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ADVANCED TECHNOLOGY SYSTEMS, INC.

ATS Project No. 00-009-P

September 12, 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 NO. 9 BATTERY COMBUSTION STACK ON FEBRUARY 23 AND 24, 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 No. 9 Battery Combustion Stack by Advanced Technology Systems, Inc. (ATS). Three two-hour test runs were conducted on February 23 and 24, 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 all three test runs, 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).

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:

R. 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

NO. 9 BATTERY COMBUSTION STACK
HYDROCHLORIC ACID AND CHLORINE GAS EMISSIONS DATA
FEBRUARY 23 AND 24, 2000

		Run 1	Run 2	Run 3	Average
Test Date		2/23/00	2/23/00	2/24/00	
Emissions Data					
Hydrochloric Acid (HCl)					
Concentration	(mg/dscm)	1.29E+01	1.15E+01	1.14E+01	1.19E+01
Mass Emission Rate	(lb/hr)	1.96E+00	1.65E+00	1.63E+00	1.75E+00
Chlorine Gas (Cl_2)					
Concentration	(mg/dscm)	5.06E-02	6.04E-02	1.45E-01	8.53E-02
Mass Emission Rate	(lb/hr)	7.70E-03	8.70E-03	2.08E-02	1.24E-02
Exhaust Stack Conditions					
Volumetric Flow Rate	(acfm)	9.35E+04	8.69E+04	8.64E+04	8.89E+04
	(scfm)	4.84E+04	4.54E+04	4.51E+04	4.63E+04
	(dscfm)	4.06E+04	3.84E+04	3.82E+04	3.91E+04
Temperature	(°F)	552	544	538	545
Moisture Content	(%)	16.0	15.2	15.3	15.5
Sampling Conditions					
Test Times	(EST)	0805 to 1024	1053 to 1308	1148 to 1405	
Sampling Time - *	(minutes)	120	120	120	
Sample Volume - **	(dscf)	72.754	69.794	69.318	
Isokinetic Variation - ***	(%)	100.1	101.6	101.4	

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 No. 9 Battery Combustion Stack on February 23 and 24, 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	February 23rd, 2000 (Wed.)	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	7
PLANT SITE	Clairton, PA	TEST NO.	CLR - #9BS - M26A - 1	ORIFICE FACTOR (ΔH@)	2.043	FILTER NO.	458 QTZ
TEST UNIT	No. 9 Battery Combustion Stack	B.P. (in. Hg)	29.76	METER CORR. (Y)	1.0023	PROBE NO.	7-3
TEST CREW	JS, KA, RS,	STATIC P. (in. H2O)	-1.0	CALIBRATION DATE	09-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 009 - P	STACK DIA. (in.)	114	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	40.6	0805	147.485	0.10	1.78	1.78	3.0	242	566	61	60	240	59	
	28.5			0.09	1.60	1.60	3.0	242	576	66	60	241	59	5 min./pt.
	20.2			0.08	1.41	1.41	3.0	242	579	69	61	241	59	
	13.5			0.08	1.41	1.41	3.0	242	586	71	61	240	56	
	7.6			0.05	0.88	0.88	2.0	243	560	72	62	240	56	
	2.4	0835	166.395	0.05	0.88	0.88	2.0	243	540	72	62	240	54	
B	40.6	0838	166.395	0.09	1.60	1.60	3.0	243	548	66	62	240	54	
	28.5			0.08	1.42	1.42	3.0	241	550	69	62	241	54	
	20.2			0.08	1.42	1.42	3.0	241	536	71	62	240	54	
	13.5			0.08	1.42	1.42	3.0	241	547	72	62	241	51	
	7.6			0.05	0.91	0.91	2.0	240	544	73	63	240	50	
	2.4	0908	183.616	0.03	0.55	0.55	2.0	240	536	73	63	240	50	
	Page 1	Δ = 60	Δ = 36.131	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.070		1.24			556 (°F)		66 (°F)			Estimates:
	Test	Δ = 120	Δ = 72.602	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.5
	Totals	min	dcf	0.075		1.32			552 (°F)		67 (°F)			%H2O = 14

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

Dry Gas Composition

	Run 1	Run 2
CO2	3.5%	
O2	12.0%	
CO	—	
N2	84.5%	

System Leak Check (60 sec)

2	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.007	< 0.02
After	5.00	0.010	< 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	652.3	485.6	166.7
2.	100 mL 0.1 N H2SO4	645.9	551.7	94.2
3.	100 mL 0.1 N H2SO4	570.3	558.0	12.3
4.	100 mL 0.1 N NaOH	551.7	549.1	2.6
5.	100 mL 0.1 N NaOH	517.0	514.6	2.4
6.	~ 200 g Silica Gel	586.0	569.4	16.6
7.				
8.			Total =	294.89

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	February 23rd (Wed.), 2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	7
PLANT SITE	Clairton, PA	TEST NO.	CLR - #9BS - M26A - 1	ORIFICE FACTOR (ΔH@)	2.ØØ3	FILTER NO.	458 QTZ
TEST UNIT	No. 9 Battery Combustion Stack	B.P. (in. Hg)	29.76	METER CORR. (Y)	1.ØØ23	PROBE NO.	7-3
TEST CREW	JS, KA, RS.	STATIC P. (in. H2O)	-1.0	CALIBRATION DATE	Ø9-2Ø-99	NOZZLE DIA. (in.)	Ø.44Ø
PROJECT NO.	00 - 009 - P	STACK DIA. (in.)	114	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	40.6	0920	182.616	0.10	1.78	1.78	4.0	242	583	69	63	242	54	
	28.5			0.11	1.95	1.95	5.0	242	524	73	63	242	54	5 min./pt.
	20.2			0.10	1.78	1.78	4.0	242	525	74	63	242	54	
	13.5			0.09	1.60	1.60	4.0	242	534	75	64	242	51	
	7.6			0.06	1.07	1.07	3.0	242	536	75	64	242	50	
	2.4	0950	202.155	0.05	0.88	0.88	2.0	242	530	75	64	242	50	
D	40.6	0954	202.155	0.11	1.95	1.95	5.0	242	537	70	64	242	52	
	28.5			0.10	1.78	1.78	4.0	242	553	74	64	242	52	
	20.2			0.08	1.46	1.46	4.0	242	561	76	65	242	52	
	13.5			0.07	1.28	1.28	4.0	242	568	77	65	245	52	
	7.6			0.06	1.09	1.09	3.0	243	571	77	65	245	52	
	2.4	1024	220.087	0.04	0.73	0.73	2.0	243	544	76	66	242	52	
	Page 2	Δ = 60	Δ = 36.471	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.08		1.41			547 (°F)		69 (°F)			MW = 27.5
														%H2O = 14

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

18.72

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

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	%H2O = 16.Ø%		
3.	100 mL 0.1 N H2SO4			
4.	100 mL 0.1 N NaOH	ISO. = 1ØØ.1%		
5.	100 mL 0.1 N NaOH			
6.	~ 200 g Silica Gel			
7.				
8.				

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	February 23rd, 2000 (Wed.)	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - #9BS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	459 QTZ/46[illegible]
TEST UNIT	No. 9 Battery Combustion Stack	B.P. (in. Hg)	29.76	METER CORR. (Y)	1.0023	PROBE NO.	7-3
TEST CREW	JS, KA, RS.	STATIC P. (in. H2O)	-1.0	CALIBRATION DATE	09-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-009-P	STACK DIA. (in.)	114	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	40.6	1053	221.156	0.10	1.83	1.83	5.0	242	558	66	64	241	56	
	28.5			0.09	1.65	1.65	5.0	242	540	69	64	241	56	5 min./pt.
	20.2			0.07	1.28	1.28	4.0	242	555	71	64	241	54	
	13.5			0.07	1.28	1.28	4.0	242	566	74	65	241	54	
	7.6			0.06	1.05	1.05	4.0	242	570	76	65	241	54	
	2.4	1123	239.237	0.04	0.70	0.70	3.0	242	557	77	66	241	54	
B	40.6	1130	239.237	0.09	1.65	1.65	5.0	242	534	70	67	241	54	FILTER REPLACED,
	28.5			0.09	1.65	1.65	5.0	242	536	73	67	241	54	MIDDLE CRACKED
	20.2			0.07	1.28	1.28	5.0	242	544	77	67	241	54	OK.
	13.5			0.06	1.11	1.11	5.0	242	548	77	68	243	50	
	7.6			0.05	0.93	0.93	3.0	242	549	77	68	244	50	
	2.4	1200	256.584	0.04	0.74	0.74	3.0	243	528	77	68	242	50	
	Page 1	Δ = 60	Δ = 35.428	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.068		1.24			549 (°F)		70 (°F)			Estimates:
	Test	Δ = 120	Δ = 70.328	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.5
	Totals	min	dcf	0.066		1.21			544 (°F)		72 (°F)			%H2O = 14

Dry Gas Composition

	Run 2	Run 3
CO2	3.5%	
O2	11.0%	
CO	—	
N2	86.5%	

18.59 ↑

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.005	< 0.02
After	5.00	0.003	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	O/C	O/C
After	O/C	O/C

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	661.7	498.5	163.2
2.	100 mL 0.1 N H2SO4	658.7	583.4	75.3
3.	100 mL 0.1 N H2SO4	568.5	559.8	8.7
4.	100 mL 0.1 N NaOH	539.1	538.1	1.0
5.	100 mL 0.1 N NaOH	539.2	540.5	-1.3
6.	~200 g Silica Gel	659.2	639.8	19.4
7.				
8.			Total =	266.39

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	February 23rd, 2000 (wed.)	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - #9BS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	460 QTZ
TEST UNIT	No. 9 Battery Combustion Stack	B.P. (in. Hg)	29.76	METER CORR. (Y)	1.0023	PROBE NO.	7-3
TEST CREW	JS, KA, RS.	STATIC P. (in. H2O)	-1.0	CALIBRATION DATE	09-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 009 - P	STACK DIA. (in.)	114	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
9B	40.6	1204	256.584	0.09	1.66	1.66	5.0	246	568	76	69	245	50	5 min./pt.
	28.5			0.09	1.63	1.63	5.0	246	571	77	69	245	49	
	20.2			0.08	1.45	1.45	5.0	246	578	78	69	245	49	
	13.5			0.06	1.09	1.09	4.0	243	581	78	69	245	49	
	7.6			0.07	1.27	1.27	5.0	243	511	79	69	245	49	
	2.4	1234	274.171	0.02	0.36	0.36	2.00	243	500	78	70	245	49	
9A	40.6	1238	274.171	0.09	1.63	1.63	5.0	244	537	75	70	245	49	
	28.5			0.08	1.45	1.45	5.0	243	540	76	70	245	49	
	20.2			0.07	1.27	1.27	5.0	243	551	78	70	245	49	
	13.5			0.06	1.09	1.09	4.0	243	556	78	70	245	49	
	7.6			0.05	0.93	0.93	4.0	243	538	79	70	245	50	
	2.4	1308	291.484	0.04	0.74	0.74	3.0	242	530	79	71	245	50	
														Estimates:
	Page 2	Δ = 60	Δ = 34.900	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.5
	Totals	min	dcf	0.065		1.18			538 (°F)		74 (°F)			%H2O = 14

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

18.12

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

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	%H2O = 15.2%		
3.	100 mL 0.1 N H2SO4			
4.	100 mL 0.1 N NaOH			
5.	100 mL 0.1 N NaOH	Iso. = 101.6%		
6.	~ 200 g Silica Gel			
7.				
8.				

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	February 24th (Thurs), 2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	3
PLANT SITE	Clairton, PA	TEST NO.	CLR - #9BS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	461 QRTZ
TEST UNIT	No. 9 Battery Combustion Stack	B.P. (in. Hg)	29.61	METER CORR. (Y)	1.0023	PROBE NO.	7-3
TEST CREW	JS, KA, RS,	STATIC P. (in. H2O)	-1.0	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-009-P	STACK DIA. (in.)	114	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	40.6	1148	292.345	0.09	1.66	1.66	6.0	242	554	74	73	240	60	5 min./pt.
	28.5			0.09	1.66	1.66	6.0	242	530	77	73	240	60	
	20.2			0.08	1.47	1.47	5.0	242	551	81	74	240	60	
	13.5			0.06	1.11	1.11	4.0	242	555	82	74	240	59	
	7.6			0.05	0.93	0.93	3.0	242	559	83	75	240	56	
	2.4	1218	310.178	0.03	0.56	0.56	2.0	242	500	84	76	240	56	
B	40.6	1224	310.178	0.09	1.68	1.68	6.0	242	508	79	76	240	54	
	28.5			0.07	1.31	1.31	5.0	242	524	83	73	241	54	
	20.2			0.07	1.31	1.31	5.0	242	529	84	77	241	54	
	13.5			0.05	0.95	0.95	3.0	241	534	84	77	241	54	
	7.6			0.04	0.76	0.76	2.0	241	531	84	77	240	54	
	2.4	1254	326.495	0.02	0.38	0.38	2.0	241	500	83	78	241	52	changed filters at port change - initial filter cracked near the edge
	Page 1	Δ = 60	Δ = 34.150	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.060		1.10			531 (°F)		78 (°F)			Estimates:
	Test	Δ = 120	Δ = 71.261	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.065		1.19			538 (°F)		80 (°F)			MW = 27.5
														%H2O = 14

Dry Gas Composition

	Run 1	Run 2
CO2	4.0 %	
O2	12.0 %	
CO	—	
N2	84.0 %	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.0	0.007	< 0.02
After	6.0	0.004	< 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	641.3	485.5	155.8
2.	100 mL 0.1 N H2SO4	590.8	508.6	82.2
3.	100 mL 0.1 N H2SO4	571.0	566.9	4.1
4.	100 mL 0.1 N NaOH	533.3	533.9	-0.6
5.	100 mL 0.1 N NaOH	553.6	550.4	3.2
6.	~200 g Silica Gel	669.4	648.2	21.2
7.				
8.			Total =	265.9 g

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	February 24th, 2000 (Thurs.)	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	3
PLANT SITE	Clairton, PA	TEST NO.	CLR - #9BS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	462 QTZ
TEST UNIT	No. 9 Battery Combustion Stack	B.P. (in. Hg)	29.61	METER CORR. (Y)	1.0023	PROBE NO.	7-3
TEST CREW	JS, KA, RS.	STATIC P. (in. H2O)	-1.0	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-009-P	STACK DIA. (in.)	114	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	40.6	1300	326.495	0.08	1.50	1.50	6.0	241	549	80	77	242	59	
	28.5			0.08	1.50	1.50	6.0	241	560	82	77	242	56	5 min./pt.
	20.2			0.07	1.29	1.29	5.0	241	569	84	77	242	54	
	13.5			0.07	1.29	1.29	5.0	241	573	85	77	241	54	
	7.6			0.05	0.92	0.92	4.0	241	571	85	78	245	54	
	2.4	1330	344.315	0.04	0.74	0.74	3.0	242	500	85	78	245	54	
D	40.6	1335	344.315	0.09	1.72	1.72	6.0	242	534	82	77	245	54	
	28.5			0.09	1.72	1.72	6.0	242	544	83	78	245	54	
	20.2			0.09	1.72	1.72	6.0	242	552	84	78	243	52	
	13.5			0.08	1.49	1.49	6.0	242	558	86	78	243	52	
	7.6			0.06	1.12	1.12	5.0	242	535	85	78	243	55	
	2.4	1405	363.606	0.04	0.75	0.75	3.0	245	500	85	78	243	55	
	Page 2	Δ = 60	Δ = 37.111	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.070		1.29			545 (°F)		81 (°F)			MW = 27.5
														%H2O = 14

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

18.44

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

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	%H2O = 15.3%		
3.	100 mL 0.1 N H2SO4			
4.	100 mL 0.1 N NaOH	Iso. = 101.4%		
5.	100 mL 0.1 N NaOH			
6.	~200 g Silica Gel			
7.				
8.				

APEX GLASS NOZZLE CALIBRATION DATA SHEET

Printed: 02/21/00

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	05-19-99

APEX GLASS NOZZLE CALIBRATION DATA SHEET

Printed: 02/21/00

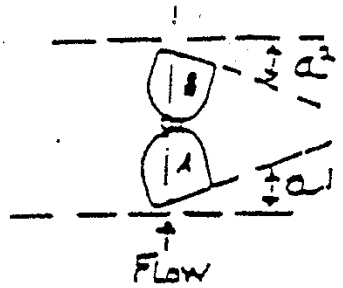
Nozzle No.	Size (inches)					Calibrated	
	Avg.		A	B	C	By	Date
53	0.440		0.440	0.440	0.440	KA	05-19-99
19	0.450		0.450	0.450	0.450	KA	04-14-98
36	0.490		0.490	0.490	0.490	KA	06-10-97
37	0.490		0.490	0.490	0.490	KA	07-05-96
38	0.495		0.495	0.495	0.495	KA	07-05-96
39	0.500		0.500	0.500	0.500	KA	07-05-96
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

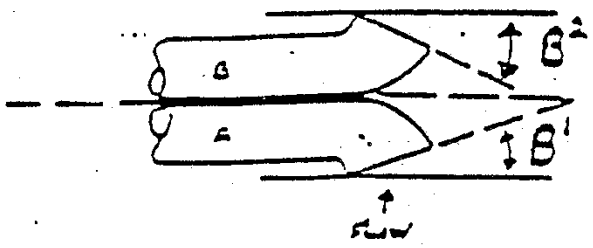
Probe #: 7-3
Date: 01-10-'00
Initials: KBA

①



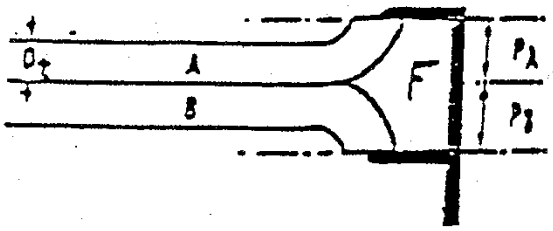
a^1 = 3°
a^2 = 3° a^1, a^2 = <10°
B^1 = 2°
B^2 = 4° B^1, B^2 = <5°
F = 0.945"

②



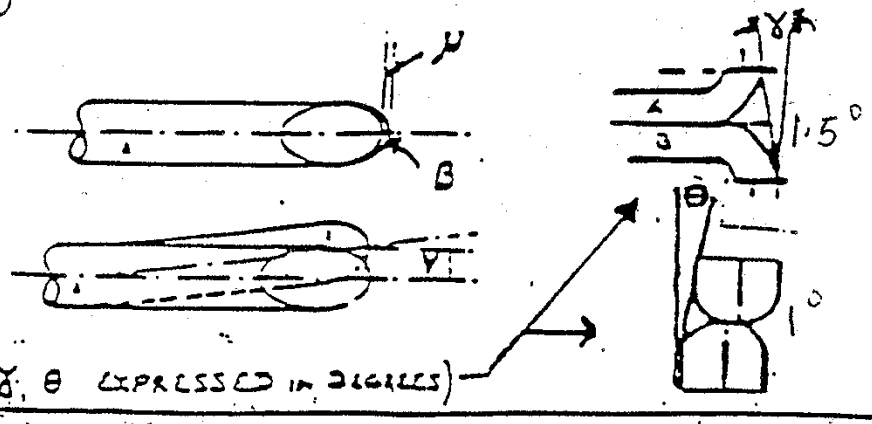
μ = 0.024" μ = ≤ 0.1250" (γ TAN x F)
V = 0.016" V = ≤0.03125" (θ TAN x F)
W = 0.487" W ≥ 0"
X = 0.923" X ≥ 0.750" (3/4" using 1/2" scale)
Y = 6.013" Y ≥ 3.0"
Z = 2.499" Z > 2.0"
D_t = 0.376" D_t > .1875"

③



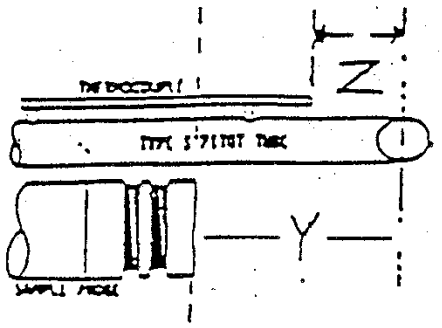
1.05 D_t < d < 1.50 D_t
P_A = P_B
2.10 D_t < d < 3.00 D_t

④

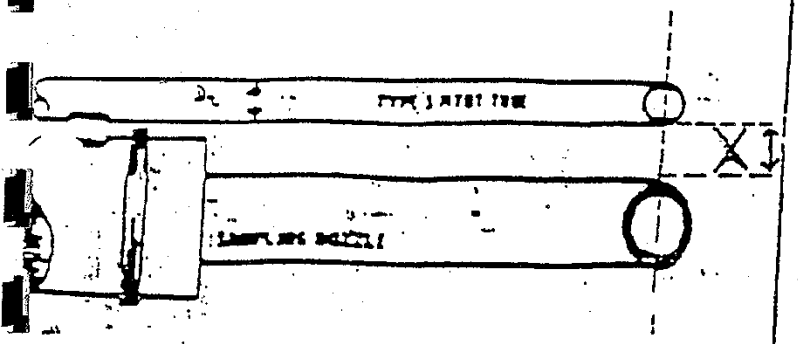


(γ, θ EXPRESSED IN DEGREES)

⑥



⑤



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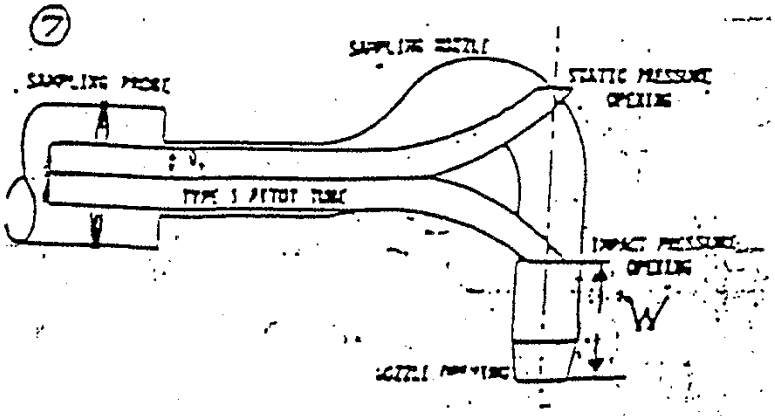

CERTIFICATE OF CALIBRATION

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		0.399				

{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 TS

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		5.130				
Dry Gas Meter Leak Check	START	0.200	0		761.484			0.0	7.5
	STOP	0.400	10:00		761.878				
	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%

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

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

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

IH & Environmental Laboratory

RECEIVED MAR 27 2000

UEC
USX Engineers
& Consultants, Inc.

March 21, 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 February 28, 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 - 03/15/2000

Customer: CD-002D

Advanced Technology Systems, Inc.
639 Alpha Drive
RIDC Park

Harmarville, PA 15238

ATTENTION: Mr. John Shimshock

Work Requested by : Mr. John Shimshock
Phone No. : 412-967-1900

CUSTOMER P.O. # : 00-009-P
SITE LOCATION : US STEEL CLAIRTON WORKS/NO. 9 BATTERY

TRACKING NUMBER: 805

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	
05771	CLR#9BS-M26A-1A	CHLORIDE	02/23/00	*	*	*	03/10/00	49							0.20 mg/L	E
05772	CLR-#9BS-M26A-1B	CHLORIDE	02/23/00	*	*	*	03/10/00	17							0.20 mg/L	E
05773	CLR-#9BS-M26A-1C	CHLORIDE	02/23/00	*	*	*	03/10/00	0.74							0.20 mg/L	E
05774	CLR-#9BS-M26A-1D	CHLORIDE	02/23/00	*	*	*	03/10/00	<0.20							0.20 mg/L	E
05775	CLR-#9BS-M26A-2A	CHLORIDE	02/23/00	*	*	*	03/10/00	47							0.20 mg/L	E
05776	CLR-#9BS-M26A-2B	CHLORIDE	02/23/00	*	*	*	03/10/00	2.4							0.20 mg/L	E
05777	CLR-#9BS-M26A-2C	CHLORIDE	02/23/00	*	*	*	03/10/00	0.81							0.20 mg/L	E
05778	CLR-#9BS-M26A-2D	CHLORIDE	02/23/00	*	*	*	03/10/00	<0.20							0.20 mg/L	E
05779	CLR-#9BS-M26A-3A	CHLORIDE	02/24/00	*	*	*	03/10/00	45							0.20 mg/L	E
05780	CLR-#9BS-M26A-3B	CHLORIDE	02/24/00	*	*	*	03/10/00	2.7							0.20 mg/L	E
05781	CLR-#9BS-M26A-3C	CHLORIDE	02/24/00	*	*	*	03/10/00	1.9							0.20 mg/L	E
05782	CLR-#9BS-M26A-3D	CHLORIDE	02/24/00	*	*	*	03/10/00	<0.20							0.20 mg/L	E
05783	CLR-H2SO4-BLK	CHLORIDE	02/24/00	*	*	*	03/10/00	<0.20							0.20 mg/L	E

NOTES: * = Information not supplied by client. < = less than. A - FILTER OR SINGLE STAGE MONITOR C - TUBE OR 2 STAGE MONITOR E - LIQUIDS OR SOLIDS J - FILTER + TUBE
= Information not requested by client. N/A = Not Applicable. B - TUBE D - BULK MATERIALS OR WIPES I - FILTER + TUBE
Time, flow rate and/or sample volume data are based on client supplied information, unless otherwise noted.

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 - 03/15/2000
PAGE - 2

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. # : 00-009-P SITE LOCATION : US STEEL CLAIRTON WORKS/NO. 9 BATTERY

TRACKING NUMBER: 805

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	
05784	CLR-NAOH-BLK	CHLORIDE	02/24/00	*	*	*	03/10/00	<0.20							0.20 mg/L	E

ANALYST : N. Ketyel Date: 3-15-00
APPROVED: Stephanie A. Guilyard Date: 3/23/00
Stephanie A. Guilyard, IHIT, Project Manager

NOTES: * = Information not supplied by client. < = less than. A - FILTER OR SINGLE STAGE MONITOR C - TUBE OR 2 STAGE MONITOR E - LIQUIDS OR SOLIDS J - FILTER + TUBE
= Information not requested by client. N/A = Not Applicable. B - TUBE D - BULK MATERIALS OR WIPES I - FILTER + TUBE
Time, flow rate and/or sample volume data are based on client supplied information, unless otherwise noted.

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 $Na_2S_2O_3 \cdot 3.5H_2O$

CHAIN OF CUSTODY RECORD

PROJECT NUMBER JL-1189-P
PROJECT NAME USC IH and Environmental Laboratory
ANALYTICAL LAB US Steel Clairton Works
DELIVER TO Sample Receiving
COMMENTS No. 9 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 IC	Thiosulfate by IC	US EPA Method 6/8								REMARKS OR OBSERVATIONS
	CLR-#9BS-M26A-1A	02-23-06	1015 →	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 472.4 mL
	CLR-#9BS-M26A-1B		1030 EST	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 157.6 mL
*	CLR-#9BS-M26A-1C			1	Comp.	✓										0.1N NaOH - Sample Volume = 149.9 mL
*	CLR-#9BS-M26A-1D			1	Comp.	✓										0.1N NaOH - Sample Volume = 143.4 mL
	CLR-#9BS-M26A-2A	02-23-06	1053 →	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 462.5 mL
	CLR-#9BS-M26A-2B		1100 EST	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 156.0 mL
*	CLR-#9BS-M26A-2C			1	Comp.	✓										0.1N NaOH - Sample Volume = 147.5 mL
*	CLR-#9BS-M26A-2D			1	Comp.	✓										0.1N NaOH - Sample Volume = 147.7 mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME		RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Sherendovich	02-24-06	0900					
							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 00-009-P
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB VEC JH and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 9 Battery Combustion Stack

ANALYSES TO BE CONDUCTED: Chloride b.i.m. | Chromatography | US 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	Chloride b.i.m.	Chromatography	US EPA Reference Method 26A								REMARKS OR OBSERVATIONS
CLR-#9BS-M26A-3A	02-24-00	1148 →	1	Comp.	✓										0.1 N H_2SO_4 - sample volume = 474.4 mL
CLR-#9BS-M26A-3B	↓	1405 EST	1	Comp.	✓										0.1 N H_2SO_4 - sample volume = 152.1 mL
* CLR-#9BS-M26A-3C	↓	↓	1	Comp.	✓										0.1 NaOH - sample volume = 150.0 mL
* CLR-#9BS-M26A-3D	↓	↓	1	Comp.	✓										0.1 NaOH - sample volume = 149.9 mL
CLR-H2SO4-BLK	02-24-00	BLANK	1	Grab	✓										0.1 H_2SO_4
* CLR-NAOH-BLK	02-24-00	BLANK	1	Grab	✓										0.1 NaOH.

RELINQUISHED BY (SIGNATURE)	DATE	TIME		RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
[illegible]	[illegible]	[illegible]				[illegible]	
							CHEST TEMP.
							TAG #

ATS 10/98

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
NO. 9 BATTERY COMBUSTION STACK
FEBRUARY 23 AND 24, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#9BS-M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	49	472.0	23.13	88.3
	1B	0.1 N H2SO4 - Impinger 3	17	159.6	2.71	
	1C	0.1 N NaOH - Impinger 4	0.74	140.9	0.10	100.0
	1D	0.1 N NaOH - Impinger 5	< 0.20	143.0	< 0.03	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	47	462.5	21.74	98.3
	2B	0.1 N H2SO4 - Impinger 3	2.4	150.8	0.36	
	2C	0.1 N NaOH - Impinger 4	0.81	147.5	0.12	100.0
	2D	0.1 N NaOH - Impinger 5	< 0.20	149.7	< 0.03	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	45	474.4	21.35	98.1
	3B	0.1 N H2SO4 - Impinger 3	2.7	152.1	0.41	
	3C	0.1 N NaOH - Impinger 4	1.9	150.0	0.29	100.0
	3D	0.1 N NaOH - Impinger 5	< 0.20	149.9	< 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: NO. 9 BATTERY COMBUSTION STACK

TEST DATE: 2/23/00
TEST NO.: CLR- #9BS-M26A-1

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.76
B.	Process Gas Static Pressure (in. H2O)	-1.00
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	114
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	0.08
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.08
K.	Average ΔH (in. H2O)	1.32
L.	Average Process Gas Temperature (°F)	552
M.	Average Dry Gas Meter Temperature (°F)	67
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	3.5
	Oxygen (%)	12.0
	Nitrogen (%)	84.5
	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)	294.8
Q.	Metered Gas Volume (dcf)	72.602

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.69	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.86	[A+(K/13.6)]
T.	Duct Area (ft.^2)	7.09E+01	[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)	1012	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	527	[M+460]
X.	Dry Gas Volume Sampled (dscf)	72.754	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	13.900	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	16.0	[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 (%)	16.0	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.160		18	2.887
CO2	0.035	0.840	44	1.293
O2	0.120	0.840	32	3.224
N2	0.845	0.840	28	19.865
CO	0.000	0.840	28	0.000
H2	0.000	0.840	2	0.000
CH4	0.000	0.840	16	0.000
C2H6	0.000	0.840	30	0.000
Ar	0.000	0.840	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.27	
DD.	Average Process Gas Velocity (ft/sec)	2.20E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	9.35E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	4.84E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	4.06E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	100.1	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0448	
JJ.	Front-Half Residue Weight (g)	0.0248	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0696	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0148	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	5.14E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA

TEST SITE: NO. 9 BATTERY COMBUSTION STACK

TEST DATE: 2/23/00

TEST NO.: CLR- #9BS-M26A-1

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)	26.57	
QQ.	Concentration (mg/dscm)	1.29E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	1.96E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	0.10	
TT.	Concentration (mg/dscm)	5.06E-02	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	7.70E-03	[TT*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 9 BATTERY COMBUSTION STACK

TEST DATE: 2/23/00
TEST NO.: CLR- #9BS-M26A-2

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.76
B.	Process Gas Static Pressure (in. H2O)	-1.00
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	114
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	0.07
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.07
K.	Average ΔH (in. H2O)	1.21
L.	Average Process Gas Temperature (°F)	544
M.	Average Dry Gas Meter Temperature (°F)	72
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	3.5
	Oxygen (%)	11.0
	Nitrogen (%)	86.5
	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)	266.3
Q.	Metered Gas Volume (dcf)	70.328

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.69	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.85	[A+(K/13.6)]
T.	Duct Area (ft.^2)	7.09E+01	[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)	1004	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	532	[M+460]
X.	Dry Gas Volume Sampled (dscf)	69.794	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	12.556	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	15.2	[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 (%)	15.2	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.152		18	2.745
CO2	0.035	0.848	44	1.305
O2	0.110	0.848	32	2.983
N2	0.865	0.848	28	20.527
CO	0.000	0.848	28	0.000
H2	0.000	0.848	2	0.000
CH4	0.000	0.848	16	0.000
C2H6	0.000	0.848	30	0.000
Ar	0.000	0.848	40	0.000

Process Gas Molecular Weight (lb/lb-mol) 27.56

DD.	Average Process Gas Velocity (ft/sec)	2.04E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	8.69E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	4.54E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.84E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	101.6	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0146	
JJ.	Front-Half Residue Weight (g)	0.0121	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0267	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0059	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	1.94E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 9 BATTERY COMBUSTION STACK

TEST DATE: 2/23/00
TEST NO.: CLR- #9BS-M26A-2

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)	22.72	
QQ.	Concentration (mg/dscm)	1.15E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	1.65E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	0.12	
TT.	Concentration (mg/dscm)	6.04E-02	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	8.70E-03	[TT*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 9 BATTERY COMBUSTION STACK

TEST DATE: 2/24/00
TEST NO.: CLR- #9BS-M26A-3

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.61
B.	Process Gas Static Pressure (in. H2O)	-1.00
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	114
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	0.07
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.07
K.	Average ΔH (in. H2O)	1.19
L.	Average Process Gas Temperature (°F)	538
M.	Average Dry Gas Meter Temperature (°F)	80
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	4.0
	Oxygen (%)	12.0
	Nitrogen (%)	84.0
	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)	265.9
Q.	Metered Gas Volume (dcf)	71.261

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.54	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.70	[A+(K/13.6)]
T.	Duct Area (ft.^2)	7.09E+01	[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)	998	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	540	[M+460]
X.	Dry Gas Volume Sampled (dscf)	69.318	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	12.537	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	15.3	[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 (%)	15.3	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.153		18	2.757
CO2	0.040	0.847	44	1.490
O2	0.120	0.847	32	3.252
N2	0.840	0.847	28	19.918
CO	0.000	0.847	28	0.000
H2	0.000	0.847	2	0.000
CH4	0.000	0.847	16	0.000
C2H6	0.000	0.847	30	0.000
Ar	0.000	0.847	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.42	
DD.	Average Process Gas Velocity (ft/sec)	2.03E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	8.64E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	4.51E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.82E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	101.4	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0102	
JJ.	Front-Half Residue Weight (g)	0.0082	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0184	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0041	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	1.34E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 9 BATTERY COMBUSTION STACK

TEST DATE: 2/24/00
TEST NO.: CLR- #9BS-M26A-3

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)	22.37	
QQ.	Concentration (mg/dscm)	1.14E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	1.63E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	0.29	
TT.	Concentration (mg/dscm)	1.45E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	2.08E-02	[TT*0.02832*GG*60/454000]