41	0.240		0.240	0.240	0.240	KA	01/05/00
50	0.260		0.260	0.260	0.260	KA	05-19-99
51	0.260		0.260	0.260	0.260	KA	01/05/00
12	0.281		0.281	0.281	0.280	KA	07-18-97
13	0.281		0.281	0.281	0.281	KA	10-20-98
14	0.281		0.281	0.280	0.281	KA	03-12-97
16	0.290		0.290	0.290	0.290	KA	07-24-96
17	0.290		0.290	0.290	0.290	KA	03-10-98
18	0.290		0.290	0.290	0.290	KA	07-05-96
45	0.290		0.290	0.290	0.290	KA	01/05/00
20	0.310		0.310	0.310	0.310	KA	03-10-98
33	0.310		0.310	0.310	0.310	KA	04-14-98
35	0.320		0.320	0.320	0.320	KA	01/05/00
21	0.344		0.344	0.344	0.344	KA	03-10-98
22	0.344		0.344	0.344	0.344	KA	02/18/00
23	0.347		0.347	0.347	0.347	KA	03-10-98
24	0.375		0.375	0.375	0.375	KA	02/18/00
25	0.375		0.375	0.375	0.375	KA	03-12-96
26	0.406		0.406	0.406	0.406	KA	04-19-96
30	0.406		0.406	0.406	0.406	KA	07-20-98
47	0.415		0.415	0.415	0.415	KA	11-25-96
34	0.425		0.425	0.425	0.424	KA	06-10-97
55	0.425		0.425	0.425	0.424	KA	01/05/00
52	0.440		0.440	0.440	0.440	KA	02/27/00

APEX GLASS NOZZLE CALIBRATION DATA SHEET

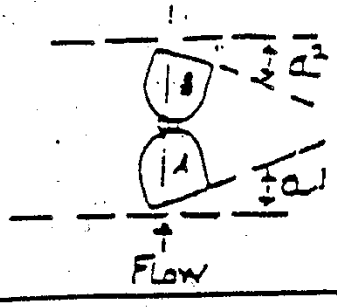
Printed: 02/29/00

Nozzle No.	Size (inches)					Calibrated	
	Avg.		A	B	C	By	Date
53	0.440		0.440	0.440	0.440	KA	02/27/00
19	0.450		0.450	0.450	0.450	KA	04-14-98
36	0.490		0.490	0.490	0.490	KA	06-10-97
37	0.490		0.490	0.490	0.490	KA	07-05-96
38	0.495		0.495	0.495	0.495	KA	07-05-96
39	0.500		0.500	0.500	0.500	KA	07-05-96
46	0.625		0.625	0.625	0.625	KA	03-10-98
43	0.750		0.750	0.750	0.750	KA	01/05/00
49	1.060		1.060	1.060	1.060	KA	11-25-96

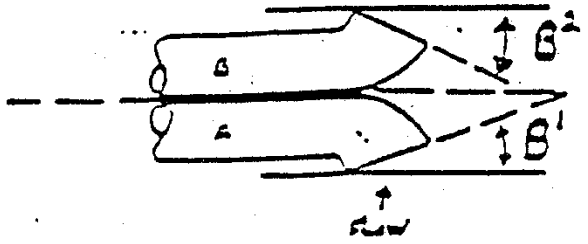
GEOMETRIC PITOT CALIBRATION

Caliper # XFS - 59
Precheck
Post Check

Probe #: 10 - 1
Date: 02 - 10 - 00
Initials: KBH

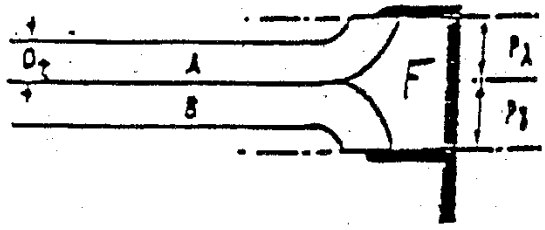
① 

$a^1 = 1^0$
$a^2 = 2^0$ — $a^1, a^2 = <10°$
$B^1 = 1^0$
$B^2 = 1^0$ — $B^1, B^2 = <5°$
$F = 0.975''$

② 

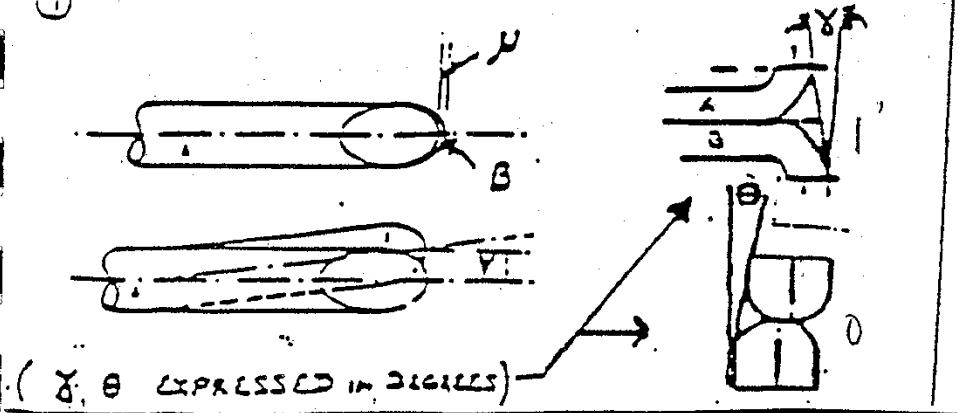
$\mu = 0.017''$ — $\mu = \leq 0.1250''$ ($\gamma_{TAN} \times F$)
$V = 0.000''$ — $V = \leq 0.03125''$ ($\theta_{TAN} \times F$)
$W = 0.195''$ — $W \geq 0''$

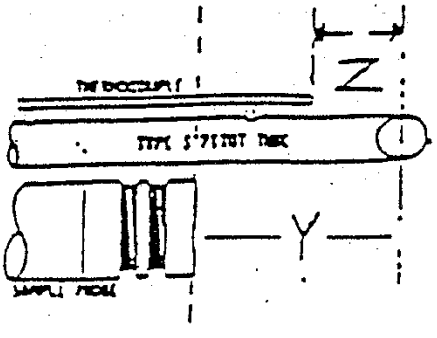
$X = 0.321''$ — $X \geq 0.750''$ (3/4" using 1/8" nozzle)

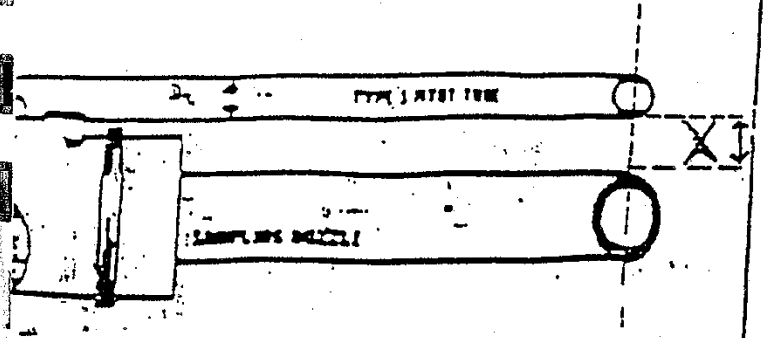
③ 

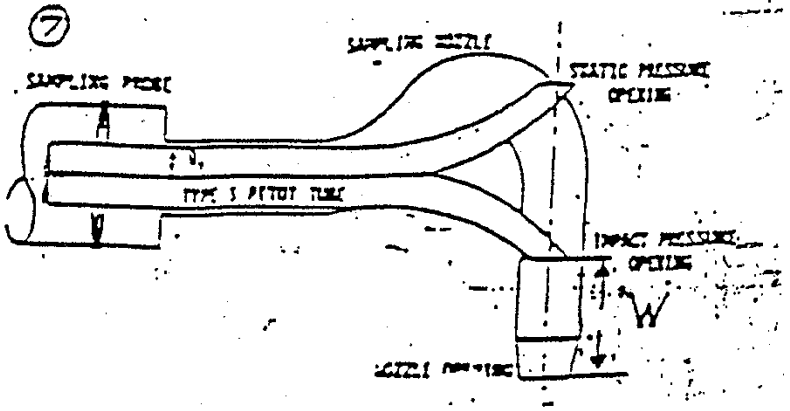
$1.05\ D_t \leq A \leq 1.50\ D_t$
$P_A = P_B$
$2.10\ D_t \leq A \leq 3.00\ D_t$

$Y = 6.215''$ — $Y \geq 3.0''$
$Z = 2.417''$ — $Z > 2.0''$
$D_t = 0.376''$ — $D_t > .1875''$

④ 

⑥ 

⑤ 

⑦ 

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-4
CALIBRATION DATE 09-24-99
BAROMETRIC PRESSURE (in. Hg) 29.10

CHECK ONE: PRE-TEST ✓ POST-TEST
CALIBRATION OFFICER JPS

RUN NO.		WET TEST METER Gas Volume Vw (cf)	Elapsed Time (min.)	Meter Temp. Tw (°F)	DRY GAS METER Gas Volume Vd (dcf)	Inlet Temp. Ti (°F)	Outlet Temp. To (°F)	Orifice Diff. Pres. ΔH (in. H2O)	Vacuum (in. H2O)
1	START	0.000	0		318.302			1.0	8.0
	MIDWAY			71		88	78		
	STOP	5.000	9:20		323.417				
	DELTA *	5.000	9.33		5.115				
2	START	0.000	0		324.438			2.0	8.0
	MIDWAY			71		92	79		
	STOP	5.000	6:39		329.522				
	DELTA *	5.000	6.65		5.084				
3	START	0.000	0		331.556			3.0	8.0
	MIDWAY			71		95	80		
	STOP	5.000	5:25		336.644				
	DELTA *	5.000	5.42		5.094				
Dry Gas Meter Leak Check	START	0.056	0		336.713			0.0	1.0
	STOP	0.358	10:00		337.112				
	DELTA *	0.308	10.0		0.399				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0091 cfm <= 0.02 cfm

*: Express final elapsed time in decimal format

Differential Pressure Gauges (check one): ✓ Inclined Manometers _____ Magnehelic Gauges

	Run #1	Run #2	Run #3	Avg.
BP (in. Hg)	29.10	29.10	29.10	
Time (min)	9.33	6.65	5.42	
Tw (°F)	71	71	71	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	88	92	95	
To (°F)	78	79	80	
ΔH (in. H2O)	1.00	2.00	3.00	
Vm (dcf)	5.115	5.084	5.094	
ΔH@ (in. H2O)	1.988	2.016	2.005	2.003
Y (Pre-test)	0.9971	1.0053	1.0044	1.0023

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-4
CALIBRATION DATE 04-13-04
BAROMETRIC PRESSURE (in. Hg) 29.40

CHECK ONE: PRE-TEST ✓ POST-TEST
CALIBRATION OFFICER JPS

RUN NO.		WET TEST METER Gas Volume Vw (cf)	Elapsed Time (min.)	Meter Temp. Tw (°F)	DRY GAS METER Gas Volume Vd (dcf)	Inlet Temp. Ti (°F)	Outlet Temp. To (°F)	Orifice Diff. Pres. ΔH (in. H2O)	Vacuum (in. H2O)
1	START	0.000	0		745.892			1.5	7.5
	MIDWAY			56		85	69		
	STOP	5.000	8:07		750.927				
	DELTA *	5.000	8.12		5.125				
2	START	0.000	0		750.927			1.5	7.5
	MIDWAY			54		86	69		
	STOP	5.000	8:07		756.052				
	DELTA *	5.000	8.12		5.125				
3	START	0.000	0		756.052			1.5	7.5
	MIDWAY			56		86	69		
	STOP	5.000	8:06		761.182				
	DELTA *	5.000	8.10		5.134				
Dry Gas	START	0.200	0		761.484			0.0	7.5
Meter Leak	STOP	0.400	10:00		761.878				
Check	DELTA *	0.200	10.0		0.394				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0194 cfm <= 0.02 cfm

*: Express final elapsed time in decimal format

Differential Pressure Gauges (check one): ✓ Inclined Manometers _____ Magnehelic Gauges

	Run #1	Run #2	Run #3	Avg.
BP (in. Hg)	29.40	29.40	29.40	
Time (min)	8.12	8.12	8.10	
Tw (°F)	56	56	56	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	85	86	86	
To (°F)	69	69	69	
ΔH (in. H2O)	1.50	1.50	1.50	
Vm (dcf)	5.125	5.125	5.130	
Y (Pre-test)				1.0023
ΔH@ (in. H2O)	2.147	2.147	2.136	2.143
Y (Post-test)	1.0115	1.0125	1.0115	1.0118
ΔY (%)				0.9%

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

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

4000 Tech Center Drive
Monroeville, PA 15146
412 825 2400
Fax: 412 825 2407

IH & Environmental Laboratory

RECEIVED MAR 2 7 2000

UEC
USX Engineers
& Consultants, Inc.

March 23, 2000

Advanced Technology Systems, Inc.
ATTN: Mr. John Shimshock
639 Alpha Drive
RIDC Park
Harmarville, PA 15238

Attached are the analytical result(s) of the analysis on sample(s) submitted to the UEC Laboratories on March 10, 2000. Should you have any questions regarding this report, please contact us. An invoice will be issued shortly.

These results are submitted persuant to USX Engineers & Consultants, Inc.'s current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions, and no responsibility or liability is assumed for the manner in which the results are used or interpreted.

The results were derived with the following methods.

ANALYTE	METHOD
CHLORIDE	EPA 26A

We appreciate the opportunity to be of service and look forward to our continued assistance to you.

NOTE: Samples will be stored for only one month following the report date.

Sincerely,

Stephanie A Guilyard

Stephanie A. Guilyard, IHIT, Project Manager

Enclosures

USX Engineers & Consultants Inc.
IH & Environmental Laboratories
4000 Tech Center Drive
Monroeville, PA 15146
PHONE: (412)825-2400 FAX: (412)825-2407
AIHA Accreditation #322

REPORT OF TEST RESULTS

DATE - 03/22/2000

Customer:	CD-002D	ATTENTION: Mr. John Shimshock
Advanced Technology Systems, Inc. 639 Alpha Drive RIDC Park Harmarville, PA 15238		Work Requested by : Mr. John Shimshock Phone No. : 412-967-1900 CUSTOMER P.O. # : 3629 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1023

UEC ID	CLIENT ID	ANALYTE	DATE SAMPLED	SAMPLE TIME (min)	PUMP RATE (LPM)	AIR VOL. SAMPLED (L)	ANALYSIS DATE	mg/L	mg/Kg	PPM	µg/L	µg/Kg	pH	%	LOD	
07367	CLRBBSM26A-1A	CHLORIDE	03/08/00	*	*	*	03/18/00	39							0.20 mg/L	E
07368	CLRBBSM26A-1B	CHLORIDE	03/08/00	*	*	*	03/18/00	6.8							0.20 mg/L	E
07369	CLRBBSM26A-1C	CHLORIDE	03/08/00	*	*	*	03/18/00	5.1							0.20 mg/L	E
07370	CLRBBSM26A-1D	CHLORIDE	03/08/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E
07371	CLRBBSM26A-2A	CHLORIDE	03/08/00	*	*	*	03/18/00	39							0.20 mg/L	E
07372	CLRBBSM26A-2B	CHLORIDE	03/08/00	*	*	*	03/18/00	3.4							0.20 mg/L	E
07373	CLRBBSM26A-2C	CHLORIDE	03/08/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E
07374	CLRBBSM26A-2D	CHLORIDE	03/08/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E
07375	CLRBBSM26A-3A	CHLORIDE	03/08/00	*	*	*	03/18/00	33							0.20 mg/L	E
07376	CLRBBSM26A-3B	CHLORIDE	03/08/00	*	*	*	03/18/00	10							0.20 mg/L	E
07377	CLRBBSM26A-3C	CHLORIDE	03/08/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E
07378	CLRBBSM26A-3D	CHLORIDE	03/08/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E
07379	CLR-H2SO4-BLK	CHLORIDE	03/09/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E

NOTES: * = Information not supplied by client. < = less than.
= Information not requested by client. N/A = Not Applicable.
Time, flow rate and/or sample volume data are based on client supplied information, unless otherwise noted.

A - FILTER OR SINGLE STAGE MONITOR
B - TUBE
C - TUBE OR 2 STAGE MONITOR
D - BULK MATERIALS OR WIPES
E - LIQUIDS OR SOLIDS
I - FILTER + TUBE
J - FILTER + TUBE

USX Engineers & Consultants Inc.
IH & Environmental Laboratories
4000 Tech Center Drive
Monroeville, PA 15146
PHONE: (412)825-2400 FAX: (412)825-2407
AIHA Accreditation #322

REPORT OF TEST RESULTS

Customer: CD-002D	ATTENTION: Mr. John Shimshock
Advanced Technology Systems, Inc. 639 Alpha Drive RIDC Park Harmarville, PA 15238	Work Requested by : Mr. John Shimshock Phone No. : 412-967-1900 CUSTOMER P.O. # : 3629 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1023

UEC ID	CLIENT ID	ANALYTE	DATE SAMPLED	SAMPLE TIME (min)	PUMP RATE (LPM)	AIR VOL. SAMPLED (L)	ANALYSIS DATE	mg/L	mg/Kg	PPM	µg/L	µg/Kg	pH	%	LOD	
07380	CLR-NAOH-BLK	CHLORIDE	03/09/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E

ANALYST : [signature] Date: 3-22-00

APPROVED: Stephanie A. Guilyard Date: 3/23/00
Stephanie A. Guilyard, IHIT, Project Manager

NOTES: * = Information not supplied by client. < = less than.
= Information not requested by client. N/A = Not Applicable.
Time, flow rate and/or sample volume data are based on client supplied information, unless otherwise noted.

A - FILTER OR SINGLE STAGE MONITOR
B - TUBE
C - TUBE OR 2 STAGE MONITOR
D - BULK MATERIALS OR WIPES
E - LIQUIDS OR SOLIDS
I - FILTER + TUBE
J - FILTER + TUBE

ATS

ADVANCED TECHNOLOGY SYSTEMS, INC.
639 ALPHA DRIVE, R.I.D.C. PARK
PITTSBURGH, PA 15238
(412)967-1900 FAX (412)967-1911

* Please add 25 mg Sodium Thiosulfate prior to analysis
$Na_2S_2O_3 \cdot 3.5\,H_2O$

CHAIN OF CUSTODY RECORD

PROJECT NUMBER 00-0016-P ; P.O. #3629
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC Air and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS B-Battery Combustion Stack

ANALYSES TO BE CONDUCTED
Chloride by ion chromatography - U.S. EPA Reference Method 26A

A: Impingers 1+2
B: Impinger 3
C: Impinger 4
D: Impinger 5

	SAMPLE IDENTIFICATION NUMBER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	NUMBER OF CONTAINERS	COMPOSITE OR GRAB	REMARKS OR OBSERVATIONS
	CLR-BBS-M26A-1A	03-08-00	0805 →	1	Comp.	0.1N H_2SO_4 - Sample Volume = 478.6 mL
	CLR-BBS-M26A-1B	↓	1020 EST	1	Comp.	0.1N H_2SO_4 - Sample Volume = 150.9 mL
*	CLR-BBS-M26A-1C	↓	↓	1	Comp.	0.1N NaOH - Sample Volume = 148.5 mL
*	CLR-BBS-M26A-1D	↓	↓	1	Comp.	0.1N NaOH - Sample Volume = 157.2 mL
	CLR-BBS-M26A-2A	03-08-00	1053 →	1	Comp.	0.1N H_2SO_4 - Sample Volume = 431.9 mL
	CLR-BBS-M26A-2B	↓	1359 EST	1	Comp.	0.1N H_2SO_4 - Sample Volume = 150.9 mL
*	CLR-BBS-M26A-2C	↓	↓	1	Comp.	0.1N NaOH - Sample Volume = 154.0 mL
*	CLR-BBS-M26A-2D	↓	↓	1	Comp.	0.1N NaOH - Sample Volume = 166.1 mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME		RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Shemchick	03-09-00	1554 EST			3.10.00	9:00 am	
	03/09/00	1555 EST					CHEST TEMP.
							TAG #

ATS 10/98

* Please add 25 mg Sodium Thiosulfate prior to analysis
$Na_2S_2O_3 \cdot 3H_2O$

ATS

ADVANCED TECHNOLOGY SYSTEMS, INC.
639 ALPHA DRIVE, R.I.D.C. PARK
PITTSBURGH, PA 15238
(412)967-1900 FAX (412)967-1911

CHAIN OF CUSTODY RECORD

PROJECT NUMBER 03-016-P; P.O.# 3629
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB WEC IH and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS B-Battery Combustion Stack

ANALYSES TO BE CONDUCTED

A: Impingers 1+2
B: Impinger 3
C: Impinger 4
D: Impinger 5

SAMPLE IDENTIFICATION NUMBER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	NUMBER OF CONTAINERS	COMPOSITE OR GRAB	Chloride by ion Chromatography - U.S. EPA Reference Method 26A									REMARKS OR OBSERVATIONS
CLR-BBS-M26A-3A	03-08-00	1350 →	1	Comp.	✓									0.1 N H_2SO_4 - Sample volume = 438.2 mL
CLR-BBS-M26A-3B	↓	1605 EST	1	Comp.	✓									0.1 N H_2SO_4 - Sample volume = 168.3 mL
* CLR-BBS-M26A-3C	↓	↓	1	Comp.	✓									0.1 N NaOH - Sample volume = 159.5 mL
* CLR-BBS-M26A-3D	↓	↓	1	Comp.	✓									0.1 N NaOH - Sample volume = 164.0 mL
CLR-H2SO4-BLK	03-09-00	BLANK	1	Grab	✓									0.1 N H_2SO_4
* CLR-NAOH-BLK	↓	BLANK	1	Grab	✓									0.1 N NaOH

RELINQUISHED BY (SIGNATURE)	DATE	TIME		RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Shumbert	03-09-00	1530 EST		[illegible]	3-10-00	9:02	
Kelly Eg	03 09 00	554 EST					CHEST TEMP.
							TAG #

ATS 10/98

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
B-BATTERY COMBUSTION STACK
MARCH 8, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-BBS-M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	39	478.6	18.67	94.5
	1B	0.1 N H2SO4 - Impinger 3	6.8	150.9	1.03	
	1C	0.1 N NaOH - Impinger 4	5.1	148.5	0.76	100.0
	1D	0.1 N NaOH - Impinger 5	< 0.20	157.2	< 0.03	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	39	431.9	16.84	97.0
	2B	0.1 N H2SO4 - Impinger 3	3.4	150.9	0.51	
	2C	0.1 N NaOH - Impinger 4	< 0.20	154.0	< 0.03	NA
	2D	0.1 N NaOH - Impinger 5	< 0.20	166.1	< 0.03	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	33	438.2	14.46	88.4
	3B	0.1 N H2SO4 - Impinger 3	10	168.3	1.68	
	3C	0.1 N NaOH - Impinger 4	< 0.20	159.5	< 0.03	NA
	3D	0.1 N NaOH - Impinger 5	< 0.20	164.0	< 0.03	
Blank	Blank	0.1 N H2SO4	< 0.20			
Blank	Blank	0.1 N NaOH	< 0.20			

<u>0.1 N H2SO4</u>

Collection Eff. = (%) 100 * {1 - [XB Chloride Catch (mg) / XA Chloride Catch (mg)] }
where X = 1, 2 or 3

<u>0.1 N NaOH</u>

Collection Eff. = (%) 100 * {1 - [XD Chloride Catch (mg) / XC Chloride Catch (mg)] }
where X = 1, 2 or 3

For chloride concentrations less than the analytical detection limit (< 0.20) ---->
Chloride catch = 0

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: B-BATTERY COMBUSTION STACK
TEST DATE: 3/8/00
TEST NO.: CLR- BBS-M26A-1

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.50
B.	Process Gas Static Pressure (in. H2O)	-1.50
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	1.0023
»»»»	Is the Duct Round (Y/N)?	Y
E.	Duct Diameter (in.) - for round duct	156
F.	Duct Width (in.) - for rectangular duct	0
G.	Duct Depth (in.) - for rectangular duct	0
H.	Nozzle Diameter (in.)	0.440
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.03
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.03
K.	Average ΔH (in. H2O)	0.71
L.	Average Process Gas Temperature (°F)	473
M.	Average Dry Gas Meter Temperature (°F)	84
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	4.0
	Oxygen (%)	11.0
	Nitrogen (%)	85.0
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
O.	Sample Time (min)	120
P.	Total H2O Mass Collected in Impingers (g)	203.3
Q.	Metered Gas Volume (dcf)	57.614

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.39	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.55	[A+(K/13.6)]
T.	Duct Area (ft.^2)	1.33E+02	[Pi*E²/(4*144) or F*G/144]
U.	Nozzle Area (ft.^2)	1.06E-03	[Pi*H²/(4*144)]
V.	Average Absolute Process Gas Temperature (R)	933	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	544	[M+460]
X.	Dry Gas Volume Sampled (dscf)	55.359	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.586	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.8	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	14.8	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.148		18	2.657
CO2	0.040	0.852	44	1.500
O2	0.110	0.852	32	3.000
N2	0.850	0.852	28	20.287
CO	0.000	0.852	28	0.000
H2	0.000	0.852	2	0.000
CH4	0.000	0.852	16	0.000
C2H6	0.000	0.852	30	0.000
Ar	0.000	0.852	40	0.000

Process Gas Molecular Weight (lb/lb-mol) 27.44

DD.	Average Process Gas Velocity (ft/sec)	1.42E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	1.13E+05	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	6.30E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	5.37E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	107.9	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0060	
JJ.	Front-Half Residue Weight (g)	0.0129	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0189	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0053	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	2.42E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST DATE: 3/8/00
TEST SITE: B-BATTERY COMBUSTION STACK
TEST NO.: CLR- BBS-M26A-1

Hydrochloric Acid (corrected for blank)			
PP.	Total Catch (mg)	20.25	
QQ.	Concentration (mg/dscm)	1.29E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	2.60E+00	[QQ*0.02832*GG*60/454000]
Chlorine Gas Acid (corrected for blank)			
SS.	Total Catch (mg)	0.76	
TT.	Concentration (mg/dscm)	4.83E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	9.72E-02	[TT*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: B-BATTERY COMBUSTION STACK
TEST DATE: 3/8/00
TEST NO.: CLR- BBS-M26A-2

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.50
B.	Process Gas Static Pressure (in. H2O)	-1.50
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	1.0023
	»»»» Is the Duct Round (Y/N)?	Y
E.	Duct Diameter (in.) - for round duct	156
F.	Duct Width (in.) - for rectangular duct	0
G.	Duct Depth (in.) - for rectangular duct	0
H.	Nozzle Diameter (in.)	0.440
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.04
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.04
K.	Average ΔH (in. H2O)	0.75
L.	Average Process Gas Temperature (°F)	472
M.	Average Dry Gas Meter Temperature (°F)	93
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	3.0
	Oxygen (%)	12.0
	Nitrogen (%)	85.0
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
O.	Sample Time (min)	120
P.	Total H2O Mass Collected in Impingers (g)	193.6
Q.	Metered Gas Volume (dcf)	59.544

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.39	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.56	[A+(K/13.6)]
T.	Duct Area (ft.^2)	1.33E+02	[Pi*E²/(4*144) or F*G/144]
U.	Nozzle Area (ft.^2)	1.06E-03	[Pi*H²/(4*144)]
V.	Average Absolute Process Gas Temperature (R)	932	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	553	[M+460]
X.	Dry Gas Volume Sampled (dscf)	56.288	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.128	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.0	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A.	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	14.0	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.140		18	2.512
CO2	0.030	0.860	44	1.136
O2	0.120	0.860	32	3.304
N2	0.850	0.860	28	20.479
CO	0.000	0.860	28	0.000
H2	0.000	0.860	2	0.000
CH4	0.000	0.860	16	0.000
C2H6	0.000	0.860	30	0.000
Ar	0.000	0.860	40	0.000

Process Gas Molecular Weight (lb/lb-mol) 27.43

DD.	Average Process Gas Velocity (ft/sec)	1.44E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	1.15E+05	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	6.40E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	5.51E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	107.0	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0051	
JJ.	Front-Half Residue Weight (g)	0.0204	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0255	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0070	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	3.30E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: B-BATTERY COMBUSTION STACK
TEST DATE: 3/8/00
TEST NO.: CLR- BBS-M26A-2

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		17.85	
QQ.	Concentration (mg/dscm)		1.12E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		2.31E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.03	
TT.	Concentration (mg/dscm)	<	1.93E-02	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	3.98E-03	[TT*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST DATE: 3/8/00
TEST SITE: B-BATTERY COMBUSTION STACK
TEST NO.: CLR- BBS-M26A-3

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.50	
B.	Process Gas Static Pressure (in. H2O)	-1.50	
C.	Pitot Tube Coefficient	0.84	
D.	Dry Gas Meter Calibration Factor	1.0023	
	»»»» Is the Duct Round (Y/N)?	Y	
E.	Duct Diameter (in.) - for round duct	156	
F.	Duct Width (in.) - for rectangular duct	0	
G.	Duct Depth (in.) - for rectangular duct	0	
H.	Nozzle Diameter (in.)	0.440	
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.03	
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.03	
K.	Average ΔH (in. H2O) variation	0.70	
L.	Average Process Gas Temperature (°F)	455	
M.	Average Dry Gas Meter Temperature (°F)	94	
N.	Dry Gas Composition (should total to 100%)		
	Carbon Dioxide (%)	3.0	
	Oxygen (%)	12.0	
	Nitrogen (%)	85.0	
	Carbon Monoxide (%)	0.0	
	Hydrogen (%)	0.0	
	Methane (%)	0.0	
	Ethane (%)	0.0	
	Argon (%)	0.0	
O.	Sample Time (min)	120	
P.	Total H2O Mass Collected in Impingers (g)	172.3	
Q.	Metered Gas Volume (dcf)	57.122	

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.39	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.55	[A+(K/13.6)]
T.	Duct Area (ft.^2)	1.33E+02	[Pi*E²/(4*144) or F*G/144]
U.	Nozzle Area (ft.^2)	1.06E-03	[Pi*H²/(4*144)]
V.	Average Absolute Process Gas Temperature (R)	915	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	554	[M+460]
X.	Dry Gas Volume Sampled (dscf)	53.894	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	8.124	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	13.1	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%)	#N/A	[100*Saturated Water Vapor
	(empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)		Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	13.1	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.131		18	2.358
CO2	0.030	0.869	44	1.147
O2	0.120	0.869	32	3.337
N2	0.850	0.869	28	20.682
CO	0.000	0.869	28	0.000
H2	0.000	0.869	2	0.000
CH4	0.000	0.869	16	0.000
C2H6	0.000	0.869	30	0.000
Ar	0.000	0.869	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.52	
DD.	Average Process Gas Velocity (ft/sec)	1.39E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	1.10E+05	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	6.26E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	5.44E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	103.7	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0035	
JJ.	Front-Half Residue Weight (g)	0.0131	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0166	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0047	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	2.22E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: B-BATTERY COMBUSTION STACK

TEST DATE: 3/8/00
TEST NO.: CLR- BBS-M26A-3

Hydrochloric Acid (corrected for blank)			
PP.	Total Catch (mg)	16.60	
QQ.	Concentration (mg/dscm)	1.09E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	2.22E+00	[QQ*0.02832*GG*60/454000]
Chlorine Gas Acid (corrected for blank)			
SS.	Total Catch (mg)	< 0.03	
TT.	Concentration (mg/dscm)	< 2.09E-02	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	< 4.26E-03	[TT*0.02832*GG*60/454000]

United States Steel
Clairton Works
400 State Street
Clairton, PA 15025-1855

September 6, 2001

Mr. Gary Fischman
Allegheny County Health Department
301 39th Street
Pittsburgh, PA 15201-1891

SUBJECT: Stack Testing Results

Dear Mr. Fischman:

Enclosed are the most recent reports of stack testing (for HCl, CL_2 and NH_3) that you requested. These would include: Batteries 1,2,3,9,13,14,19,20 and B and the SCOT Plant Incinerator.

If you have any questions, please contact me at (412) 233-1486.

Sincerely,

R. P. Spargal, P.E.
Environmental Engineer

C: WCG

639 Alpha Drive
Pittsburgh, Pennsylvania 15238
Telephone (412) 967-1900
FAX (412) 967-1911

ADVANCED TECHNOLOGY SYSTEMS, INC.

ATS Project No. 00-016-P

September 13, 2000

Mr. William C. Graeser
Manager – Environmental and Quality Assurance
U.S. Steel Clairton Works
400 State Street
Clairton, PA 15025

RE: LETTER REPORT – HYDROCHLORIC ACID AND CHLORINE GAS EMISISONS TESTING CONDUCTED AT B-BATTERY COMBUSTION STACK ON MARCH 8, 2000

Dear Mr. Graeser:

This letter, with attachments, constitutes the report that summarizes the results of the hydrochloric acid (HCl) and chlorine gas (Cl_2) emissions testing conducted at B-Battery Combustion Stack by Advanced Technology Systems, Inc. (ATS). Three two-hour test runs were conducted on March 8, 2000 simultaneous with the compliance test program at this stack (particulate matter and visible emissions were measured as part of the compliance test program).

The test results have been summarized in the attached Table 1. Hydrochloric acid and chlorine gas concentrations are listed in units of milligrams per dry standard cubic meter (mg/dscm). Hydrochloric acid and chlorine gas mass emission rates are listed in units of pounds per hour (lb/hr). Table 1 also presents pertinent exhaust gas and sampling parameters including exhaust gas flow rates in units of actual cubic feet per minute (acfm), standard cubic feet per minute (scfm), and dry standard cubic feet per minute (dscfm), exhaust gas temperature (^{o}F), and moisture content of the exhaust gas (percent by volume), gas volume sampled for each test run in units of dry standard cubic feet (dscf) and the isokinetic variation value for each test run. The isokinetic variation value is equal to the ratio of the average linear gas velocity sampled through the probe nozzle to the average exhaust gas velocity. All isokinetic variation values are between 90 percent and 110 percent, which is the acceptable range of values. Actual test sampling times have also been included in Table 1.

Hydrochloric acid and chlorine gas emission testing was performed in accordance with U.S. EPA Reference Methods 1 through 4 and 26A and the requirements of the Pennsylvania Department of Environmental Protection (PA DEP) Source Testing Manual (Draft Revision 3.1, May 3, 1999). Detailed information regarding the procedures used to measure the exhaust gas stream velocity and volumetric flow rate (i.e., U.S. EPA Reference Methods 1 through 4) can be found in the summary report for the compliance test program. Hydrochloric acid and chlorine gas sampling was performed in accordance with U.S. EPA Reference Method 26A. Process gas samples were withdrawn

isokinetically from the stack, with particulate matter collected in a glass nozzle, a heated glass-lined probe, and on a heated quartz filter. Vapor phase hydrochloric acid and chlorine gas were collected in a series of chilled impingers. The impinger type and sequence is listed below:

No.	Impinger Type	Contents
1.	Modified Greenburg-Smith	50 mL 0.1 N sulfuric acid (for HCl collection)
2.	Greenburg-Smith	100 mL 0.1 N sulfuric acid (for HCl collection)
3.	Greenburg-Smith	100 mL 0.1 N sulfuric acid (for HCl collection)
4.	Modified Greenburg-Smith	100 mL 0.1 N sodium hydroxide (for Cl_2 collection)
5.	Modified Greenburg-Smith	100 mL 0.1 N sodium hydroxide (for Cl_2 collection)
6.	Modified Greenburg-Smith	200 g Silica Gel

A gas volume greater than 50 dry standard cubic feet (dscf) – the minimum gas volume required by the PA DEP for the compliance test program - was sampled for each test run. The flow rate through each sample train was less than 1 dry standard cubic foot per minute as required by U.S. EPA Reference Method 26A.

Following each test run, the sample trains were processed in accordance with PA DEP requirements. Detailed information regarding the procedures used to recover the particulate matter catch (essentially U.S. EPA Reference Method 5 procedures) can be found in the summary report for the compliance test program. Following the gravimetric analysis of the impingers for moisture gain, the following four samples fractions were generated for each sample train:

Fraction	Description
A	Contents of Impinger Nos. 1 & 2 plus applicable distilled deionized water rinses (for HCl)
B	Contents of Impinger No. 3 plus applicable distilled deionized water rinses (for HCl)
C	Contents of Impinger No. 4 plus applicable distilled deionized water rinses (for Cl_2)
D	Contents of Impinger No. 5 plus applicable distilled deionized water rinses (for Cl_2)

For each sample train, each of the four fractions were analyzed separately as required by the PA DEP to allow for the calculation of the collection efficiency of the sample train for HCl and Cl_2 collection. The contents of Impinger No. 6 were discarded.

The actual test samples plus field blanks of the impinger scrubbing solutions (0.1 N sulfuric acid and 0.1 N sodium hydroxide) were submitted to the subcontract analytical laboratory for chloride ion analyses using ion chromatographic techniques in accordance with U.S. EPA Reference Method 26A. The analytical laboratory results showed the following:

- The chloride ion concentrations of the field blanks were less than the analytical detection limit;

- For all three test runs, the HCl collection efficiency of the sample train was calculated to be greater than the minimum collection efficiency specified by the PA DEP (i.e., the chloride catch of the Sample Fraction B was at most 10 percent of the chloride catch from Sample Fraction A plus Sample Fraction B); and

- For the first test run, the Cl_2 collection efficiency of the sample train was calculated to be greater than the minimum collection efficiency specified by the PA DEP (i.e., the chloride catch of the Sample Fraction D was at most 10 percent of the chloride catch from Sample Fraction C plus Sample Fraction D). The Cl_2 collection efficiency of the sample train for the second and third test runs could not be calculated since the chloride catches in Sample Fractions C and D were less than the analytical detection limit.

Copies of the field data sheets, equipment calibration data, analytical laboratory results and emissions calculations are included in the appendix.

ATS appreciates the opportunity to provide U.S. Steel with process gas testing services. If you have any questions regarding this letter report, please call Dr. Robinson Khosah or me at (412) 967-1900 or e-mail me at the following address: jshimshock@atsengineers.com.

Very truly yours,

John P. Shimshock

John P. Shimshock, Ph.D.
Senior Project Scientist

Approved by:

Robinson P. Khosah

Robinson P. Khosah, Ph.D.
Vice President
Science and Technology Division

JPS/blc
Enclosures

U.S. STEEL CLAIRTON WORKS
CLAIRTON, PENNSYLVANIA

TABLE 1

B-BATTERY COMBUSTION STACK
HYDROCHLORIC ACID AND CHLORINE GAS EMISSIONS DATA
MARCH 8, 2000

		Run 1	Run 2	Run 3	Average
Emissions Data					
Hydrochloric Acid (HCl)					
Concentration	(mg/dscm)	1.29E+01	1.12E+01	1.09E+01	1.17E+01
Mass Emission Rate	(lb/hr)	2.60E+00	2.31E+00	2.22E+00	2.38E+00
Chlorine Gas (Cl_2)					
Concentration	(mg/dscm)	4.83E-01	< 1.93E-02	< 2.09E-02	< 1.74E-01
Mass Emission Rate	(lb/hr)	9.72E-02	< 3.98E-03	< 4.26E-03	< 3.51E-02
Exhaust Stack Conditions					
Volumetric Flow Rate	(acfm)	1.13E+05	1.15E+05	1.10E+05	1.13E+05
	(scfm)	6.30E+04	6.40E+04	6.26E+04	6.32E+04
	(dscfm)	5.37E+04	5.51E+04	5.44E+04	5.44E+04
Temperature	(°F)	473	472	455	467
Moisture Content	(%)	14.8	14.0	13.1	14.0
Sampling Conditions					
Test Times	(EST)	0805 to 1020	1053 to 1309	1350 to 1605	
Sampling Time - *	(minutes)	120	120	120	
Sample Volume - **	(dscf)	55.359	56.288	53.894	
Isokinetic Variation - ***	(%)	107.9	107.0	103.7	

mg / dscm = milligrams per dry standard cubic meter
*: Minimum required sampling time is 2 hours (120 minutes)
**: Minimum required sample volume is 50 dscf
***: Acceptable range of values is 90.0% <= Isokinetic Variation < = 110.0%

U.S. STEEL CLAIRTON WORKS
CLAIRTON, PENNSYLVANIA

Hydrochloric Acid and Chlorine Gas Emissions Testing Conducted at B-Battery Combustion Stack on March 8, 2000

September 2000

APPENDIX

Field Data Sheets, Equipment Calibration Data, Analytical Laboratory Results and Emissions Calculations

ATS
ADVANCED TECHNOLOGY SYSTEMS, INC.

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	7
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 1	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	467 QTZ
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10 - 1
TEST CREW	JS, KA, RS,	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 016 - P -	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
A	55.5	0805	714.685	0.04	0.82	0.82	4.0	241	468	73	71	245	63	
	39.0			0.04	0.82	0.82	4.0	241	480	77	72	245	63	5 min./pt.
	27.7			0.04	0.81	0.81	4.0	242	490	81	72	245	58	
	18.4			0.04	0.81	0.81	4.0	242	500	83	73	245	59	
	10.5			0.03	0.61	0.61	3.0	242	506	85	74	244	59	
	3.3	0835	729.141	0.03	0.60	0.60	3.0	242	468	86	74	243	59	
B	55.5	0840	729.141	0.03	0.61	0.61	3.0	242	444	81	76	243	61	
	39.0			0.03	0.61	0.61	3.0	242	451	85	76	243	60	
	27.7			0.03	0.63	0.63	3.0	241	457	87	77	243	60	
	18.4			0.04	0.84	0.84	5.0	241	466	90	78	243	59	
	10.5			0.02	0.42	0.42	2.0	241	466	89	79	243	58	
	3.3	0910	742.181	0.02	0.42	0.42	2.0	242	471	89	79	243	58	
	Page 1	Δ = 60	Δ = 27.496	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.032		0.66			472 (°F)		79 (°F)			
	Test	Δ = 120	Δ = 57.614	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.034		0.71			473 (°F)		84 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4.0%	
O2	14.0%	
CO	—	
N2	85.0%	

$= \left[\frac{\sum \Delta p'}{n}\right]^2$

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.010	< 0.02
After	7.00	0.006	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	613.4	489.6	123.8
2.	100 mL 0.1 N H2SO4	612.8	553.5	59.3
3.	100 mL 0.1 N H2SO4	528.5	523.9	4.6
4.	100 mL 0.1 N NaOH	537.8	537.4	0.4
5.	100 mL 0.1 N NaOH	554.6	553.0	1.6
6.	~200 g Silica Gel	591.6	578.0	13.6
7.				
8.			Total	243.39

HIGH FLOW SOURCE SAMPLING DATA SHEET

Page 2 of 2

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	7
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 1	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	467 QTZ
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10 - 1
TEST CREW	JS, KA, RS.	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 016 - P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
C	55.5	0915	742.181	0.05	1.05	1.05	6.0	242	462	86	81	243	58	5 min./pt.
	39.0			0.06	1.26	1.26	7.0	242	503	92	81	242	58	
	27.7			0.05	1.05	1.05	6.0	241	513	94	82	242	58	
	18.4			0.04	0.84	0.84	5.0	241	522	94	83	242	58	
	10.5			0.03	0.63	0.63	4.0	241	444	94	83	243	62	
	3.3	0945	758.418	0.02	0.42	0.42	2.0	242	446	93	84	243	60	
D	55.5	0950	758.418	0.04	0.86	0.86	5.0	242	456	90	85	243	60	
	39.0			0.03	0.64	0.64	3.0	242	468	92	85	242	58	
	27.7			0.03	0.64	0.64	3.0	243	475	93	85	243	58	
	18.4			0.04	0.86	0.86	5.0	243	469	94	85	242	57	
	10.5			0.03	0.64	0.64	3.0	243	476	95	85	242	57	
	3.3	1020	772.299	0.02	0.43	0.43	2.0	242	460	94	86	242	57	
	Page 2	Δ = 60	Δ = 29.118	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.036		0.76			474 (°F)		88 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

$= \left[\frac{\Sigma V \sqrt{\Delta P}}{\Lambda}\right]^2$

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before			< 0.02
After			< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before		
After		

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4			
2.	100 mL 0.1 N H2SO4			
3.	100 mL 0.1 N H2SO4	946	= 14.8%	
4.	100 mL 0.1 N NaOH			
5.	100 mL 0.1 N NaOH	150.	= 1.8%	
6.	~200 g Silica Gel			
7.				
8.				

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	469 QTZ
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10-1
TEST CREW	JS, KA, RS	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-016-P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
A	55.5	1053	772.827	0.04	0.85	0.85	4.0	240	456	86	86	243	60	
	39.0			0.03	0.64	0.64	3.0	240	478	90	86	243	60	5 min./pt.
	27.7			0.04	0.85	0.85	4.0	240	473	93	87	243	60	
	18.4			0.04	0.83	0.83	4.0	240	483	95	87	242	59	
	10.5			0.03	0.63	0.63	3.0	241	475	96	88	242	55	
	3.3	1123	787.370	0.03	0.63	0.63	3.0	241	491	96	88	242	55	
B	55.5	1132	787.370	0.04	0.85	0.85	4.0	242	480	92	89	242	55	
	39.0			0.03	0.63	0.63	3.0	242	445	96	89	242	52	
	27.7			0.03	0.63	0.63	3.0	241	447	96	89	243	52	
	18.4			0.03	0.63	0.63	3.0	241	455	97	90	243	52	
	10.5			0.02	0.43	0.43	2.0	241	460	97	90	243	52	
	3.3		800.842	0.02	0.43	0.43	2.0	242	462	97	90	243	52	
	Page 1	Δ=60	Δ=28.015	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.031		0.66			467 (°F)		91 (°F)			
	Test	Δ=120	Δ=59.544	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.035		0.75			472 (°F)		93 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition 31.35

	Run 1	Run 2
CO2	30 %	
O2	12.0 %	
CO	-	
N2	85.0 %	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.004	< 0.02
After	5.00	0.005	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	637.1	512.8	124.3
2.	100 mL 0.1 N H2SO4	618.8	568.9	49.9
3.	100 mL 0.1 N H2SO4	569.4	566.4	3.0
4.	100 mL 0.1 N NaOH	553.1	551.5	1.6
5.	100 mL 0.1 N NaOH	535.3	533.8	1.5
6.	~200 g Silica Gel	661.9	648.6	13.3
7.				
8.		total =	193.6	194.9

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8 & 15, 2000	CONTROL BOX NO.	APEX- 4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	469 QTZ
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10 - 1
TEST CREW	JS, KA, RS.	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 016 - P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
C	55.5	1205	800.842	0.04	0.86	0.86	4.0	241	455	92	90	243	54	
	39.0			0.05	1.08	1.08	5.0	241	485	97	90	243	54	5 min./pt.
	27.7			0.05	1.08	1.08	5.0	242	497	98	90	242	54	
	18.4			0.05	1.02	1.02	5.0	242	506	99	90	242	54	
	10.5			0.04	0.82	0.82	4.0	242	597	99	91	243	55	
	3.3	1225	816.751	0.03	0.61	0.61	2.0	243	461	98	91	243	55	
D	55.5	1239	816.751	0.04	0.86	0.86	4.0	242	452	96	91	243	55	
	39.0			0.04	0.86	0.86	4.0	242	454	96	91	243	55	
	27.7			0.04	0.86	0.86	4.0	242	464	98	91	243	54	
	18.4			0.04	0.86	0.86	4.0	242	467	99	91	243	54	
	10.5			0.03	0.65	0.65	3.0	242	455	99	91	243	54	
	3.3	1309	832.371	0.03	0.65	0.65	3.0	242	451	99	91	243	54	
	Page 2	Δ = 60	Δ = 31.529	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.04		0.844			478 (°F)		94 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

$= \frac{\sum \sqrt{\Delta P}}{n}$

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before			< 0.02
After			< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before		
After		

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4			
2.	100 mL 0.1 N H2SO4			
3.	100 mL 0.1 N H2SO4	$\%H_2O$ = 14.0 %		
4.	100 mL 0.1 N NaOH			
5.	100 mL 0.1 N NaOH			
6.	~200 g Silica Gel	Iso. = 107 %		
7.				
8.				

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX-4	Page	1 of 2
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	HOT/COLD BOX NO.	1
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	FILTER NO.	470 QTZ
TEST CREW	JS, KA, RS.	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	PROBE NO.	10 - 1
PROJECT NO.	00 - 016 - P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	NOZZLE DIA. (in.)	0.440
						PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
A	55.5	1350	833.350	0.03	0.65	0.65	2.0	241	449	89	89	242	59	
	39.0			0.03	0.65	0.65	2.0	241	460	93	89	242	56	5 min./pt.
	27.7			0.03	0.65	0.65	2.0	241	464	95	89	242	56	
	18.4			0.03	0.65	0.65	2.0	242	465	96	90	242	56	
	10.5			0.02	0.43	0.43	2.0	242	470	96	90	242	56	
	3.3	1420	846.294	0.02	0.43	0.43	2.0	242	477	96	90	243	54	
B	55.5	1427	846.294	0.04	0.85	0.85	4.0	241	461	93	90	243	54	
	39.0			0.04	0.85	0.85	4.0	242	509	97	90	243	54	
	27.7			0.03	0.65	0.65	3.0	241	437	98	90	243	54	
	18.4			0.03	0.65	0.65	3.0	241	436	99	90	243	54	
	10.5			0.02	0.43	0.43	2.0	242	440	99	91	243	55	
	3.3	1457	859.875	0.02	0.43	0.43	2.0	241	441	98	91	242	55	
	Page 1	Δ = 60	Δ = 26.525	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.028		0.60			459 (°F)		93 (°F)			
	Test	Δ = 120	Δ = 57.122	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.033		0.70			455 (°F)		94 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition 31.50

	Run 1	Run 2
CO2	3.0	
O2	12.0	
CO	—	
N2	85.0	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.010	<0.02
After	5.00	0.006	<0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	588.1	484.7	103.4
2.	100 mL 0.1 N H2SO4	595.6	546.0	49.6
3.	100 mL 0.1 N H2SO4	568.1	565.9	2.2
4.	100 mL 0.1 N NaOH	524.7	523.4	1.3
5.	100 mL 0.1 N NaOH	545.4	542.9	2.5
6.	~ 200 g Silica Gel	666.6	653.3	13.3
7.				
8.			total =	172.39

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	March 8th, 2000	CONTROL BOX NO.	APEX- 4	HOT/COLD BOX NO.	1
PLANT SITE	Clairton, PA	TEST NO.	CLR - BBS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	490 QTZ
TEST UNIT	B-Battery Combustion Stack	B.P. (in. Hg)	29.50	METER CORR. (Y)	1.0023	PROBE NO.	10 - 1
TEST CREW	JS, KA, RS	STATIC P. (in. H2O)	-1.50	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 016 - P	STACK DIA. (in.)	156	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EST)	DGM Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Vacuum (in. Hg)	Probe Temp. (°F)	Stack Temp. (°F)	Meter Temp. In (°F)	Meter Temp. Out (°F)	Filter Temp. (°F)	Exit Temp. (°F)	Comments
C	55.5	1500	859-875	0.03	0.65	0.65	2.0	242	452	95	92	243	53	
	39.0			0.05	1.05	1.05	5.0	242	466	99	92	243	53	5 min./pt.
	27.7			0.05	1.05	1.05	5.0	242	474	99	92	243	53	
	18.4			0.04	0.85	0.85	4.0	242	480	100	92	243	53	
	10.5			0.04	0.85	0.85	4.0	242	479	99	92	243	54	
	3.3	1530	875.605	0.03	0.65	0.65	4.0	242	431	99	91	243	54	
D	55.5	1535	875.605	0.04	0.86	0.86	4.0	241	430	93	90	242	54	
	39.0			0.04	0.86	0.86	4.0	241	436	97	90	242	54	
	27.7			0.04	0.86	0.86	4.0	242	442	98	90	243	53	
	18.4			0.04	0.86	0.86	4.0	241	446	98	98	243	53	
	10.5			0.03	0.65	0.65	3.0	241	449	98	90	242	53	
	3.3	1605	890.472	0.03	0.65	0.65	3.0	242	445	98	90	241	53	
	Page 2	Δ = 60	Δ = 30.597	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.038		0.81			452 (°F)		95 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	3 %	
O2	12 %	
CO	—	
N2	85 %	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before			< 0.02
After			< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before		
After		

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4			
2.	100 mL 0.1 N H2SO4	760 = 13.1 %		
3.	100 mL 0.1 N H2SO4			
4.	100 mL 0.1 N NaOH			
5.	100 mL 0.1 N NaOH	ISO. = 144 %		
6.	~ 200 g Silica Gel			
7.				
8				

APEX GLASS NOZZLE CALIBRATION DATA SHEET

Printed: 02/29/00

Nozzle No.	Size (inches)				Calibrated	
	Avg.	A	B	C	By	Date
1	0.125	0.125	0.125	0.125	KA	03-12-96
2	0.156	0.156	0.156	0.156	KA	03-12-96
3	0.156	0.156	0.156	0.156	KA	09-04-96
44	0.156	0.156	0.156	0.156	KA	09-04-96
11	0.180	0.180	0.180	0.180	KA	07-20-98
5	0.190	0.190	0.190	0.190	KA	02/18/00
27	0.190	0.190	0.190	0.190	KA	05-19-99
28	0.190	0.190	0.190	0.190	KA	05-19-99
29	0.190	0.190	0.190	0.190	KA	01/05/00
31	0.190	0.190	0.190	0.190	KA	05-19-99
4	0.219	0.219	0.219	0.219	KA	10-20-98
6	0.219	0.219	0.219	0.219	KA	03-12-97
7	0.219	0.219	0.219	0.219	KA	03-12-97
15	0.219	0.219	0.219	0.219	KA	05-19-99
42	0.219	0.219	0.219	0.219	KA	01/05/00
40	0.220	0.220	0.220	0.220	KA	05-19-99
10	0.225	0.225	0.225	0.225	KA	05-19-99
8	0.240	0.240	0.240	0.240	KA	01/05/00
9	0.240	0.240	0.240	0.240	KA	01/05/00
41	0.240	0.240	0.240	0.240	KA	01/05/00
50	0.260	0.260	0.260	0.260	KA	05-19-99
51	0.260	0.260	0.260	0.260	KA	01/05/00
12	0.281	0.281	0.281	0.280	KA	07-18-97
13	0.281	0.281	0.281	0.281	KA	10-20-98
14	0.281	0.281	0.280	0.281	KA	03-12-97
16	0.290	0.290	0.290	0.290	KA	07-24-96
17	0.290	0.290	0.290	0.290	KA	03-10-98
18	0.290	0.290	0.290	0.290	KA	07-05-96
45	0.290	0.290	0.290	0.290	KA	01/05/00
20	0.310	0.310	0.310	0.310	KA	03-10-98
33	0.310	0.310	0.310	0.310	KA	04-14-98
35	0.320	0.320	0.320	0.320	KA	01/05/00
21	0.344	0.344	0.344	0.344	KA	03-10-98
22	0.344	0.344	0.344	0.344	KA	02/18/00
23	0.347	0.347	0.347	0.347	KA	03-10-98
24	0.375	0.375	0.375	0.375	KA	02/18/00
25	0.375	0.375	0.375	0.375	KA	03-12-96
26	0.406	0.406	0.406	0.406	KA	04-19-96
30	0.406	0.406	0.406	0.406	KA	07-20-98
47	0.415	0.415	0.415	0.415	KA	11-25-96
34	0.425	0.425	0.425	0.424	KA	06-10-97
55	0.425	0.425	0.425	0.424	KA	01/05/00
52	0.440	0.440	0.440	0.440	KA	02/27/00

APEX GLASS NOZZLE CALIBRATION DATA SHEET

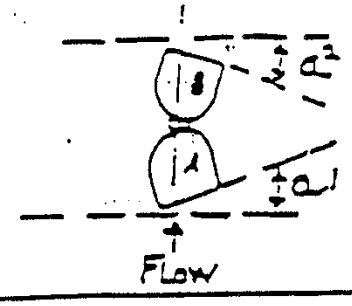
Printed: 02/29/00

Nozzle No.	Size (inches)					Calibrated	
	Avg.		A	B	C	By	Date
53	0.440		0.440	0.440	0.440	KA	02/27/00
19	0.450		0.450	0.450	0.450	KA	04-14-98
36	0.490		0.490	0.490	0.490	KA	06-10-97
37	0.490		0.490	0.490	0.490	KA	07-05-96
38	0.495		0.495	0.495	0.495	KA	07-05-96
39	0.500		0.500	0.500	0.500	KA	07-05-96
46	0.625		0.625	0.625	0.625	KA	03-10-98
43	0.750		0.750	0.750	0.750	KA	01/05/00
49	1.060		1.060	1.060	1.060	KA	11-25-96

GEOMETRIC PITOT CALIBRATION

Caliper # XFS - 59
Precheck
Post Check

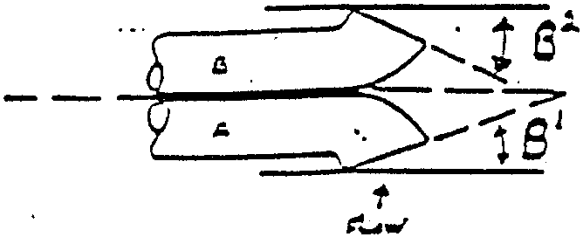
Probe #: 10 - 1
Date: 02 - 10 - 00
Initials: KBH

① 

a^1 = 1°
a^2 = 2°
$a^1, a^2 = <10°$

B^1 = 1°
B^2 = 1°
$B^1, B^2 = <5°$

F = 0.975"

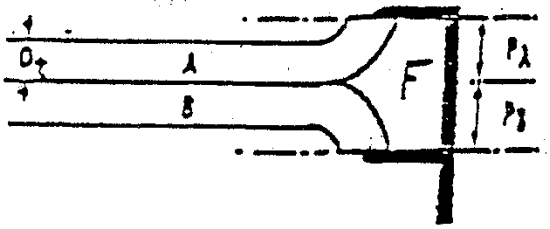
② 

μ = 0.017" — $\mu = \leq 0.1250" (\gamma_{TAN} \times F_{eq})$

V = 0.000" — $V = \leq 0.03125" (\Theta_{TAN} \times F_{eq})$

W = 0.195" — $W \geq 0"$

X = 0.321" — $X \geq 0.750"$ (3/4" using 1/2" nozzle)

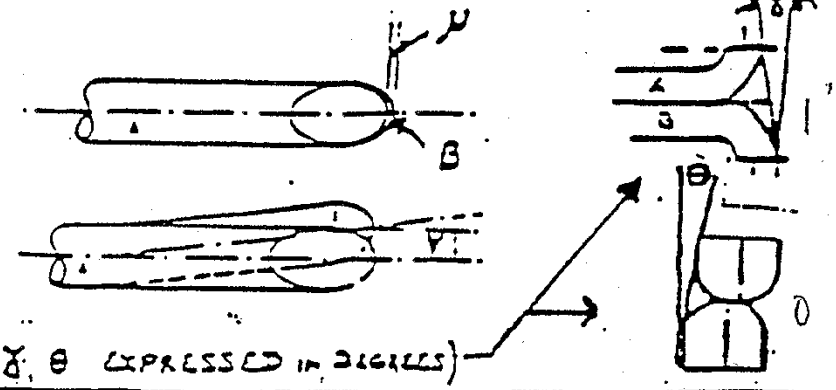
③ 

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

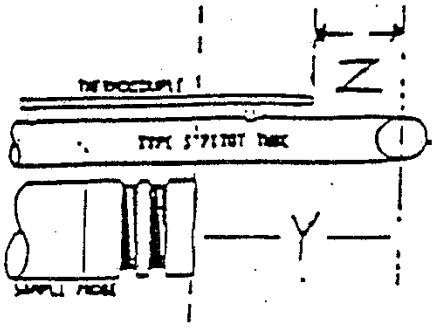
Y = 6.215" — $Y \geq 3.0"$

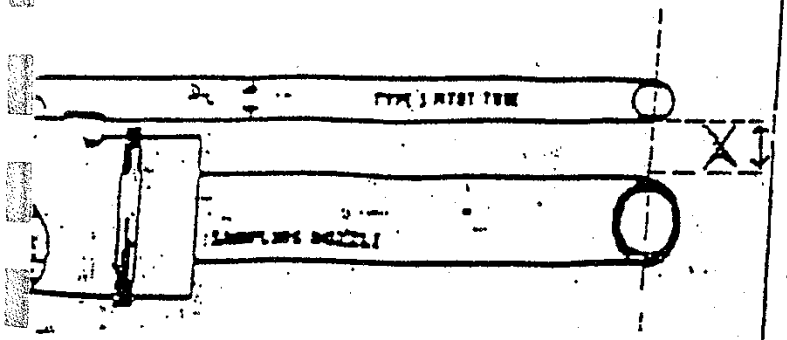
Z = 2.417" — $Z > 2.0"$

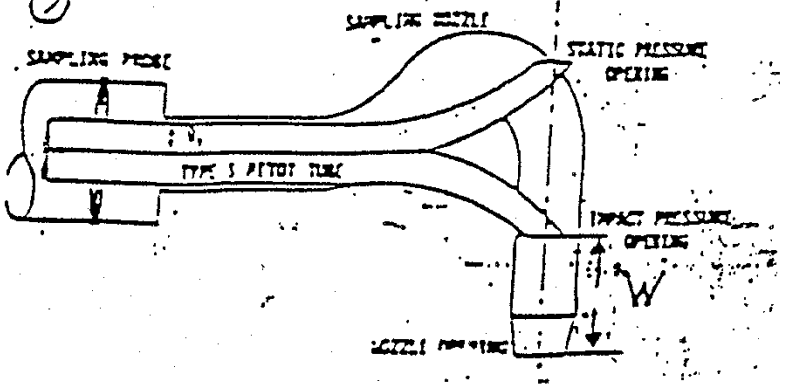
D_t = 0.376" — $D_t > .1875"$

④ 

(γ, θ EXPRESSED IN DEGREES)

⑥ 

⑤ 

⑦ 

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-4
CALIBRATION DATE 09-24-99
BAROMETRIC PRESSURE (in. Hg) 29.10

CHECK ONE: PRE-TEST ✓ POST-TEST
CALIBRATION OFFICER JPS

RUN NO.		WET TEST METER Gas Volume Vw (cf)	Elapsed Time (min.)	Meter Temp. Tw (°F)	DRY GAS METER Gas Volume Vd (dcf)	Inlet Temp. Ti (°F)	Outlet Temp. To (°F)	Orifice Diff. Pres. ΔH (in. H2O)	Vacuum (in. H2O)
1	START	0.000	0		318.302			1.0	8.0
	MIDWAY			71		88	78		
	STOP	5.000	9:20		323.417				
	DELTA *	5.000	9.33		5.115				
2	START	0.000	0		324.438			2.0	8.0
	MIDWAY			71		92	79		
	STOP	5.000	6:39		329.522				
	DELTA *	5.000	6.65		5.084				
3	START	0.000	0		331.550			3.0	8.0
	MIDWAY			71		95	80		
	STOP	5.000	5:25		336.644				
	DELTA *	5.000	5.42		5.094				
Dry Gas Meter Leak Check	START	0.056	0		336.713			0.0	1.0
	STOP	0.358	10:00		337.112				
	DELTA *	0.308	10.0		0.359				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0051 cfm <= 0.02 cfm

*: Express final elapsed time in decimal format

Differential Pressure Gauges (check one): ✓ Inclined Manometers _____ Magnehelic Gauges

	Run #1	Run #2	Run #3	Avg.
BP (in. Hg)	29.10	29.10	29.10	
Time (min)	9.33	6.65	5.42	
Tw (°F)	71	71	71	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	88	92	95	
To (°F)	78	79	80	
ΔH (in. H2O)	1.00	2.00	3.00	
Vm (dcf)	5.115	5.084	5.094	
ΔH@ (in. H2O)	1.988	2.016	2.005	2.003
Y (Pre-test)	0.9971	1.0053	1.0044	1.0023

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-4
CALIBRATION DATE 04-13-04
BAROMETRIC PRESSURE (in. Hg) 29.40

CHECK ONE: PRE-TEST ✓ POST-TEST
CALIBRATION OFFICER JPS

RUN NO.		WET TEST METER Gas Volume Vw (cf)	Elapsed Time (min.)	Meter Temp. Tw (°F)	DRY GAS METER Gas Volume Vd (dcf)	Inlet Temp. Ti (°F)	Outlet Temp. To (°F)	Orifice Diff. Pres. ΔH (in. H2O)	Vacuum (in. H2O)
1	START	0.000	0		745.802			1.5	7.5
	MIDWAY			56		85	69		
	STOP	5.000	8:07		750.927				
	DELTA *	5.000	8.12		5.125				
2	START	0.000	0		750.927			1.5	7.5
	MIDWAY			54		86	69		
	STOP	5.000	8:07		756.052				
	DELTA *	5.000	8.12		5.125				
3	START	0.000	0		756.052			1.5	7.5
	MIDWAY			56		86	69		
	STOP	5.000	8:06		761.182				
	DELTA *	5.000	8.10		5.134				
Dry Gas	START	0.200	0		761.484			0.0	7.5
Meter Leak	STOP	0.400	10:00		761.878				
Check	DELTA *	0.200	10.0		0.394				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0194 cfm <= 0.02 cfm

*: Express final elapsed time in decimal format

Differential Pressure Gauges (check one): ✓ Inclined Manometers _____ Magnehelic Gauges

	Run #1	Run #2	Run #3	Avg.
BP (in. Hg)	29.40	29.40	29.40	
Time (min)	8.12	8.12	8.10	
Tw (°F)	56	56	56	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	85	86	86	
To (°F)	69	69	69	
ΔH (in. H2O)	1.50	1.50	1.50	
Vm (dcf)	5.125	5.125	5.130	
Y (Pre-test)				1.0023
ΔH@ (in. H2O)	2.147	2.147	2.136	2.143
Y (Post-test)	1.0115	1.0125	1.0115	1.0118
ΔY (%)				0.9%

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

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

Monroeville, PA 15146
412 825 2400
Fax: 412 825 2407

RECEIVED MAR 2 7 2000

UEC
USX Engineers
& Consultants, Inc.

March 23, 2000

Advanced Technology Systems, Inc.
ATTN: Mr. John Shimshock
639 Alpha Drive
RIDC Park
Harmarville, PA 15238

Attached are the analytical result(s) of the analysis on sample(s) submitted to the UEC Laboratories on March 10, 2000. Should you have any questions regarding this report, please contact us. An invoice will be issued shortly.

These results are submitted persuant to USX Engineers & Consultants, Inc.'s current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions, and no responsibility or liability is assumed for the manner in which the results are used or interpreted.

The results were derived with the following methods.

ANALYTE	METHOD
CHLORIDE	EPA 26A

We appreciate the opportunity to be of service and look forward to our continued assistance to you.

NOTE: Samples will be stored for only one month following the report date.

Sincerely,

Stephanie A Guilyard

Stephanie A. Guilyard, IHIT, Project Manager

Enclosures

USX Engineers & Consultants Inc.
IH & Environmental Laboratories
4000 Tech Center Drive
Monroeville, PA 15146
PHONE: (412)825-2400 FAX: (412)825-2407
AIHA Accreditation #322

REPORT OF TEST RESULTS

DATE - 03/22/2000

Customer: CD-002D	ATTENTION: Mr. John Shimshock
Advanced Technology Systems, Inc. 639 Alpha Drive RIDC Park Harmarville, PA 15238	Work Requested by : Mr. John Shimshock Phone No. : 412-967-1900 CUSTOMER P.O. # : 3629 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1023

UEC ID	CLIENT ID	ANALYTE	DATE SAMPLED	SAMPLE TIME (min)	PUMP RATE (LPM)	AIR VOL. SAMPLED (L)	ANALYSIS DATE	mg/L	mg/Kg	PPM	µg/L	µg/Kg	pH	%	LOD	
07367	CLRBBSM26A-1A	CHLORIDE	03/08/00	*	*	*	03/18/00	39							0.20 mg/L	E
07368	CLRBBSM26A-1B	CHLORIDE	03/08/00	*	*	*	03/18/00	6.8							0.20 mg/L	E
07369	CLRBBSM26A-1C	CHLORIDE	03/08/00	*	*	*	03/18/00	5.1							0.20 mg/L	E
07370	CLRBBSM26A-1D	CHLORIDE	03/08/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E
07371	CLRBBSM26A-2A	CHLORIDE	03/08/00	*	*	*	03/18/00	39							0.20 mg/L	E
07372	CLRBBSM26A-2B	CHLORIDE	03/08/00	*	*	*	03/18/00	3.4							0.20 mg/L	E
07373	CLRBBSM26A-2C	CHLORIDE	03/08/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E
07374	CLRBBSM26A-2D	CHLORIDE	03/08/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E
07375	CLRBBSM26A-3A	CHLORIDE	03/08/00	*	*	*	03/18/00	33							0.20 mg/L	E
07376	CLRBBSM26A-3B	CHLORIDE	03/08/00	*	*	*	03/18/00	10							0.20 mg/L	E
07377	CLRBBSM26A-3C	CHLORIDE	03/08/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E
07378	CLRBBSM26A-3D	CHLORIDE	03/08/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E
07379	CLR-H2SO4-BLK	CHLORIDE	03/09/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E

NOTES: * = Information not supplied by client. < = less than.
= Information not requested by client. N/A = Not Applicable.
Time, flow rate and/or sample volume data are based on client supplied information, unless otherwise noted.

A - FILTER OR SINGLE STAGE MONITOR
B - TUBE
C - TUBE OR 2 STAGE MONITOR
D - BULK MATERIALS OR WIPES
E - LIQUIDS OR SOLIDS
I - FILTER + TUBE
J - FILTER + TUBE

USX Engineers & Consultants Inc.
IH & Environmental Laboratories
4000 Tech Center Drive
Monroeville, PA 15146
PHONE: (412)825-2400 FAX: (412)825-2407
AIHA Accreditation #322

REPORT OF TEST RESULTS

Customer: CD-002D	ATTENTION: Mr. John Shimshock
Advanced Technology Systems, Inc. 639 Alpha Drive RIDC Park Harmarville, PA 15238	Work Requested by : Mr. John Shimshock Phone No. : 412-967-1900 CUSTOMER P.O. # : 3629 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1023

UEC ID	CLIENT ID	ANALYTE	DATE SAMPLED	SAMPLE TIME (min)	PUMP RATE (LPM)	AIR VOL. SAMPLED (L)	ANALYSIS DATE	mg/L	mg/Kg	PPM	µg/L	µg/Kg	pH	%	LOD	
07380	CLR-NAOH-BLK	CHLORIDE	03/09/00	*	*	*	03/18/00	<0.20							0.20 mg/L	E

ANALYST : [signature] Date: 3-22-00

APPROVED: Stephanie A Guilyard Date: 3/23/00
Stephanie A. Guilyard, IHIT, Project Manager

NOTES: * = Information not supplied by client. < = less than.
= Information not requested by client. N/A = Not Applicable.
Time, flow rate and/or sample volume data are based on client supplied information, unless otherwise noted.

A - FILTER OR SINGLE STAGE MONITOR
B - TUBE
C - TUBE OR 2 STAGE MONITOR
D - BULK MATERIALS OR WIPES
E - LIQUIDS OR SOLIDS
I - FILTER + TUBE
J - FILTER + TUBE

ATS

ADVANCED TECHNOLOGY SYSTEMS, INC.
639 ALPHA DRIVE, R.I.D.C. PARK
PITTSBURGH, PA 15238
(412)967-1900 FAX (412)967-1911

* Please add 25mg Sodium Thiosulfate prior to analysis
$Na_2S_2O_3 \cdot 3.5 H_2O$

CHAIN OF CUSTODY RECORD

PROJECT NUMBER 00-016-P ; P.O. #3629
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC IH and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS B-Battery Combustion Stack

ANALYSES TO BE CONDUCTED
A: Impingers 1+2
B: Impinger 3
C: Impinger 4
D: Impinger 5

	SAMPLE IDENTIFICATION NUMBER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	NUMBER OF CONTAINERS	COMPOSITE OR GRAB	Chloride by ion Chromatography - U.S. EPA Reference Method 26A	REMARKS OR OBSERVATIONS
	CLR-BBS-M26A-1A	03-08-00	0805 →	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 478.6 mL
	CLR-BBS-M26A-1B		1020 EST	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 150.9 mL
*	CLR-BBS-M26A-1C			1	Comp.	✓	0.1N NaOH - Sample Volume = 148.5 mL
*	CLR-BBS-M26A-1D	↓	↓	1	Comp.	✓	0.1N NaOH - Sample Volume = 157.2 mL
	CLR-BBS-M26A-2A	03-09-00	1453 →	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 431.9 mL
	CLR-BBS-M26A-2B		1359 EST	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 150.9 mL
*	CLR-BBS-M26A-2C			1	Comp.	✓	0.1N NaOH - Sample Volume = 154.0 mL
*	CLR-BBS-M26A-2D	↓	↓	1	Comp.	✓	0.1N NaOH - Sample Volume = 166.1 mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Shymanski	03-09-00	1555 EST		3.10.00	9:00 AM	
	03/09/00	1555 EST				CHEST TEMP.
						TAG #

ATS 10/98

ATS

ADVANCED TECHNOLOGY SYSTEMS, INC.
639 ALPHA DRIVE, R.I.D.C. PARK
PITTSBURGH, PA 15238
(412)967-1900 FAX (412)967-1911

* Please add 25 mg Sodium Thiosulfate prior to analysis
$Na_2S_2O_3 \cdot 3H_2O$

CHAIN OF CUSTODY RECORD

PROJECT NUMBER 03-016-P; P.O.# 3629
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB VEC IH and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS B-Battery Combustion Stack

ANALYSES TO BE CONDUCTED
Chloride by ion Chromatography - U.S. EPA Reference Method 26A

A: Impingers 1+2
B: Impinger 3
C: Impinger 4
D: Impinger 5

	SAMPLE IDENTIFICATION NUMBER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	NUMBER OF CONTAINERS	COMPOSITE OR GRAB	REMARKS OR OBSERVATIONS
	CLR-BBS-M26A-3A	03-08-04	1350 →	1	Comp.	0.1 NH_2SO_4 - Sample volume = 438.2 mL
	CLR-BBS-M26A-3B	↓	1605 EST	1	Comp.	0.1 N H_2SO_4 - Sample volume = 168.3 mL
*	CLR-BBS-M26A-3C	↓	↓	1	Comp.	0.1 N NaOH - Sample volume = 159.5 mL
*	CLR-BBS-M26A-3D	↓	↓	1	Comp.	0.1 N NaOH - Sample volume = 164.0 mL
	CLR-H2SO4-BLK	03-09-04	BLANK	1	~~Grab~~	0.1 N H_2SO_4
*	CLR-NAOH-BLK	↓	BLANK	1	Grab	0.1 N NaOH

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Shumaker	03-09-04	1530 EST	[illegible]	3-10-04	9:00 A.M.	
Kelly Cy	03 09 04	554 EST				CHEST TEMP.
						TAG #

ATS 10/98

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
B-BATTERY COMBUSTION STACK
MARCH 8, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-BBS-M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	39	478.6	18.67	94.5
	1B	0.1 N H2SO4 - Impinger 3	6.8	150.9	1.03	
	1C	0.1 N NaOH - Impinger 4	5.1	148.5	0.76	100.0
	1D	0.1 N NaOH - Impinger 5	< 0.20	157.2	< 0.03	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	39	431.9	16.84	97.0
	2B	0.1 N H2SO4 - Impinger 3	3.4	150.9	0.51	
	2C	0.1 N NaOH - Impinger 4	< 0.20	154.0	< 0.03	NA
	2D	0.1 N NaOH - Impinger 5	< 0.20	166.1	< 0.03	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	33	438.2	14.46	88.4
	3B	0.1 N H2SO4 - Impinger 3	10	168.3	1.68	
	3C	0.1 N NaOH - Impinger 4	< 0.20	159.5	< 0.03	NA
	3D	0.1 N NaOH - Impinger 5	< 0.20	164.0	< 0.03	
Blank	Blank	0.1 N H2SO4	< 0.20			
Blank	Blank	0.1 N NaOH	< 0.20			

<u>0.1 N H2SO4</u>

Collection Eff. = (%) 100 * {1 - [XB Chloride Catch (mg) / XA Chloride Catch (mg)] }
where X = 1, 2 or 3

<u>0.1 N NaOH</u>

Collection Eff. = (%) 100 * {1 - [XD Chloride Catch (mg) / XC Chloride Catch (mg)] }
where X = 1, 2 or 3

For chloride concentrations less than the analytical detection limit (< 0.20) ---->
Chloride catch = 0

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: B-BATTERY COMBUSTION STACK
TEST DATE: 3/8/00
TEST NO.: CLR- BBS-M26A-1

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.50
B.	Process Gas Static Pressure (in. H2O)	-1.50
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	1.0023
	»»»» Is the Duct Round (Y/N)?	Y
E.	Duct Diameter (in.) - for round duct	156
F.	Duct Width (in.) - for rectangular duct	0
G.	Duct Depth (in.) - for rectangular duct	0
H.	Nozzle Diameter (in.)	0.440
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.03
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.03
K.	Average ΔH (in. H2O)	0.71
L.	Average Process Gas Temperature (°F)	473
M.	Average Dry Gas Meter Temperature (°F)	84
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	4.0
	Oxygen (%)	11.0
	Nitrogen (%)	85.0
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
O.	Sample Time (min)	120
P.	Total H2O Mass Collected in Impingers (g)	203.3
Q.	Metered Gas Volume (dcf)	57.614

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.39	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.55	[A+(K/13.6)]
T.	Duct Area (ft.^2)	1.33E+02	[Pi*E²/(4*144) or F*G/144]
U.	Nozzle Area (ft.^2)	1.06E-03	[Pi*H²/(4*144)]
V.	Average Absolute Process Gas Temperature (R)	933	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	544	[M+460]
X.	Dry Gas Volume Sampled (dscf)	55.359	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.586	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.8	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	14.8	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.148		18	2.657
CO2	0.040	0.852	44	1.500
O2	0.110	0.852	32	3.000
N2	0.850	0.852	28	20.287
CO	0.000	0.852	28	0.000
H2	0.000	0.852	2	0.000
CH4	0.000	0.852	16	0.000
C2H6	0.000	0.852	30	0.000
Ar	0.000	0.852	40	0.000

Process Gas Molecular Weight (lb/lb-mol) 27.44

DD.	Average Process Gas Velocity (ft/sec)	1.42E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	1.13E+05	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	6.30E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	5.37E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	107.9	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0060	
JJ.	Front-Half Residue Weight (g)	0.0129	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0189	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0053	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	2.42E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: B-BATTERY COMBUSTION STACK

TEST DATE: 3/8/00
TEST NO.: CLR- BBS-M26A-1

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)	20.25	
QQ.	Concentration (mg/dscm)	1.29E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	2.60E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	0.76	
TT.	Concentration (mg/dscm)	4.83E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	9.72E-02	[TT*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: B-BATTERY COMBUSTION STACK
TEST DATE: 3/8/00
TEST NO.: CLR- BBS-M26A-2

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.50
B.	Process Gas Static Pressure (in. H2O)	-1.50
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	1.0023
»»»»	Is the Duct Round (Y/N)?	Y
E.	Duct Diameter (in.) - for round duct	156
F.	Duct Width (in.) - for rectangular duct	0
G.	Duct Depth (in.) - for rectangular duct	0
H.	Nozzle Diameter (in.)	0.440
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.04
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.04
K.	Average ΔH (in. H2O)	0.75
L.	Average Process Gas Temperature (°F)	472
M.	Average Dry Gas Meter Temperature (°F)	93
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	3.0
	Oxygen (%)	12.0
	Nitrogen (%)	85.0
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
O.	Sample Time (min)	120
P.	Total H2O Mass Collected in Impingers (g)	193.6
Q.	Metered Gas Volume (dcf)	59.544

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.39	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.56	[A+(K/13.6)]
T.	Duct Area (ft.^2)	1.33E+02	[Pi*E²/(4*144) or F*G/144]
U.	Nozzle Area (ft.^2)	1.06E-03	[Pi*H²/(4*144)]
V.	Average Absolute Process Gas Temperature (R)	932	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	553	[M+460]
X.	Dry Gas Volume Sampled (dscf)	56.288	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.128	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.0	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	14.0	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.140		18	2.512
CO2	0.030	0.860	44	1.136
O2	0.120	0.860	32	3.304
N2	0.850	0.860	28	20.479
CO	0.000	0.860	28	0.000
H2	0.000	0.860	2	0.000
CH4	0.000	0.860	16	0.000
C2H6	0.000	0.860	30	0.000
Ar	0.000	0.860	40	0.000

Process Gas Molecular Weight (lb/lb-mol) 27.43

DD.	Average Process Gas Velocity (ft/sec)	1.44E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	1.15E+05	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	6.40E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	5.51E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	107.0	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0051	
JJ.	Front-Half Residue Weight (g)	0.0204	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0255	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0070	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	3.30E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: B-BATTERY COMBUSTION STACK

TEST DATE: 3/8/00
TEST NO.: CLR- BBS-M26A-2

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)	17.85	
QQ.	Concentration (mg/dscm)	1.12E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	2.31E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	< 0.03	
TT.	Concentration (mg/dscm)	< 1.93E-02	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	< 3.98E-03	[TT*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: B-BATTERY COMBUSTION STACK
TEST DATE: 3/8/00
TEST NO.: CLR- BBS-M26A-3

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.50
B.	Process Gas Static Pressure (in. H2O)	-1.50
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	1.0023
	»»»» Is the Duct Round (Y/N)?	Y
E.	Duct Diameter (in.) - for round duct	156
F.	Duct Width (in.) - for rectangular duct	0
G.	Duct Depth (in.) - for rectangular duct	0
H.	Nozzle Diameter (in.)	0.440
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.03
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.03
K.	Average ΔH (in. H2O)	0.70
L.	Average Process Gas Temperature (°F)	455
M.	Average Dry Gas Meter Temperature (°F)	94
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	3.0
	Oxygen (%)	12.0
	Nitrogen (%)	85.0
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
O.	Sample Time (min)	120
P.	Total H2O Mass Collected in Impingers (g)	172.3
Q.	Metered Gas Volume (dcf)	57.122

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.39	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.55	[A+(K/13.6)]
T.	Duct Area (ft.^2)	1.33E+02	[Pi*E²/(4*144) or F*G/144]
U.	Nozzle Area (ft.^2)	1.06E-03	[Pi*H²/(4*144)]
V.	Average Absolute Process Gas Temperature (R)	915	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	554	[M+460]
X.	Dry Gas Volume Sampled (dscf)	53.894	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	8.124	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	13.1	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	13.1	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.131		18	2.358
CO2	0.030	0.869	44	1.147
O2	0.120	0.869	32	3.337
N2	0.850	0.869	28	20.682
CO	0.000	0.869	28	0.000
H2	0.000	0.869	2	0.000
CH4	0.000	0.869	16	0.000
C2H6	0.000	0.869	30	0.000
Ar	0.000	0.869	40	0.000

Process Gas Molecular Weight (lb/lb-mol) 27.52

DD.	Average Process Gas Velocity (ft/sec)	1.39E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	1.10E+05	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	6.26E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	5.44E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	103.7	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0035	
JJ.	Front-Half Residue Weight (g)	0.0131	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0166	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0047	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	2.22E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST DATE: 3/8/00
TEST SITE: B-BATTERY COMBUSTION STACK
TEST NO.: CLR- BBS-M26A-3

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)	16.60	
QQ.	Concentration (mg/dscm)	1.09E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	2.22E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.03	
TT.	Concentration (mg/dscm)	<	2.09E-02	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	4.26E-03	[TT*0.02832*GG*60/454000]