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ADVANCED TECHNOLOGY SYSTEMS, INC.

ATS Project No. 00-030-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 NO. 1 BATTERY COMBUSTION STACK ON APRIL 19 AND 20, 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. 1 Battery Combustion Stack by Advanced Technology Systems, Inc. (ATS). Three two-hour test runs were conducted on April 19 and 20, 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 could not be calculated since the chloride catch of 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:

A. R. 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. 1 BATTERY COMBUSTION STACK
HYDROCHLORIC ACID AND CHLORINE GAS EMISSIONS DATA
APRIL 19 AND 20, 2000

		Run 1	Run 2	Run 3	Average
Test Date		4/19/00	4/19/00	4/20/00	
Emissions Data					
Hydrochloric Acid (HCl)					
Concentration	(mg/dscm)	6.60E+00	6.76E+00	6.51E+00	6.62E+00
Mass Emission Rate	(lb/hr)	8.85E-01	8.54E-01	7.64E-01	8.34E-01
Chlorine Gas (Cl_2)					
Concentration	(mg/dscm)	< 1.49E-01	< 1.48E-01	< 1.77E-01	< 1.58E-01
Mass Emission Rate	(lb/hr)	< 2.00E-02	< 1.87E-02	< 2.07E-02	< 1.98E-02
Exhaust Stack Conditions					
Volumetric Flow Rate	(acfm)	7.78E+04	7.33E+04	6.87E+04	7.33E+04
	(scfm)	4.14E+04	3.90E+04	3.65E+04	3.90E+04
	(dscfm)	3.58E+04	3.38E+04	3.14E+04	3.37E+04
Temperature	(°F)	516	516	513	515
Moisture Content	(%)	13.4	13.4	14.1	13.6
Sampling Conditions					
Test Times +	(EDT)	0810 to 0912 & 1117 to 1220	1510 to 1718	1055 to 1308	
Sampling Time *	(minutes)	120	120	120	
Sample Volume **	(dscf)	65.979	63.092	58.614	
Isokinetic Variation ***	(%)	103.0	104.5	104.6	

mg / dscm = milligrams per dry standard cubic meter
+: Battery heat delay from 0912 to 1030 EDT
*: 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. 1 Battery Combustion Stack on April 19 and 20, 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	April 19th, 2000	CONTROL BOX NO.	APEX-1	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 1	ORIFICE FACTOR (ΔH@)	1.911	FILTER NO.	480 QTZ
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.51	METER CORR. (Y)	0.9851	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.0	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 030 - 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	0810	688.863	0.07	1.30	1.30	8.0	248	502	59	57	245	60	5 min./pt.
	28.5			0.07	1.30	1.30	8.0	248	509	62	58	245	50	
	20.2			0.07	1.28	1.28	6.0	248	519	67	59	245	50	
	13.5			0.06	1.09	1.09	4.0	248	529	68	60	245	51	
	7.6			0.04	0.72	0.72	2.0	247	517	70	60	245	48	
	2.4	0840	706.567	0.03	0.54	0.54	2.0	247	505	72	61	245	48	
B	40.6	0842	706.567	0.08	1.47	1.47	7.0	247	513	68	61	245	48	
	28.5			0.07	1.24	1.24	6.0	247	557	75	62	245	49	
	20.2			0.07	1.23	1.23	6.0	247	569	78	63	245	49	
	13.5			0.06	1.05	1.05	5.0	247	489	79	64	244	48	
	7.6			0.03	0.53	0.53	2.0	247	480	78	64	245	49	
	2.4	0912	724.682	0.03	0.53	0.53	2.0	247	482	78	64	245	49	
	Page 1	Δ = 60	Δ = 35.819	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.055		0.99			514 (°F)		66 (°F)			Estimates:
	Test	Δ = 120	Δ = 67.869	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.054		0.99			516 (°F)		69 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4.6 %	
O2	12.4 %	
CO	—	
N2	84.0 %	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.0	0.008	< 0.02
After	8.0	0.009	< 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	519.5	117.6
2.	100 mL 0.1 N H2SO4	614.8	545.3	69.5
3.	100 mL 0.1 N H2SO4	574.2	553.5	19.7
4.	100 mL 0.1 N NaOH	541.7	539.4	2.3
5.	100 mL 0.1 N NaOH	537.5	518.5	2.6
6.	~200 g Silica Gel	664.5	649.2	15.3
7.			total =	217.4g
8.				

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	April 19th, 2000	CONTROL BOX NO.	APEX-1	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 1	ORIFICE FACTOR (ΔH@)	1.911	FILTER NO.	480 QTZ
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.51	METER CORR. (Y)	0.9851	PROBE NO.	7-1
TEST-CREW	JS, KA	STATIC P. (in. H2O)	-1.4	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 030 - 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	1117	724.682	0.06	1.10	1.10	5.00	249	513	66	64	245	50	
	28.5			0.06	1.10	1.10	5.0	249	519	69	65	245	49	5 min./pt.
	20.2			0.06	1.10	1.10	5.0	248	506	69	64	245	49	
	13.5			0.07	1.29	1.29	6.0	248	518	71	65	245	49	
	7.6			0.05	0.92	0.92	4.0	248	539	76	65	245	49	
	2.4	1147	740.606	0.04	0.74	0.74	3.0	248	500	78	66	245	49	
D	40.6	1150	740.606	0.08	1.47	1.47	6.0	248	551	77	67	245	49	
	28.5			0.08	1.47	1.47	6.0	248	577	79	67	245	50	
	20.2			0.05	0.92	0.92	5.0	247	501	80	68	245	50	
	13.5			0.03	0.56	0.56	2.0	248	498	81	68	245	49	
	7.6			0.03	0.56	0.56	2.0	248	494	81	68	244	52	
	2.4	1220	756.732	0.03	0.56	0.56	2.0	248	496	81	68	244	52	
	Page 2	Δ = 60	Δ = 32.050	(ΔP) avg =	(ΔH) avg =	0.98			(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.052					517 (°F)		71 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4%	
O2	12%	
CO	—	
N2	84%	

$= \left[\frac{2.4}{n}\right]^2$

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			
4.	100 mL 0.1 N NaOH			
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	April 19th, 2000	CONTROL BOX NO.	APEX- 1	HOT/COLD BOX NO.	4
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 2	ORIFICE FACTOR (ΔH@)	1.911	FILTER NO.	481 QTZ
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.51	METER CORR. (Y)	0.9851	PROBE NO.	7 - 1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.1	CALIBRATION DATE	9-20-00	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 030 - 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	1510	757.105	0.05	0.94	0.94	5.0	243	500	71	69	248	60	
	28.5			0.05	0.94	0.94	5.0	243	507	72	69	248	59	5 min./pt.
	20.2			0.04	0.74	0.74	4.0	243	513	75	70	248	59	
	13.5			0.035	0.65	0.65	3.0	242	520	78	70	248	59	
	7.6			0.04	0.74	0.74	4.0	242	526	80	70	246	53	
	2.4	1540	772.258	0.035	0.65	0.65	3.0	242	522	82	71	247	51	
C	40.6	1542	772.258	0.08	1.50	1.50	7.0	243	534	81	72	246	50	
	28.5			0.08	1.50	1.50	7.0	243	561	84	72	246	50	
	20.2			0.07	1.27	1.27	6.0	244	570	85	73	246	50	
	13.5			0.05	0.91	0.91	6.0	244	496	85	73	246	49	
	7.6			0.04	0.72	0.72	4.0	245	489	86	73	245	49	
	2.4	1612	790.867	0.03	0.54	0.54	2.0	244	490	86	73	245	49	
	Page 1	Δ = 60	Δ = 33.762	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.049		0.90			519 (°F)		76 (°F)			Estimates:
	Test	Δ = 120	Δ = 66.020	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.048		0.886			516 (°F)		78 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4.0 %	
O2	12.5 %	
CO	— %	
N2	83.5 %	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.009	< 0.02
After	7.00	0.010	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
	19K	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	622.7	503.6	119.1
2.	100 mL 0.1 N H2SO4	634.1	568.4	65.7
3.	100 mL 0.1 N H2SO4	522.9	522.8	0.1
4.	100 mL 0.1 N NaOH	517.7	519.3	-1.6
5.	100 mL 0.1 N NaOH	561.0	552.9	8.1
6.	~200 g Silica Gel	679.5	664.1	15.4
7.				

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	April 19th, 2000	CONTROL BOX NO.	APEX- 1	HOT/COLD BOX NO.	4
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 2	ORIFICE FACTOR (ΔH@)	1.911	FILTER NO.	481 QTZ
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.51	METER CORR. (Y)	0.9851	PROBE NO.	7 - 1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.1	CALIBRATION DATE	9-20-00	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 030 - 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
EB	40.6	1616	790.867	0.06	1.13	1.13	6.0	244	509	83	73	246	47	5 min./pt.
	28.5			0.06	1.13	1.13	6.0	244	516	84	73	246	47	
	20.2			0.05	0.94	0.94	5.0	246	527	86	73	246	48	
	13.5			0.05	0.94	0.94	5.0	246	512	87	73	244	48	
	7.6			0.03	0.56	0.56	3.0	244	529	87	73	245	48	
	2.4	1646	806.964	0.03	0.56	0.56	3.0	244	480	86	73	245	48	
EA	40.6	1648	806.964	0.06	1.11	1.11	6.0	245	536	83	73	245	49	
	28.5			0.06	1.11	1.11	6.0	245	565	86	74	245	49	
	20.2			0.06	1.11	1.11	6.0	245	509	86	74	246	50	
	13.5			0.05	0.96	0.96	5.0	247	498	88	74	246	49	
	7.6			0.03	0.57	0.57	3.0	247	495	88	74	246	50	
	2.4	1718	823.125	0.03	0.57	0.57	3.0	247	490	88	74	246	50	
	Page 2	Δ = 60	Δ = 32.258	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.047		0.873			513 (°F)		79 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

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

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			
4.	100 mL 0.1 N NaOH			
5.	100 mL 0.1 N NaOH			
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	April 20th, 2000	CONTROL BOX NO.	APEX-4
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 3	ORIFICE FACTOR (ΔH@)	1.911
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.35	METER CORR. (Y)	0.9851
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.1	CALIBRATION DATE	9-20-99
PROJECT NO.	00 - 030 - P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges

HOT/COLD BOX NO. 8
FILTER NO. 466 QTZ
PROBE NO. 7-1
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	40.6	1055	823.543	0.06	1.07	1.07	5.0	235	562	71	71	250	59	5 min./pt.
	28.5			0.05	0.89	0.89	4.0	245	494	74	71	250	59	
	20.2			0.05	0.89	0.89	4.0	245	491	77	73	246	56	
	13.5			0.03	0.57	0.57	2.0	245	500	81	72	246	56	
	7.6			0.03	0.57	0.57	2.0	245	504	83	72	246	54	
	2.4	1125	838.352	0.03	0.57	0.57	2.0	245	506	84	73	246	54	
B	40.6	1130	838.352	0.06	1.14	1.14	5.0	247	498	82	74	246	54	
	28.5			0.06	1.14	1.14	5.0	247	525	86	75	246	54	
	20.2			0.04	0.75	0.75	4.0	247	527	88	75	246	54	
	13.5			0.04	0.75	0.75	4.0	246	538	88	76	247	54	
	7.6			0.03	0.55	0.55	2.0	245	542	89	76	247	55	
	2.4	1200	853.857	0.03	0.55	0.55	2.0	245	480	89	76	247	55	
	Page 1	Δ=60	Δ=30.314	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.042		0.771			514 (°F)		78 (°F)			Estimates:
	Test	Δ=120	Δ=62.141	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.042		0.785			513 (°F)		82 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4%	
O2	12.5%	
CO	—	
N2	83.5%	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.006	< 0.02
After	5.00	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	614.0	468.5	145.5
2.	100 mL 0.1 N H2SO4	525.9	486.8	39.1
3.	100 mL 0.1 N H2SO4	584.5	583.7	0.8
4.	100 mL 0.1 N NaOH	553.0	550.7	2.3
5.	100 mL 0.1 N NaOH	533.1	531.4	1.7
6.	~200 g Silica Gel	632.6	618.5	14.1
7.				
8.			total =	243.5

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	April 20th, 2000	CONTROL BOX NO.	APEX- 1	HOT/COLD BOX NO.	8
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 3	ORIFICE FACTOR (ΔH@)	1.911	FILTER NO.	466 QTZ
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.35	METER CORR. (Y)	0.9851	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.1	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 030 - 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	1204	853.857	0.05	0.96	0.96	4.0	246	500	84	77	247	5.5	5 min./pt.
	28.5			0.04	0.77	0.77	3.0	246	495	87	77	247	56	
	20.2			0.04	0.77	0.77	3.0	247	504	91	78	246	56	
	13.5			0.04	0.76	0.76	3.0	247	509	92	79	246	56	
	7.6			0.03	0.59	0.59	2.0	246	493	93	80	246	56	
	2.4	1234	869.550	0.03	0.59	0.59	2.0	246	490	92	80	247	57	
D	40.6	1238	869.550	0.06	1.15	1.15	5.0	246	507	86	81	247	57	
	28.5			0.06	1.15	1.15	5.0	246	544	92	81	248	57	
	20.2			0.05	0.92	0.92	4.0	247	548	94	82	248	56	
	13.5			0.05	0.92	0.92	4.0	246	555	95	82	246	57	
	7.6			0.03	0.58	0.58	2.0	247	501	95	83	246	57	
	2.4	1308	885.684	0.03	0.58	0.58	2.0	247	498	95	83	246	56	
	Page 2	Δ = 60	Δ = 31.827	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.042		0.799			512 (°F)		86 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4%	
O2	12.5%	
CO	—	
N2	83.5%	

$= \left[2\sqrt{\Delta R'}\right]^2$

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			
4.	100 mL 0.1 N NaOH			
5.	100 mL 0.1 N NaOH			
6.	~ 200 g Silica Gel			
7.				
8.				

APEX GLASS NOZZLE CALIBRATION DATA SHEET

Printed: 03/06/00

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	03/06/00
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

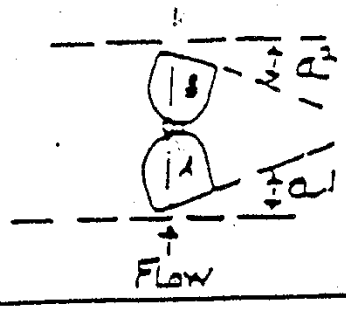
Printed: 03/06/00

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 #: ~~X~~ FS-59
Precheck: ✓
Post Check:

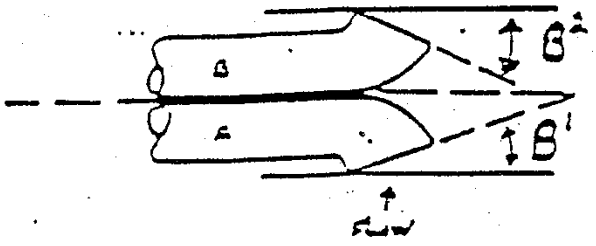
Probe #: 7-1
Date: 01-10-'00
Initials: KBA

① 

α^1 = 2°
α^2 = 1°
$\alpha^1, \alpha^2 = <10°$

β^1 = 1°
β^2 = 1°
$\beta^1, \beta^2 = <5°$

F = 1.000"

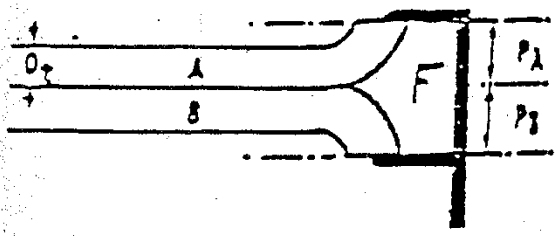
② 

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

V = 0.017" — $V = \leq 0.03125" (\theta_{TAN} \times F$

W = 0.480" — $W \geq 0"$

X = 0.910" — $X \geq 0.750"$ (3/4" using 1/2" scale)

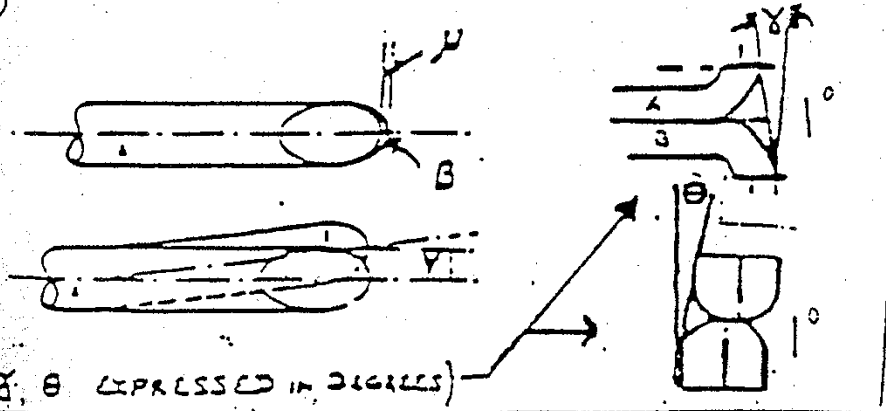
③ 

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

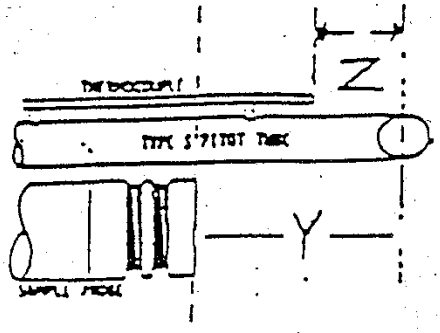
Y = 6.211" — $Y \geq 3.0"$

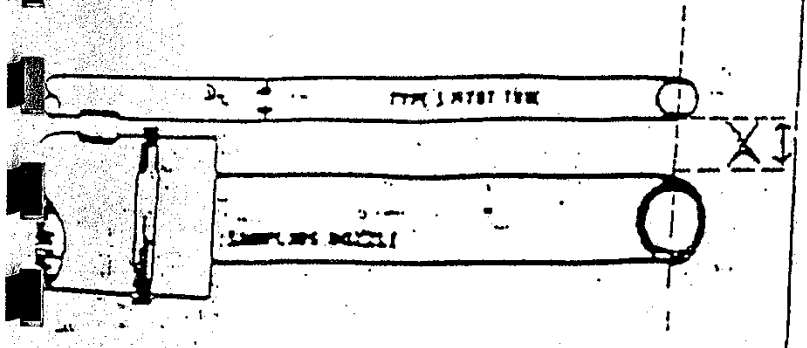
Z = 2.495" — $Z > 2.0"$

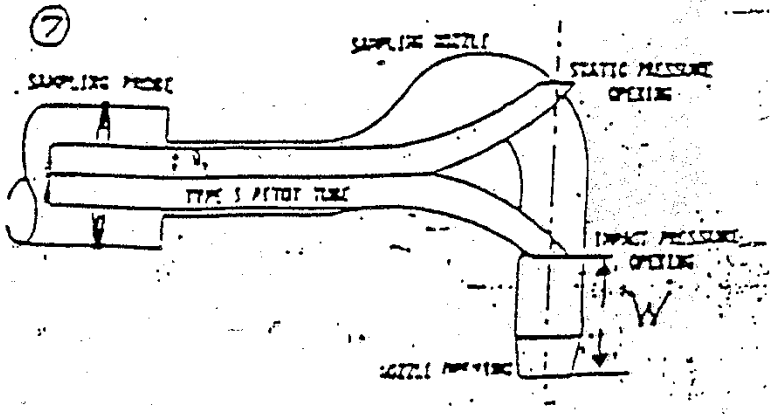
D_t = 0.376" — $D_t > .1875"$

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

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2-8-96
Date

Mark Poe
Signature

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-1
CALIBRATION DATE 09-24-99
BAROMETRIC PRESSURE (in. Hg) 29.19

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

RUN NO.		WET TEST METER			DRY GAS METER				
		Gas Volume Vw (cf)	Elapsed Time (min.)	Meter Temp. Tw (°F)	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		51.045			1.9	8.0
	MIDWAY			71		94	81		
	STOP	5.000	9:09		56.283				
	DELTA *	5.000	9.15		5.238				
2	START	0.000	0		57.334			2.0	8.0
	MIDWAY			71		97	81		
	STOP	5.000	6:31		62.546				
	DELTA *	5.000	6.52		5.216				
3	START	0.000	0		63.558			3.0	8.0
	MIDWAY			71		100	81		
	STOP	5.000	5:17		68.848				
	DELTA *	5.000	5.28		5.210				
Dry Gas Meter Leak Check	START	0.150	0		68.995			0.0	1.0
	STOP	0.343	10:00		69.291				
	DELTA *	0.193	10.0		0.296				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0103 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)	9.15	6.52	5.28	
Tw (°F)	71	71	71	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	94	97	100	
To (°F)	81	81	81	
ΔH (in. H2O)	1.00	2.00	3.00	
Vm (dcf)	5.238	5.216	5.210	
ΔH@ (in. H2O)	1.901	1.931	1.899	1.911
Y (Pre-test)	0.9817	0.9861	0.9875	0.9851

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-1
CALIBRATION DATE 09-24-99
BAROMETRIC PRESSURE (in. Hg) 29.10

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

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		51.045			1.9	8.0
	MIDWAY			71		94	81		
	STOP	5.000	9:09		56.283				
	DELTA *	5.000	9.15		5.238				
2	START	0.000	0		57.334			2.0	8.0
	MIDWAY			71		97	81		
	STOP	5.000	6:31		62.546				
	DELTA *	5.000	6.52		5.216				
3	START	0.000	0		63.598			3.0	8.0
	MIDWAY			71		100	81		
	STOP	5.000	5:17		68.848				
	DELTA *	5.000	5.28		5.210				
Dry Gas Meter Leak Check	START	0.150	0		68.995			0.0	1.0
	STOP	0.343	10:00		69.291				
	DELTA *	0.193	10.0		0.296				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0103 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)	9.15	6.52	5.28	
Tw (°F)	71	71	71	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	94	97	100	
To (°F)	81	81	81	
ΔH (in. H2O)	1.00	2.00	3.00	
Vm (dcf)	5.238	5.216	5.210	
ΔH@ (in. H2O)	1.901	1.931	1.899	1.911
Y (Pre-test)	0.9817	0.9861	0.9875	0.9851

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-1
CALIBRATION DATE 07-24-97
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		51.045			1.0	8.0
	MIDWAY			71		94	81		
	STOP	5.000	9:09		56.283				
	DELTA *	5.000	9.15		5.238				
2	START	0.000	0		57.334			2.0	8.0
	MIDWAY			71		97	81		
	STOP	5.000	6:31		62.546				
	DELTA *	5.000	6.52		5.216				
3	START	0.000	0		63.598			3.0	8.0
	MIDWAY			71		100	81		
	STOP	5.000	5:17		68.848				
	DELTA *	5.000	5.28		5.210				
Dry Gas Meter Leak Check	START	0.150	0		68.995			0.0	1.0
	STOP	0.343	10:00		69.291				
	DELTA *	0.193	10.0		0.296				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0103 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)	9.15	6.52	5.28	
Tw (°F)	71	71	71	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	94	97	100	
To (°F)	81	81	81	
ΔH (in. H2O)	1.00	2.00	3.00	
Vm (dcf)	5.238	5.216	5.210	
ΔH@ (in. H2O)	1.901	1.931	1.899	1.911
Y (Pre-test)	0.9817	0.9861	0.9875	0.9851

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-1
CALIBRATION DATE 09-24-99
BAROMETRIC PRESSURE (in. Hg) 29.10

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

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		50.045			1.0	8.0
	MIDWAY			71		94	81		
	STOP	5.000	9:09		56.283				
	DELTA *	5.000	9.15		5.238				
2	START	0.000	0		57.334			2.0	8.0
	MIDWAY			71		97	81		
	STOP	5.000	6:31		62.546				
	DELTA *	5.000	6.52		5.216				
3	START	0.000	0		63.598			3.0	8.0
	MIDWAY			71		100	81		
	STOP	5.000	5:17		68.848				
	DELTA *	5.000	5.28		5.210				
Dry Gas Meter Leak Check	START	0.150	0		68.995			0.0	1.0
	STOP	0.343	10:00		69.291				
	DELTA *	0.193	10.0		0.296				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0103 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)	9.15	6.52	5.28	
Tw (°F)	71	71	71	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	94	97	100	
To (°F)	81	81	81	
ΔH (in. H2O)	1.00	2.00	3.00	
Vm (dcf)	5.238	5.216	5.210	
ΔH@ (in. H2O)	1.901	1.931	1.899	1.911
Y (Pre-test)	0.9817	0.9861	0.9875	0.9851

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex - 1
CALIBRATION DATE 05-28-04
BAROMETRIC PRESSURE (in. Hg) 29.03

CHECK ONE: PRE-TEST / POST-TEST
CALIBRATION OFFICER JS

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		078.370			2.0	8
	MIDWAY			75		102	83		
	STOP	6.000	7:42		084.592				
	DELTA *	6.000	7.70		6.292				
2	START	0.000	0		084.592			2.0	8
	MIDWAY			75		102	84		
	STOP	5.000	6:25		089.787				
	DELTA *	5.000	6.42		5.195				
3	START	0.000	0		089.787			2.0	8
	MIDWAY			75		103	84		
	STOP	5.000	6:25		094.974				
	DELTA *	5.000	6.42		5.187				
Dry Gas	START	0.350	0		095.357			0.0	8
Meter Leak	STOP	0.514	10:00		095.604				
Check	DELTA *	0.164	10.0		0.247				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.008 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)	29.03	29.03	29.03	
Time (min)	7.70	6.42	6.42	
Tw (°F)	75	75	75	
Vw (cf)	6.000	5.000	5.000	
Ti (°F)	102	102	103	
To (°F)	83	84	84	
ΔH (in. H2O)	2.00	2.00	2.00	
Vm (dcf)	6.292	5.195	5.187	
Y (Pre-test)				0.9851
ΔH@ (in. H2O)	1.896	1.894	1.894	1.895
Y (Post-test)	0.9798	0.9898	0.9923	0.9873
ΔY (%)				0.2%

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex - 1
CALIBRATION DATE 05-18-04
BAROMETRIC PRESSURE (in. Hg) 29.03

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

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		078.374			2.0	8
	MIDWAY			75		102	83		
	STOP	6.000	7:42		084.592				
	DELTA *	6.000	7.70		6.292				
2	START	0.000	0		084.592			2.0	8
	MIDWAY			75		102	84		
	STOP	5.000	6:25		089.787				
	DELTA *	5.000	6.42		5.195				
3	START	0.000	0		089.787			2.0	8
	MIDWAY			75		103	84		
	STOP	5.000	6:25		094.974				
	DELTA *	5.000	6.42		5.187				
Dry Gas	START	0.350	0		095.357			0.0	8
Meter Leak	STOP	0.514	10:00		095.604				
Check	DELTA *	0.164	10.0		0.247				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.008 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)	29.03	29.03	29.03	
Time (min)	7.70	6.42	6.42	
Tw (°F)	75	75	75	
Vw (cf)	6.000	5.000	5.000	
Ti (°F)	102	102	103	
To (°F)	83	84	84	
ΔH (in. H2O)	2.00	2.00	2.00	
Vm (dcf)	6.292	5.195	5.187	
Y (Pre-test)				0.9851
ΔH@ (in. H2O)	1.896	1.894	1.894	1.895
Y (Post-test)	0.9798	0.9898	0.9923	0.9873
ΔY (%)				0.2%

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex - 1
CALIBRATION DATE 05-08-04
BAROMETRIC PRESSURE (in. Hg) 29.03

CHECK ONE: PRE-TEST / POST-TEST
CALIBRATION OFFICER JS

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		078.374			2.0	8
	MIDWAY			75		102	83		
	STOP	6.000	7:42		084.592				
	DELTA *	6.000	7.70		6.292				
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	MIDWAY			75		102	84		
	STOP	5.000	6:25		089.787				
	DELTA *	5.000	6.42		5.195				
3	START	0.000	0		089.787			2.0	8
	MIDWAY			75		103	84		
	STOP	5.000	6:25		094.974				
	DELTA *	5.000	6.42		5.187				
Dry Gas Meter Leak Check	START	0.350	0		095.357			0.0	8
	STOP	0.514	10:00		095.604				
	DELTA *	0.164	10.0		0.247				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.008 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)	29.03	29.03	29.03	
Time (min)	7.70	6.42	6.42	
Tw (°F)	75	75	75	
Vw (cf)	6.000	5.000	5.000	
Ti (°F)	102	102	103	
To (°F)	83	84	84	
ΔH (in. H2O)	2.00	2.00	2.00	
Vm (dcf)	6.292	5.195	5.187	
Y (Pre-test)				0.9851
ΔH@ (in. H2O)	1.896	1.894	1.894	1.895
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ΔY (%)				0.2%

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex - 1
CALIBRATION DATE 05-12-04
BAROMETRIC PRESSURE (in. Hg) 29.03

CHECK ONE: PRE-TEST / POST-TEST
CALIBRATION OFFICER JS

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		078.374			2.0	8
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*: 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)	29.03	29.03	29.03	
Time (min)	7.70	6.42	6.42	
Tw (°F)	75	75	75	
Vw (cf)	6.000	5.000	5.000	
Ti (°F)	102	102	103	
To (°F)	83	84	84	
ΔH (in. H2O)	2.00	2.00	2.00	
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4000 Tech Center Drive
Monroeville, PA 15146
412 825 2400
Fax: 412 825 2407

IH & Environmental Laboratory

RECEIVED MAY 10 2000

UEC
USX Engineers
& Consultants, Inc.

May 3, 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 April 25, 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

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

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Stephanie A. Guilyard, IHIT, Project Manager

Enclosures

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Fax: 412 825 2407

IH & Environmental Laboratory

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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 - 05/03/2000

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. # : 3692 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1748

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	
13753	CLR-#1BS-M26A-1A	CHLORIDE	04/19/00	*	*	*	05/02/00	29							2.0 mg/L	E
13754	CLR-#1BS-M26A-1B	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13755	CLR-#1BS-M26A-1C	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13756	CLR-#1BS-M26A-1D	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13757	CLR-#1BS-M26A-2A	CHLORIDE	04/19/00	*	*	*	05/02/00	29							2.0 mg/L	E
13758	CLR-#1BS-M26A-2B	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13759	CLR-#1BS-M26A-2C	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13760	CLR-#1BS-M26A-2D	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13761	CLR-#1BS-M26A-3A	CHLORIDE	04/20/00	*	*	*	05/02/00	26							2.0 mg/L	E
13762	CLR-#1BS-M26A-3B	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13763	CLR-#1BS-M26A-3C	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13764	CLR-#1BS-M26A-3D	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13765	CLR-H2SO4-BLANK	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

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

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DATE - 05/03/2000

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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. # : 3692 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1748

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	
13753	CLR-#1BS-M26A-1A	CHLORIDE	04/19/00	*	*	*	05/02/00	29							2.0 mg/L	E
13754	CLR-#1BS-M26A-1B	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13755	CLR-#1BS-M26A-1C	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13756	CLR-#1BS-M26A-1D	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13757	CLR-#1BS-M26A-2A	CHLORIDE	04/19/00	*	*	*	05/02/00	29							2.0 mg/L	E
13758	CLR-#1BS-M26A-2B	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13759	CLR-#1BS-M26A-2C	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13760	CLR-#1BS-M26A-2D	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13761	CLR-#1BS-M26A-3A	CHLORIDE	04/20/00	*	*	*	05/02/00	26							2.0 mg/L	E
13762	CLR-#1BS-M26A-3B	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13763	CLR-#1BS-M26A-3C	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13764	CLR-#1BS-M26A-3D	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13765	CLR-H2SO4-BLANK	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E

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

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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	
13753	CLR-#1BS-M26A-1A	CHLORIDE	04/19/00	*	*	*	05/02/00	29							2.0 mg/L	E
13754	CLR-#1BS-M26A-1B	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13755	CLR-#1BS-M26A-1C	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13756	CLR-#1BS-M26A-1D	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13757	CLR-#1BS-M26A-2A	CHLORIDE	04/19/00	*	*	*	05/02/00	29							2.0 mg/L	E
13758	CLR-#1BS-M26A-2B	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13759	CLR-#1BS-M26A-2C	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13760	CLR-#1BS-M26A-2D	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13761	CLR-#1BS-M26A-3A	CHLORIDE	04/20/00	*	*	*	05/02/00	26							2.0 mg/L	E
13762	CLR-#1BS-M26A-3B	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13763	CLR-#1BS-M26A-3C	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13764	CLR-#1BS-M26A-3D	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13765	CLR-H2SO4-BLANK	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

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
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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 - 05/03/2000

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. # : 3692 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1748

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	
13753	CLR-#1BS-M26A-1A	CHLORIDE	04/19/00	*	*	*	05/02/00	29							2.0 mg/L	E
13754	CLR-#1BS-M26A-1B	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13755	CLR-#1BS-M26A-1C	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13756	CLR-#1BS-M26A-1D	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13757	CLR-#1BS-M26A-2A	CHLORIDE	04/19/00	*	*	*	05/02/00	29							2.0 mg/L	E
13758	CLR-#1BS-M26A-2B	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13759	CLR-#1BS-M26A-2C	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13760	CLR-#1BS-M26A-2D	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13761	CLR-#1BS-M26A-3A	CHLORIDE	04/20/00	*	*	*	05/02/00	26							2.0 mg/L	E
13762	CLR-#1BS-M26A-3B	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13763	CLR-#1BS-M26A-3C	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13764	CLR-#1BS-M26A-3D	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13765	CLR-H2SO4-BLANK	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

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= 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.

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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. # : 3692 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1748

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	
13766	CLR-NAOH-BLANK	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

ANALYST : Neelem Patel Date: 5-3-00

APPROVED: Stephanie A Guilyard Date: 5/5/00
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

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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. # : 3692 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1748

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	
13766	CLR-NAOH-BLANK	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

ANALYST : Neelam Patel Date: 5-3-00

APPROVED: Stephanie A Guilyard Date: 5/5/100
Stephanie A. Guilyard, IHIT, Project Manager

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Time, flow rate and/or sample volume data are based on client supplied information, unless otherwise noted.

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

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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. # : 3692 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1748

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	
13766	CLR-NAOH-BLANK	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

ANALYST : Neelam Patel Date: 5-3-00

APPROVED: Stephanie A Guilyard Date: 5/5/00

Stephanie A. Guilyard, IHIT, Project Manager

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

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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. # : 3692 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1748

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	
13766	CLR-NAOH-BLANK	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

ANALYST : Neelam Patel Date: 5-3-00

APPROVED: Stephanie A Guilyard Date: 5/5/00

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

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

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 04-037-P ; P.O.#3692
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC Lab and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 1 Battery Combustion Stack

ANALYSES TO BE CONDUCTED: Chloride ion (Cl-) via 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	Chloride ion (Cl-)	REMARKS OR OBSERVATIONS
	CLR-#1BS-M26A-1A	04-19-04	Test #1	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 413.8mL
	CLR-#1BS-M26A-1B	↓	↓	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 149.3mL
*	CLR-#1BS-M26A-1C			1	Comp.	✓	* 0.1N NaOH - Sample Volume = 139.3mL
*	CLR-#1BS-M26A-1D			1	Comp.	✓	* 0.1N NaOH - Sample Volume = 157.4mL
	CLR-#1BS-M26A-2A	04-19-04	Test #2	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 404.8mL
	CLR-#1BS-M26A-2B	↓	↓	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 135.3mL
*	CLR-#1BS-M26A-2C			1	Comp.	✓	* 0.1N NaOH - Sample Volume = 132.4mL
*	CLR-#1BS-M26A-2D			1	Comp.	✓	* 0.1N NaOH - Sample Volume = 153.4mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME
John P. Shumbrock	04-24-04	11:05	Kelly Cy.	04-24-04	11:52
Jody Strickler	4.25.04	12:45pm	Jody Strickler	4.24.04	4:27pm

ICE CHEST #
CHEST TEMP.
TAG #

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* Please add 2 mg Sodium thiosulfate $Na_2S_2O_3 \cdot 3.5H_2O$ prior to analysis

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

CHAIN OF CUSTODY RECORD

PROJECT NUMBER 40-034-P ; P.O. #3692
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC Ill and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 1 Battery Combustion Stack

ANALYSES TO BE CONDUCTED
- Chloride ion (Cl-) via ion chromatography - U.S. EPA Alternate Method 26A

A: Impinger 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	Cl-	REMARKS OR OBSERVATIONS
	CLR-#1BS-M26A-1A	04-19-00	Test #1	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 413.8 mL
	CLR-#1BS-M26A-1B	↓	↓	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 149.3 mL
*	CLR-#1BS-M26A-1C			1	Comp.	✓	* 0.1N NaOH - Sample Volume = 139.3 mL
*	CLR-#1BS-M26A-1D			1	Comp.	✓	* 0.1N NaOH - Sample Volume = 157.4 mL
	CLR-#1BS-M26A-2A	04-19-00	Test #2	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 404.8 mL
	CLR-#1BS-M26A-2B	↓	↓	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 135.3 mL
*	CLR-#1BS-M26A-2C			1	Comp.	✓	* 0.1N NaOH - Sample Volume = 132.0 mL
*	CLR-#1BS-M26A-2D			1	Comp.	✓	* 0.1N NaOH - Sample Volume = 153.0 mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Shumaker	04-24-00	11:30	Kelly Cy	04-24-00	11:52	
Judy Stanko	4-25-00	12:45pm	Judy Stanko	4-24-00	4:27pm	CHEST TEMP.
						TAG #

* Please add 25mg sodium thiosulfate $Na_2S_2O_3 \cdot 3.5H_2O$ prior to analysis

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 00-030-P ; P.O. #3692
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC IH and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 1 Battery Combustion Stack

ANALYSES TO BE CONDUCTED: Chloride ion (Cl-) via 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	Chloride ion (Cl-)										REMARKS OR OBSERVATIONS
	CLR-#1BS-M26A-1A	04-19-00	Test #1	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 413.8 mL
	CLR-#1BS-M26A-1B	↓	↓	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 149.3 mL
*	CLR-#1BS-M26A-1C	↓	↓	1	Comp.	✓									*	0.1N NaOH - Sample Volume = 139.3 mL
*	CLR-#1BS-M26A-1D	↓	↓	1	Comp.	✓									*	0.1N NaOH - Sample Volume = 157.4 mL
	CLR-#1BS-M26A-2A	04-19-00	Test #2	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 404.8 mL
	CLR-#1BS-M26A-2B	↓	↓	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 135.3 mL
*	CLR-#1BS-M26A-2C	↓	↓	1	Comp.	✓									*	0.1N NaOH - Sample Volume = 132.0 mL
*	CLR-#1BS-M26A-2D	↓	↓	1	Comp.	✓									*	0.1N NaOH - Sample Volume = 153.0 mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Shumlick	04-24-00	1100 EST	[signature]	04-24-00	11:52	
			Judy Strehle	4-24-00	4:27 pm	CHEST TEMP.
Judy Strehle	4-25-00	12:45 pm				
						TAG #

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

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PITTSBURGH, PA 15238
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CHAIN OF CUSTODY RECORD

PROJECT NUMBER 04-037-P ; P.O.#3692
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC Ult and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 1 Battery Combustion Stack

ANALYSES TO BE CONDUCTED

A: Impinges 1+2
B: Impinge 3
C: Impinge 4
D: Impinge 5

	SAMPLE IDENTIFICATION NUMBER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	NUMBER OF CONTAINERS	COMPOSITE OR GRAB	Chloride ion (Cl-) via ion chromatography - U.S. EPA Alternate Method 300.0										REMARKS OR OBSERVATIONS
	CLR-#1BS-M26A-1A	04-19-00	Test #1	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 413.8 mL
	CLR-#1BS-M26A-1B			1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 149.3 mL
*	CLR-#1BS-M26A-1C			1	Comp.	✓									*	0.1N NaOH - Sample Volume = 139.3 mL
*	CLR-#1BS-M26A-1D			1	Comp.	✓									*	0.1N NaOH - Sample Volume = 157.4 mL
	CLR-#1BS-M26A-2A	04-19-00	Test #2	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 404.8 mL
	CLR-#1BS-M26A-2B			1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 135.3 mL
*	CLR-#1BS-M26A-2C			1	Comp.	✓									*	0.1N NaOH - Sample Volume = 132.0 mL
*	CLR-#1BS-M26A-2D			1	Comp.	✓									*	0.1N NaOH - Sample Volume = 153.0 mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Swanback	04-24-00	11:05 EDT	Kelly Cy.	04-24-00	11:52	
			Judy Strickler	4-24-00	4:27 pm	CHEST TEMP.
Judy Strickler	4-25-00	12:45 pm				
						TAG #

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

Sodium Thiosulfate
$Na_2S_2O_3 \cdot 3.5H_2O$
prior to analysis

CHAIN OF CUSTODY RECORD

PROJECT NUMBER 00-030-P ; P.O. #3692
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB CEC and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 1 Battery Combustion Stack

ANALYSES TO BE CONDUCTED
- Chloride ion (Cl^-)
- Via 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-#1BS-M26A-3A	04-27-00	Test #3	1	Comp.	0.1N H_2SO_4 - Sample Volume = 404.2 mL
	CLR-#1BS-M26A-3B	↓	↓	1	Comp.	0.1N H_2SO_4 - Sample Volume = 137.0 mL
*	CLR-#1BS-M26A-3C			1	Comp.	* 0.1N NaOH - Sample Volume = 146.6 mL
*	CLR-#1BS-M26A-3D			1	Comp.	* 0.1N NaOH - Sample Volume = 132.5 mL
	CLR-H2SO4-BLANK	04-27-00	BLANK	1	Grab	0.1N H_2SO_4
*	CLR-NAOH-BLANK	↓	↓ 1700 EDT	1	Grab	* 0.1N NaOH.

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
Thur P. Summerville	04-27-00	1400 EST	Kelly Gy	04-28-00	11:02	
			Judy Abetheles	4.28.00	4:35 pm	CHEST TEMP.
Judy Abetheles	4-28-00	12:45 pm				
						TAG #

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* Preserved w/ 5% Sodium Thiosulfate $Na_2S_2O_3 \cdot 3.5H_2O$ prior to analysis

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 00-030-P ; P.O. #3692
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB ~~CEC~~ H and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 1 Battery Combustion Stack

ANALYSES TO BE CONDUCTED: Chloride ion (CI⁻); Vic 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-#1BS-M26A-3A	04-27-00	Test #3	1	Comp.	0.1N H_2SO_4 - Sample Volume = 404.2 mL
	CLR-#1BS-M26A-3B	↓	↓	1	Comp.	0.1N H_2SO_4 - Sample Volume = 137.0 mL
*	CLR-#1BS-M26A-3C			1	Comp.	* 0.1N NaOH - Sample Volume = 146.6 mL
*	CLR-#1BS-M26A-3D			1	Comp.	* 0.1N NaOH - Sample Volume = 132.5 mL
	CLR-H2SO4-BLANK	04-24-00	BLANK	1	Grab	0.1N H_2SO_4
*	CLR-NAOH-BLANK	↓	↓ 1700 EDT	1	Grab	* 0.1N NaOH

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
Blair P. Summerville	04-24-00	1400 EDT	Kelly Eg	04-24-00	11:02	
			Judy Stutzbach	4.24.00	4:35 pm	CHEST TEMP.
Judy Stutzbach	4-25-00	12:45 pm				
						TAG #

ATS 10/98

Sodium Thiosulfate
$Na_2S_2O_3 \cdot 3.5H_2O$
prior to analysis

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 00-030-P ; P.O. #3692
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB CEIH and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 1 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 ion (Cl⁻)	Vic ion chromatography	U.S. EPA Reference Method 26A								REMARKS OR OBSERVATIONS
CLR-#1BS-M26A-3A	04-27-00	Test #3	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 404.2 mL
CLR-#1BS-M26A-3B	↓	↓	1	Comp.	✓										0.1N H_2SO_4 - Sample Volume = 137.0 mL
* CLR-#1BS-M26A-3C	↓	↓	1	Comp.	✓									*	0.1N NaOH - Sample Volume = 146.6 mL
* CLR-#1BS-M26A-3D	↓	↓	1	Comp.	✓									*	0.1N NaOH - Sample Volume = 132.5 mL
CLR-H2SO4-BLANK	04-24-00	BLANK	1	Grab	✓										0.1N H_2SO_4
* CLR-NAOH-BLANK	↓	↓ 1700 EDT	1	Grab	✓									*	0.1N NaOH

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
Brian P. Immekeit	04-24-00	1100 EDT	Kelly Eby	04-24-00	11:02	
			Judy Abetheles	4-24-00	4:30 pm	CHEST TEMP.
Judy Abetheles	4-25-00	12:45 pm				
						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

Sodium Thiosulfate
$Na_2S_2O_3 \cdot 3.5H_2O$
Prior to analyses

CHAIN OF CUSTODY RECORD

PROJECT NUMBER 00-030-P ; P.O. #3692
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB CEET and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 1 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 ion (Cl⁻) via ion chromatography U.S. EPA Reference Method 26A	REMARKS OR OBSERVATIONS
	CLR-#1BS-M26A-3A	04-24-00	Test #3	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 404.2 mL
	CLR-#1BS-M26A-3B	↓	↓	1	Comp.	✓	0.1N H_2SO_4 - Sample Volume = 137.0 mL
*	CLR-#1BS-M26A-3C			1	Comp.	✓	* 0.1N NaOH - Sample Volume = 146.6 mL
*	CLR-#1BS-M26A-3D			1	Comp.	✓	* 0.1N NaOH - Sample Volume = 132.5 mL
	CLR-H2SO4-BLANK	04-24-00	BLANK	1	Grab	✓	0.1N H_2SO_4
*	CLR-NAOH-BLANK	↓	↓ 1720 EDT	1	Grab	✓	* 0.1N NaOH

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
Paul P. Summerville	04-24-00	1140 EDT	Kelly G.	04-24-00	11:02	
			Judy Stuchell	4.24.00	4:35 pm	CHEST TEMP.
Judy Stuchles	4-2000	12:45 pm				
						TAG #

ATS 10/98

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
NO. 1 BATTERY COMBUSTION STACK
APRIL 19 AND 20, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#1BS-M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	29	413.8	12.00	100.0
	1B	0.1 N H2SO4 - Impinger 3	< 2.0	149.3	< 0.30	
	1C	0.1 N NaOH - Impinger 4	< 2.0	139.3	< 0.28	NA
	1D	0.1 N NaOH - Impinger 5	< 2.0	157.4	< 0.31	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	29	404.8	11.74	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 2.0	135.3	< 0.27	
	2C	0.1 N NaOH - Impinger 4	< 2.0	132.0	< 0.26	NA
	2D	0.1 N NaOH - Impinger 5	< 2.0	153.0	< 0.31	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	26	404.2	10.51	100.0
	3B	0.1 N H2SO4 - Impinger 3	< 2.0	137.0	< 0.27	
	3C	0.1 N NaOH - Impinger 4	< 2.0	146.6	< 0.29	NA
	3D	0.1 N NaOH - Impinger 5	< 2.0	132.5	< 0.27	
Blank	Blank	0.1 N H2SO4	< 2.0			
Blank	Blank	0.1 N NaOH	< 2.0			

<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 (< 2.0) ---->
Chloride catch = 0

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
NO. 1 BATTERY COMBUSTION STACK
APRIL 19 AND 20, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#1BS-M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	29	413.8	12.00	100.0
	1B	0.1 N H2SO4 - Impinger 3	< 2.0	149.3	< 0.30	
	1C	0.1 N NaOH - Impinger 4	< 2.0	139.3	< 0.28	NA
	1D	0.1 N NaOH - Impinger 5	< 2.0	157.4	< 0.31	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	29	404.8	11.74	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 2.0	135.3	< 0.27	
	2C	0.1 N NaOH - Impinger 4	< 2.0	132.0	< 0.26	NA
	2D	0.1 N NaOH - Impinger 5	< 2.0	153.0	< 0.31	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	26	404.2	10.51	100.0
	3B	0.1 N H2SO4 - Impinger 3	< 2.0	137.0	< 0.27	
	3C	0.1 N NaOH - Impinger 4	< 2.0	146.6	< 0.29	NA
	3D	0.1 N NaOH - Impinger 5	< 2.0	132.5	< 0.27	
Blank	Blank	0.1 N H2SO4	< 2.0			
Blank	Blank	0.1 N NaOH	< 2.0			

<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 (< 2.0) ---->
Chloride catch = 0

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
NO. 1 BATTERY COMBUSTION STACK
APRIL 19 AND 20, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#1BS-M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	29	413.8	12.00	100.0
	1B	0.1 N H2SO4 - Impinger 3	< 2.0	149.3	< 0.30	
	1C	0.1 N NaOH - Impinger 4	< 2.0	139.3	< 0.28	NA
	1D	0.1 N NaOH - Impinger 5	< 2.0	157.4	< 0.31	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	29	404.8	11.74	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 2.0	135.3	< 0.27	
	2C	0.1 N NaOH - Impinger 4	< 2.0	132.0	< 0.26	NA
	2D	0.1 N NaOH - Impinger 5	< 2.0	153.0	< 0.31	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	26	404.2	10.51	100.0
	3B	0.1 N H2SO4 - Impinger 3	< 2.0	137.0	< 0.27	
	3C	0.1 N NaOH - Impinger 4	< 2.0	146.6	< 0.29	NA
	3D	0.1 N NaOH - Impinger 5	< 2.0	132.5	< 0.27	
Blank	Blank	0.1 N H2SO4	< 2.0			
Blank	Blank	0.1 N NaOH	< 2.0			

<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 (< 2.0) ---->
Chloride catch = 0

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
NO. 1 BATTERY COMBUSTION STACK
APRIL 19 AND 20, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#1BS-M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	29	413.8	12.00	100.0
	1B	0.1 N H2SO4 - Impinger 3	< 2.0	149.3	< 0.30	
	1C	0.1 N NaOH - Impinger 4	< 2.0	139.3	< 0.28	NA
	1D	0.1 N NaOH - Impinger 5	< 2.0	157.4	< 0.31	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	29	404.8	11.74	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 2.0	135.3	< 0.27	
	2C	0.1 N NaOH - Impinger 4	< 2.0	132.0	< 0.26	NA
	2D	0.1 N NaOH - Impinger 5	< 2.0	153.0	< 0.31	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	26	404.2	10.51	100.0
	3B	0.1 N H2SO4 - Impinger 3	< 2.0	137.0	< 0.27	
	3C	0.1 N NaOH - Impinger 4	< 2.0	146.6	< 0.29	NA
	3D	0.1 N NaOH - Impinger 5	< 2.0	132.5	< 0.27	
Blank	Blank	0.1 N H2SO4	< 2.0			
Blank	Blank	0.1 N NaOH	< 2.0			

<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 (< 2.0) ---->
Chloride catch = 0

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 1 BATTERY COMBUSTION STACK
TEST DATE: 4/19/00
TEST NO.: CLR- #1BS-M26A-1

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.51	
B.	Process Gas Static Pressure (in. H2O)	-1.00	
C.	Pitot Tube Coefficient	0.84	
D.	Dry Gas Meter Calibration Factor	0.9851	
»»»»	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	0.05	
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.05	
K.	Average ΔH (in. H2O) variation	0.99	
L.	Average Process Gas Temperature (°F)	516	
M.	Average Dry Gas Meter Temperature (°F)	69	
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)	217.4	
Q.	Metered Gas Volume (dcf)	67.869	

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.44	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.58	[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)	976	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	529	[M+460]
X.	Dry Gas Volume Sampled (dscf)	65.979	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	10.250	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	13.4	[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 (%)	13.4	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.134		18	2.420
CO2	0.040	0.866	44	1.523
O2	0.120	0.866	32	3.324
N2	0.840	0.866	28	20.357
CO	0.000	0.866	28	0.000
H2	0.000	0.866	2	0.000
CH4	0.000	0.866	16	0.000
C2H6	0.000	0.866	30	0.000
Ar	0.000	0.866	40	0.000

Process Gas Molecular Weight (lb/lb-mol): 27.62

DD.	Average Process Gas Velocity (ft/sec)	1.83E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	7.78E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	4.14E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.58E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	103.0	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0052	
JJ.	Front-Half Residue Weight (g)	0.0075	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0127	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0030	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	9.11E-01	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST DATE: 4/19/00
TEST SITE: NO. 1 BATTERY COMBUSTION STACK
TEST NO.: CLR- #1BS-M26A-1

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)	12.34	
QQ.	Concentration (mg/dscm)	6.60E+00	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	8.85E-01	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	< 0.28	
TT.	Concentration (mg/dscm)	< 1.49E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	< 2.00E-02	[TT*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 1 BATTERY COMBUSTION STACK
TEST DATE: 4/19/00
TEST NO.: CLR- #1BS-M26A-2

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.51
B.	Process Gas Static Pressure (in. H2O)	-1.10
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	0.9851
»»»»	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	0.05
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.05
K.	Average ΔH (in. H2O) variation	0.89
L.	Average Process Gas Temperature (°F)	516
M.	Average Dry Gas Meter Temperature (°F)	78
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	4.0
	Oxygen (%)	12.5
	Nitrogen (%)	83.5
	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)	206.8
Q.	Metered Gas Volume (dcf)	66.020

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.43	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.58	[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)	976	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	538	[M+460]
X.	Dry Gas Volume Sampled (dscf)	63.092	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.751	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	13.4	[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 (%)	13.4	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.134		18	2.409
CO2	0.040	0.866	44	1.524
O2	0.125	0.866	32	3.465
N2	0.835	0.866	28	20.250
CO	0.000	0.866	28	0.000
H2	0.000	0.866	2	0.000
CH4	0.000	0.866	16	0.000
C2H6	0.000	0.866	30	0.000
Ar	0.000	0.866	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.65	
DD.	Average Process Gas Velocity (ft/sec)	1.72E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	7.33E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	3.90E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.38E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	104.5	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0040	
JJ.	Front-Half Residue Weight (g)	0.0066	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0106	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0026	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	7.50E-01	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST DATE: 4/19/00
TEST SITE: NO. 1 BATTERY COMBUSTION STACK
TEST NO.: CLR- #1BS-M26A-2

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)	12.07	
QQ.	Concentration (mg/dscm)	6.76E+00	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	8.54E-01	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.26	
TT.	Concentration (mg/dscm)	<	1.48E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	1.87E-02	[TT*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 4/20/00

TEST SITE: NO. 1 BATTERY COMBUSTION STACK — TEST NO.: CLR- #1BS-M26A-3

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.35	
B.	Process Gas Static Pressure (in. H2O)	-1.10	
C.	Pitot Tube Coefficient	0.84	
D.	Dry Gas Meter Calibration Factor	0.9851	
	»»»» 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	0.04	
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.04	
K.	Average ΔH (in. H2O) variation	0.79	
L.	Average Process Gas Temperature (°F)	513	
M.	Average Dry Gas Meter Temperature (°F)	82	
N.	Dry Gas Composition (should total to 100%)		
	Carbon Dioxide (%)	4.0	
	Oxygen (%)	12.5	
	Nitrogen (%)	83.5	
	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)	203.5	
Q.	Metered Gas Volume (dcf)	62.141	

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.27	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.41	[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)	973	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	542	[M+460]
X.	Dry Gas Volume Sampled (dscf)	58.614	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.595	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.1	[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 (%)	14.1	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.141		18	2.532
CO2	0.040	0.859	44	1.512
O2	0.125	0.859	32	3.437
N2	0.835	0.859	28	20.091
CO	0.000	0.859	28	0.000
H2	0.000	0.859	2	0.000
CH4	0.000	0.859	16	0.000
C2H6	0.000	0.859	30	0.000
Ar	0.000	0.859	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.57	
DD.	Average Process Gas Velocity (ft/sec)	1.62E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	6.87E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	3.65E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.14E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	104.6	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0030	
JJ.	Front-Half Residue Weight (g)	0.0083	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0113	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0030	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	7.99E-01	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST DATE: 4/20/00
TEST SITE: NO. 1 BATTERY COMBUSTION STACK
TEST NO.: CLR- #1BS-M26A-3

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		10.81	
QQ.	Concentration (mg/dscm)		6.51E+00	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		7.64E-01	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.29	
TT.	Concentration (mg/dscm)	<	1.77E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	2.07E-02	[TT*0.02832*GG*60/454000]

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

ADVANCED TECHNOLOGY SYSTEMS, INC.

ATS Project No. 00-030-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 NO. 1 BATTERY COMBUSTION STACK ON APRIL 19 AND 20, 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. 1 Battery Combustion Stack by Advanced Technology Systems, Inc. (ATS). Three two-hour test runs were conducted on April 19 and 20, 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 could not be calculated since the chloride catch of 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

NO. 1 BATTERY COMBUSTION STACK
HYDROCHLORIC ACID AND CHLORINE GAS EMISSIONS DATA
APRIL 19 AND 20, 2000

Test Date		Run 1 4/19/00	Run 2 4/19/00	Run 3 4/20/00	Average
Emissions Data					
Hydrochloric Acid (HCl)					
Concentration	(mg/dscm)	6.60E+00	6.76E+00	6.51E+00	6.62E+00
Mass Emission Rate	(lb/hr)	8.85E-01	8.54E-01	7.64E-01	8.34E-01
Chlorine Gas (Cl_2)					
Concentration	(mg/dscm)	< 1.49E-01	< 1.48E-01	< 1.77E-01	< 1.58E-01
Mass Emission Rate	(lb/hr)	< 2.00E-02	< 1.87E-02	< 2.07E-02	< 1.98E-02
Exhaust Stack Conditions					
Volumetric Flow Rate	(acfm)	7.78E+04	7.33E+04	6.87E+04	7.33E+04
	(scfm)	4.14E+04	3.90E+04	3.65E+04	3.90E+04
	(dscfm)	3.58E+04	3.38E+04	3.14E+04	3.37E+04
Temperature	(°F)	516	516	513	515
Moisture Content	(%)	13.4	13.4	14.1	13.6
Sampling Conditions					
Test Times +	(EDT)	0810 to 0912 & 1117 to 1220	1510 to 1718	1055 to 1308	
Sampling Time *	(minutes)	120	120	120	
Sample Volume **	(dscf)	65.979	63.092	58.614	
Isokinetic Variation ***	(%)	103.0	104.5	104.6	

mg / dscm = milligrams per dry standard cubic meter
+: Battery heat delay from 0912 to 1030 EDT
*: 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. 1 Battery Combustion Stack on April 19 and 20, 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	April 19th, 2000	CONTROL BOX NO.	APEX-1
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 1	ORIFICE FACTOR (ΔH@)	1.911
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.51	METER CORR. (Y)	0.9851
TEST CREW	JS, KA -	STATIC P. (in. H2O)	−1.0	CALIBRATION DATE	9-20-99
PROJECT NO.	00 - 030 - P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges

HOT/COLD BOX NO.	5.													
FILTER NO.	480 QTZ.													
PROBE NO.	7-1													
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	40.6	0810	688.863	0.07	1.30	1.30	8.0	248	502	59	57	245	60	
	28.5			0.07	1.30	1.30	8.0	248	509	62	58	245	50	5 min./pt.
	20.2			0.07	1.28	1.28	6.0	248	519	67	59	245	50	
	13.5			0.06	1.09	1.09	4.0	248	529	68	60	245	51	
	7.6			0.04	0.72	0.72	2.0	247	517	70	60	245	48	
	2.4	0840	706.567	0.03	0.54	0.54	2.0	247	505	72	61	245	48	
B	40.6	0842	706.567	0.08	1.47	1.47	7.0	247	513	68	61	245	48	
	28.5			0.07	1.24	1.24	6.0	247	557	75	62	245	49	
	20.2			0.07	1.23	1.23	6.0	247	569	78	63	245	49	
	13.5			0.06	1.05	1.05	5.0	247	489	79	64	244	48	
	7.6			0.03	0.53	0.53	2.0	247	480	78	64	245	49	
	2.4	0912	724.682	0.03	0.53	0.53	2.0	247	482	78	64	245	49	
	Page 1	Δ = 60	Δ = 35.819	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.055		0.99			514 (°F)		66 (°F)			
	Test	Δ = 120	Δ = 67.869	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.054		0.99			516 (°F)		69 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4.6 %	
O2	12.4 %	
CO	—	
N2	84.6 %	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.0	0.008	< 0.02
After	8.0	0.009	< 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	634.1	525	117.6
2.	100 mL 0.1 N H2SO4	614.8	545.3	69.5
3.	100 mL 0.1 N H2SO4	577.2	563.5	14.7
4.	100 mL 0.1 N NaOH	541.7	539.4	2.3
5.	100 mL 0.1 N NaOH	551.5	548.5	2.6
6.	~ 200 g Silica Gel	664.5	649.2	15.3
7.			Total =	217.4g
8.				

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	April 19th, 2000	CONTROL BOX NO.	APEX-1
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 1	ORIFICE FACTOR (ΔH@)	1.911
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.51	METER CORR. (Y)	0.9851
TEST CREW	JS, KA.	STATIC P. (in. H2O)	-1.0	CALIBRATION DATE	9-20-99
PROJECT NO.	00 - 030 - P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges

HOT/COLD BOX NO.	5
FILTER NO.	480 QTZ
PROBE NO.	7-1
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
C	40.6	1117	724.682	0.06	1.10	1.10	5.00	249	513	66	64	245	50	
	28.5			0.06	1.10	1.10	5.0	249	519	69	65	245	49	5 min./pt.
	20.2			0.06	1.10	1.10	5.0	248	506	69	64	245	49	
	13.5			0.07	1.29	1.29	6.0	248	518	71	65	245	49	
	7.6			0.05	0.92	0.92	4.0	248	539	76	65	245	49	
	2.4	1147	740.606	0.04	0.74	0.74	3.0	248	500	78	66	245	49	
D	40.6	1150	740.606	0.08	1.47	1.47	6.0	248	551	77	67	245	49	
	28.5			0.08	1.47	1.47	6.0	248	577	79	67	245	50	
	20.2			0.05	0.92	0.92	5.0	247	501	80	68	245	50	
	13.5			0.03	0.56	0.56	2.0	248	498	81	68	245	49	
	7.6			0.03	0.56	0.56	2.0	248	494	81	68	244	52	
	2.4	1220	756.732	0.03	0.56	0.56	2.0	248	496	81	68	244	52	
	Page 2	Δ = 60	Δ = 32.050	(ΔP) avg =	(ΔH) avg =	0.98			(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.052					517 (°F)		71 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4 %	
O2	12 %	
CO	—	
N2	84 %	

$$= \left[2\sqrt{\Delta P_{avg}}\right]^2$$

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			
4.	100 mL 0.1 N NaOH			
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	April 19th, 2000	CONTROL BOX NO.	APEX- 1	Page	1 of 2
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 2	ORIFICE FACTOR (ΔH@)	1.911	HOT/COLD BOX NO.	4
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.51	METER CORR. (Y)	0.9851	FILTER NO.	481 QTZ
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.1	CALIBRATION DATE	9-20-00	PROBE NO.	7-1
PROJECT NO.	00 - 030 - P	STACK DIA. (in.)	114	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	40.6	1510	757.105	0.05	0.94	0.94	5.0	243	500	71	69	248	60	
	28.5			0.05	0.94	0.94	5.0	243	507	72	69	248	59	5 min./pt.
	20.2			0.04	0.74	0.74	4.0	243	513	75	70	248	59	
	13.5			0.035	0.65	0.65	3.0	242	520	78	70	248	59	
	7.6			0.04	0.74	0.74	4.0	242	526	80	70	246	53	
	2.4	1540	772.258	0.035	0.65	0.65	3.0	242	522	82	71	247	51	
BC	40.6	1542	772.258	0.08	1.50	1.50	7.0	243	534	81	72	246	50	
	28.5			0.08	1.50	1.50	7.0	243	561	84	72	246	50	
	20.2			0.07	1.27	1.27	6.0	244	570	85	73	246	50	
	13.5			0.05	0.91	0.91	6.0	244	496	85	73	246	49	
	7.6			0.04	0.72	0.72	4.0	245	489	86	73	245	49	
	2.4	1612	790.867	0.03	0.54	0.54	2.0	244	490	86	73	245	49	
	Page 1	Δ = 60	Δ = 33.762	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.049		0.90			519 (°F)		76 (°F)			
	Test	Δ = 120	Δ = 66.020	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.048		0.886			516 (°F)		78 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4 %	
O2	12.5 %	
CO	— %	
N2	83.5 %	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.009	< 0.02
After	7.00	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	622.7	503.6	119.1
2.	100 mL 0.1 N H2SO4	634.1	568.4	65.7
3.	100 mL 0.1 N H2SO4	522.9	522.9	0.1
4.	100 mL 0.1 N NaOH	517.7	519.3	-1.6
5.	100 mL 0.1 N NaOH	561.0	552.9	8.1
6.	~ 200 g Silica Gel	679.5	664.1	15.4
7.				
8.			total =	246.8 g

HIGH FLOW SOURCE SAMPLING DATA SHEET

Page 2 of 2

CLIENT	U.S. Steel Clairton Works	TEST DATE	April 19th, 2000	CONTROL BOX NO.	APEX-1	HOT/COLD BOX NO.	A
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 2	ORIFICE FACTOR (ΔH@)	1.911	FILTER NO.	481 QTZ
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.51	METER CORR. (Y)	0.9851	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.1	CALIBRATION DATE	9-20-00	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 030 - 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
EB	40.6	1416	790.867	0.06	1.13	1.13	6.0	244	509	83	73	246	47	
	28.5			0.06	1.13	1.13	6.0	244	516	84	73	246	47	5 min./pt.
	20.2			0.05	0.94	0.94	5.0	246	527	86	73	246	48	
	13.5			0.05	0.94	0.94	5.0	246	512	87	73	244	48	
	7.6			0.03	0.56	0.56	3.0	244	529	87	73	245	48	
	2.4	1646	806.964	0.03	0.56	0.56	3.0	244	480	86	73	245	48	
EA	40.6	1648	806.964	0.06	1.11	1.11	6.0	245	536	83	73	245	49	
	28.5			0.06	1.11	1.11	6.0	245	565	86	74	245	49	
	20.2			0.06	1.11	1.11	6.0	245	509	86	74	246	50	
	13.5			0.05	0.96	0.96	5.0	247	498	88	74	246	49	
	7.6			0.03	0.57	0.57	3.0	247	495	88	74	246	50	
	2.4	1718	823.125	0.03	0.57	0.57	3.0	247	490	88	74	246	50	
	Page 2	Δ = 60	Δ = 32.258	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.047		0.873			513 (°F)		79 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

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

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			
4.	100 mL 0.1 N NaOH			
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	April 20th, 2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	8
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 3	ORIFICE FACTOR (ΔH@)	1.911	FILTER NO.	466 QTZ
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.35	METER CORR. (Y)	0.9851	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.1	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 030 - 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	1055	823.543	0.06	1.07	1.07	5.0	235	562	71	71	250	59	
	28.5			0.05	0.89	0.89	4.0	245	494	74	71	250	59	5 min./pt.
	20.2			0.05	0.89	0.89	4.0	245	491	77	73	246	56	
	13.5			0.03	0.57	0.57	2.0	245	500	81	72	246	56	
	7.6			0.03	0.57	0.57	2.0	245	504	83	72	246	54	
	2.4	1125	838.352	0.03	0.57	0.57	2.0	245	506	84	73	246	54	
B	40.6	1130	838.352	0.06	1.14	1.14	5.0	247	498	82	74	246	54	
	28.5			0.06	1.14	1.14	5.0	247	525	86	75	246	54	
	20.2			0.04	0.75	0.75	4.0	247	527	88	75	246	54	
	13.5			0.04	0.75	0.75	4.0	246	538	88	76	247	54	
	7.6			0.03	0.55	0.55	2.0	245	542	89	76	247	55	
	2.4	1200	853.857	0.03	0.55	0.55	2.0	245	480	89	76	247	55	
	Page 1	Δ=60	Δ=30.314	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.042		0.771			514 (°F)		78 (°F)			Estimates:
	Test	Δ=120	Δ=62.141	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.042		0.785			513 (°F)		82 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4%	
O2	12.5%	
CO	—	
N2	83.5%	

$$\left[\frac{\sum}{n}\right]^2$$

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.006	< 0.02
After	5.00	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	614.0	468.5	145.5
2.	100 mL 0.1 N H2SO4	525.9	486.8	39.1
3.	100 mL 0.1 N H2SO4	584.5	583.7	0.8
4.	100 mL 0.1 N NaOH	553.0	550.7	2.3
5.	100 mL 0.1 N NaOH	533.1	531.4	1.7
6.	~200 g Silica Gel	632.6	618.5	14.1
7.				
8.				total = 203.5

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	April 20th, 2000	CONTROL BOX NO.	APEX-1
PLANT SITE	Clairton, PA	TEST NO.	CLR - #1BS - M26A - 3	ORIFICE FACTOR (ΔH@)	1.911
TEST UNIT	No. 1 Battery Combustion Stack	B.P. (in. Hg)	29.35	METER CORR. (Y)	0.9851
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.1	CALIBRATION DATE	9-20-99
PROJECT NO.	00 - 030 - P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges

HOT/COLD BOX NO.	8													
FILTER NO.	466 QTZ													
PROBE NO.	7-1													
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
C	40.6	1204	853.857	0.05	0.96	0.96	4.0	246	500	84	77	247	55	
	28.5			0.04	0.77	0.77	3.0	246	495	87	77	247	56	5 min./pt.
	20.2			0.04	0.77	0.77	3.0	247	504	91	78	246	56	
	13.5			0.04	0.76	0.76	3.0	247	509	92	79	246	56	
	7.6			0.03	0.59	0.59	2.0	246	493	93	80	246	56	
	2.4	1234	869.550	0.03	0.59	0.59	2.0	246	490	92	80	247	57	
D	40.6	1238	869.550	0.06	1.15	1.15	5.0	246	507	86	81	247	57	
	28.5			0.06	1.15	1.15	5.0	246	544	92	81	248	57	
	20.2			0.05	0.92	0.92	4.0	247	548	94	82	248	56	
	13.5			0.05	0.92	0.92	4.0	246	555	95	82	246	57	
	7.6			0.03	0.58	0.58	2.0	247	501	95	83	246	57	
	2.4	1308	885.684	0.03	0.58	0.58	2.0	247	498	95	83	246	56	
	Page 2	Δ = 60	Δ = 31.827	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			Estimates:
	Totals	min	dcf	0.042		0.799			512 (°F)		86 (°F)			MW = 27.6
														%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4%	
O2	12.5%	
CO	—	
N2	83.5%	

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

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			
3.	100 mL 0.1 N H2SO4			
4.	100 mL 0.1 N NaOH			
5.	100 mL 0.1 N NaOH			
6.	~200 g Silica Gel			
7.				
8.				

APEX GLASS NOZZLE CALIBRATION DATA SHEET

Printed: 03/06/00

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	03/06/00
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

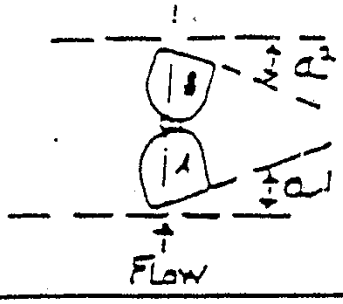
Printed: 03/06/00

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

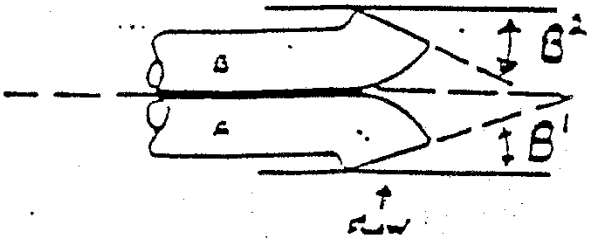
GEOMETRIC PITOT CALIBRATION

Caliper # XFS-59
Precheck ✓
Post Check

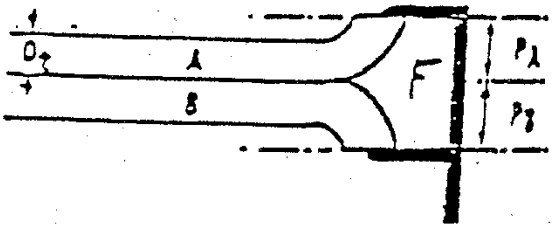
Probe #: 7-1
Date: 01-10-00
Initials: KBA

① 

$A^1 = 2^\circ$
$A^2 = 1^\circ$ → $A^1, A^2 = <10^\circ$
$B^1 = 1^\circ$
$B^2 = 1^\circ$ → $B^1, B^2 = <5^\circ$
$F = 1.000''$

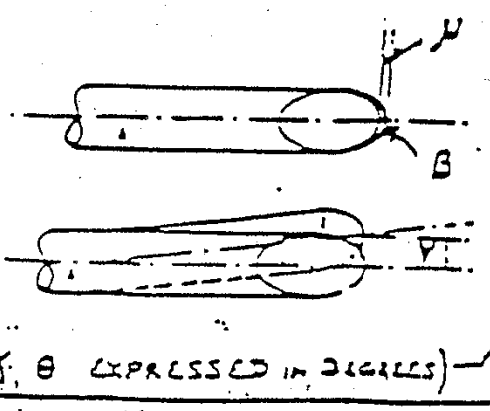
② 

$\mu = 0.017''$ $\mu = \leq 0.1250''$ ($\gamma_{TAN} \times F$)
$V = 0.017''$ $V = \leq 0.03125''$ ($\Theta_{TAN} \times F$)
$W = 0.480''$ $W \geq 0''$
$X = 0.910''$ $X \geq 0.750''$ (3/4" using 1.0" scale)

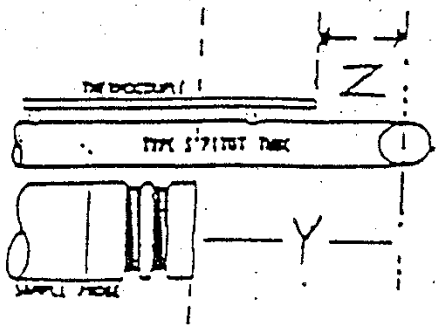
③ 

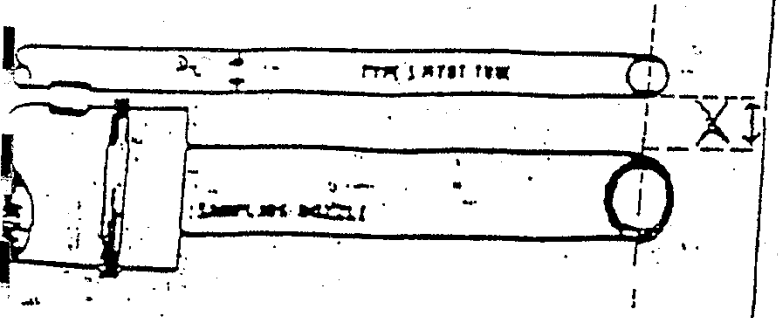
1.05 D_t < P_A < 1.50 D_t
$P_A = P_B$
2.10 D_t < P_B < 3.00 D_t

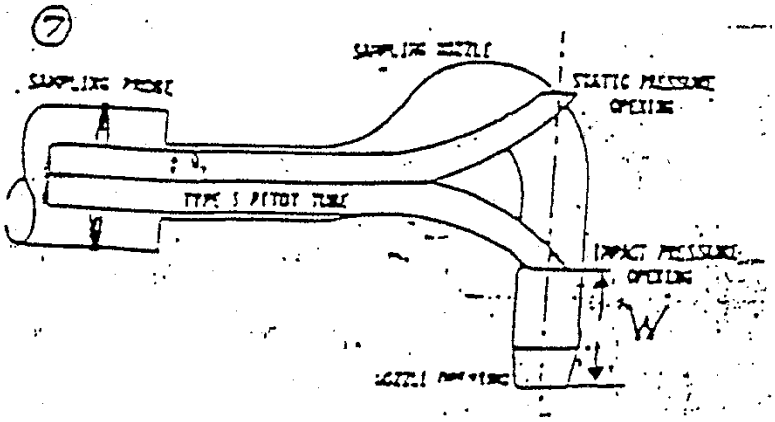
$Y = 6.211''$ $Y \geq 3.0''$
$Z = 2.495''$ $Z > 2.0''$
$D_t = 0.376''$ $D_t > .1875''$

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-1
CALIBRATION DATE 09-24-99
BAROMETRIC PRESSURE (in. Hg) 29.10

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

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		51.045			1.0	8.0
	MIDWAY			71		94	81		
	STOP	5.000	9:09		56.283				
	DELTA *	5.000	9.15		5.238				
2	START	0.000	0		57.334			2.0	8.0
	MIDWAY			71		97	81		
	STOP	5.000	6:31		62.546				
	DELTA *	5.000	6.52		5.216				
3	START	0.000	0		63.598			3.0	8.0
	MIDWAY			71		100	81		
	STOP	5.000	5:17		68.848				
	DELTA *	5.000	5.28		5.210				
Dry Gas Meter Leak Check	START	0.150	0		68.995			0.0	1.0
	STOP	0.343	10:00		69.291				
	DELTA *	0.193	10.0		0.296				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0103 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)	9.15	6.52	5.28	
Tw (°F)	71	71	71	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	94	97	100	
To (°F)	81	81	81	
ΔH (in. H2O)	1.00	2.00	3.00	
Vm (dcf)	5.238	5.216	5.210	
ΔH@ (in. H2O)	1.901	1.931	1.899	1.911
Y (Pre-test)	0.9817	0.9861	0.9875	0.9851

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex - 1
CALIBRATION DATE 05-18-00
BAROMETRIC PRESSURE (in. Hg) 29.03

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

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		78.370			2.0	8
	MIDWAY			75		102	83		
	STOP	6.000	7:42		84.592				
	DELTA *	6.000	7.70		6.292				
2	START	0.000	0		84.592			2.0	8
	MIDWAY			75		102	84		
	STOP	5.000	6:25		89.787				
	DELTA *	5.000	6.42		5.195				
3	START	0.000	0		89.787			2.0	8
	MIDWAY			75		103	84		
	STOP	5.000	6:25		94.974				
	DELTA *	5.000	6.42		5.187				
Dry Gas Meter Leak Check	START	0.350	0		95.357			0.0	8
	STOP	0.514	10:00		95.604				
	DELTA *	0.164	10.0		0.247				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.008 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)	29.03	29.03	29.03	
Time (min)	7.70	6.42	6.42	
Tw (°F)	75	75	75	
Vw (cf)	6.000	5.000	5.000	
Ti (°F)	102	102	103	
To (°F)	83	84	84	
ΔH (in. H2O)	2.00	2.00	2.00	
Vm (dcf)	6.292	5.195	5.187	
Y (Pre-test)				0.9851
ΔH@ (in. H2O)	1.896	1.894	1.894	1.895
Y (Post-test)	0.9798	0.9898	0.9923	0.9873
ΔY (%)				0.2%

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

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

4888 Tech Center Drive
Monroeville, PA 15146
412 825 2400
Fax: 412 825 2407

RECEIVED MAY 1 0 2000

UEC
USX Engineers
& Consultants, Inc.

May 3, 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 April 25, 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 - 05/03/2000

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. # : 3692 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1748

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	
13753	CLR-#1BS-M26A-1A	CHLORIDE	04/19/00	*	*	*	05/02/00	29							2.0 mg/L	E
13754	CLR-#1BS-M26A-1B	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13755	CLR-#1BS-M26A-1C	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13756	CLR-#1BS-M26A-1D	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13757	CLR-#1BS-M26A-2A	CHLORIDE	04/19/00	*	*	*	05/02/00	29							2.0 mg/L	E
13758	CLR-#1BS-M26A-2B	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13759	CLR-#1BS-M26A-2C	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13760	CLR-#1BS-M26A-2D	CHLORIDE	04/19/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13761	CLR-#1BS-M26A-3A	CHLORIDE	04/20/00	*	*	*	05/02/00	26							2.0 mg/L	E
13762	CLR-#1BS-M26A-3B	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13763	CLR-#1BS-M26A-3C	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13764	CLR-#1BS-M26A-3D	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E
13765	CLR-H2SO4-BLANK	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

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. # : 3692 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 1748

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	
13766	CLR-NAOH-BLANK	CHLORIDE	04/20/00	*	*	*	05/02/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

ANALYST : Neelam Patel Date: 5-3-00

APPROVED: Stephanie A Guilyard Date: 5/5/00

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

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

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 00-0354P ; P.O.#3692
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC Ill and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 1 Battery Combustion Stack

ANALYSES TO BE CONDUCTED: Chloride ion (Cl⁻) via ion chromatography - U.S. EPA reference Method 26A

A: Impinges 1+2
B: Impinge 3
C: Impinge 4
D: Impinge 5

	SAMPLE IDENTIFICATION NUMBER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	NUMBER OF CONTAINERS	COMPOSITE OR GRAB	REMARKS OR OBSERVATIONS
	CLR-#1BS-M26A-1A	04-19-00	Test #1	1	Comp.	0.1N H_2SO_4 - Sample Volume = 413.8 mL
	CLR-#1BS-M26A-1B			1	Comp.	0.1N H_2SO_4 - Sample Volume = 149.3 mL
*	CLR-#1BS-M26A-1C			1	Comp.	* 0.1N NaOH - Sample Volume = 139.3 mL
*	CLR-#1BS-M26A-1D			1	Comp.	* 0.1N NaOH - Sample Volume = 157.4 mL
	CLR-#1BS-M26A-2A	04-19-00	Test #2	1	Comp.	0.1N H_2SO_4 - Sample Volume = 404.8 mL
	CLR-#1BS-M26A-2B			1	Comp.	0.1N H_2SO_4 - Sample Volume = 135.3 mL
*	CLR-#1BS-M26A-2C			1	Comp.	* 0.1N NaOH - Sample Volume = 132.0 mL
*	CLR-#1BS-M26A-2D			1	Comp.	* 0.1N NaOH - Sample Volume = 153.0 mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME
John P. Shumbrick	04-24-00	11:00 EDT	Kelly Cy.	04-24-00	11:02
Judy Doehle	4-25-00	12:45 pm	Judy Doehle	4-24-00	4:27 pm

ICE CHEST #
CHEST TEMP.
TAG #

ATS 10/98

* Rec. cold 5% Sodium Thiosulfate $Na_2S_2O_3 \cdot 3.5H_2O$ prior to analysis

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 00-030-P ; P.O. #3692
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB ~~CEC~~ H and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS No. 1 Battery Combustion Stack

ANALYSES TO BE CONDUCTED

Chloride ion (C1⁻)	Vic 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-#1BS-M26A-3A	04-27-00	Test #3	1	Comp.	✓									0.1N H_2SO_4 - Sample Volume = 404.2 mL
	CLR-#1BS-M26A-3B	↓	↓	1	Comp.	✓									0.1N H_2SO_4 - Sample Volume = 137.0 mL
*	CLR-#1BS-M26A-3C			1	Comp.	✓								*	0.1N NaOH - Sample Volume = 146.6 mL
*	CLR-#1BS-M26A-3D			1	Comp.	✓								*	0.1N NaOH - Sample Volume = 132.5 mL
	CLR-H2SO4-BLANK	04-20-00	BLANK	1	Grab	✓									0.1N H_2SO_4
*	CLR-NAOH-BLANK	↓	↓ 1700 EDT	1	Grab	✓								*	0.1N NaOH

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
Brent P. Summerville	04-24-00	1140 EDT	Kelly Eg	04-24-00	11:02	
			Judy Abetles	4.24.00	4:30 pm	CHEST TEMP.
Judy Abetles	4-25-00	12:45 pm				
						TAG #

ATS 1/0/98

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
NO. 1 BATTERY COMBUSTION STACK
APRIL 19 AND 20, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#1BS-M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	29	413.8	12.00	100.0
	1B	0.1 N H2SO4 - Impinger 3	< 2.0	149.3	< 0.30	
	1C	0.1 N NaOH - Impinger 4	< 2.0	139.3	< 0.28	NA
	1D	0.1 N NaOH - Impinger 5	< 2.0	157.4	< 0.31	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	29	404.8	11.74	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 2.0	135.3	< 0.27	
	2C	0.1 N NaOH - Impinger 4	< 2.0	132.0	< 0.26	NA
	2D	0.1 N NaOH - Impinger 5	< 2.0	153.0	< 0.31	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	26	404.2	10.51	100.0
	3B	0.1 N H2SO4 - Impinger 3	< 2.0	137.0	< 0.27	
	3C	0.1 N NaOH - Impinger 4	< 2.0	146.6	< 0.29	NA
	3D	0.1 N NaOH - Impinger 5	< 2.0	132.5	< 0.27	
Blank	Blank	0.1 N H2SO4	< 2.0			
Blank	Blank	0.1 N NaOH	< 2.0			

<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 (< 2.0) ---->
Chloride catch = 0

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 1 BATTERY COMBUSTION STACK
TEST DATE: 4/19/00
TEST NO.: CLR- #1BS-M26A-1

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.51	
B.	Process Gas Static Pressure (in. H2O)	-1.00	
C.	Pitot Tube Coefficient	0.84	
D.	Dry Gas Meter Calibration Factor	0.9851	
	»»»» 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	0.05	
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.05	
K.	Average ΔH (in. H2O) variation	0.99	
L.	Average Process Gas Temperature (°F)	516	
M.	Average Dry Gas Meter Temperature (°F)	69	
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)	217.4	
Q.	Metered Gas Volume (dcf)	67.869	

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.44	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.58	[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)	976	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	529	[M+460]
X.	Dry Gas Volume Sampled (dscf)	65.979	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	10.250	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	13.4	[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 (%)	13.4	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.134		18	2.420
CO2	0.040	0.866	44	1.523
O2	0.120	0.866	32	3.324
N2	0.840	0.866	28	20.357
CO	0.000	0.866	28	0.000
H2	0.000	0.866	2	0.000
CH4	0.000	0.866	16	0.000
C2H6	0.000	0.866	30	0.000
Ar	0.000	0.866	40	0.000

Process Gas Molecular Weight (lb/lb-mol): 27.62

DD.	Average Process Gas Velocity (ft/sec)	1.83E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	7.78E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	4.14E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.58E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	103.0	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0052	
JJ.	Front-Half Residue Weight (g)	0.0075	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0127	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0030	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	9.11E-01	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 1 BATTERY COMBUSTION STACK

TEST DATE: 4/19/00
TEST NO:: CLR- #1BS-M26A-1

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		12.34	
QQ.	Concentration (mg/dscm)		6.60E+00	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		8.85E-01	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.28	
TT.	Concentration (mg/dscm)	<	1.49E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	2.00E-02	[TT*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 1 BATTERY COMBUSTION STACK
TEST DATE: 4/19/00
TEST NO.: CLR- #1BS-M26A-2

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.51
B.	Process Gas Static Pressure (in. H2O)	-1.10
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	0.9851
	»»»» 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	0.05
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.05
K.	Average ΔH (in. H2O) variation	0.89
L.	Average Process Gas Temperature (°F)	516
M.	Average Dry Gas Meter Temperature (°F)	78
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	4.0
	Oxygen (%)	12.5
	Nitrogen (%)	83.5
	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)	206.8
Q.	Metered Gas Volume (dcf)	66.020

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.43	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.58	[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)	976	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	538	[M+460]
X.	Dry Gas Volume Sampled (dscf)	63.092	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.751	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	13.4	[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 (%)	13.4	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.134		18	2.409
CO2	0.040	0.866	44	1.524
O2	0.125	0.866	32	3.465
N2	0.835	0.866	28	20.250
CO	0.000	0.866	28	0.000
H2	0.000	0.866	2	0.000
CH4	0.000	0.866	16	0.000
C2H6	0.000	0.866	30	0.000
Ar	0.000	0.866	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.65	
DD.	Average Process Gas Velocity (ft/sec)	1.72E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	7.33E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	3.90E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.38E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	104.5	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0040	
JJ.	Front-Half Residue Weight (g)	0.0066	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0106	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0026	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	7.50E-01	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST DATE: 4/19/00
TEST SITE: NO. 1 BATTERY COMBUSTION STACK
TEST NO.: CLR- #1BS-M26A-2

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		12.07	
QQ.	Concentration (mg/dscm)		6.76E+00	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		8.54E-01	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.26	
TT.	Concentration (mg/dscm)	<	1.48E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	1.87E-02	[TT*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 1 BATTERY COMBUSTION STACK
TEST DATE: 4/20/00
TEST NO.: CLR- #1BS-M26A-3

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.35
B.	Process Gas Static Pressure (in. H2O)	-1.10
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	0.9851
»»»»	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	0.04
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.04
K.	Average ΔH (in. H2O)	0.79
L.	Average Process Gas Temperature (°F)	513
M.	Average Dry Gas Meter Temperature (°F)	82
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	4.0
	Oxygen (%)	12.5
	Nitrogen (%)	83.5
	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)	203.5
Q.	Metered Gas Volume (dcf)	62.141

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.27	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.41	[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)	973	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	542	[M+460]
X.	Dry Gas Volume Sampled (dscf)	58.614	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.595	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.1	[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 (%)	14.1	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.141		18	2.532
CO2	0.040	0.859	44	1.512
O2	0.125	0.859	32	3.437
N2	0.835	0.859	28	20.091
CO	0.000	0.859	28	0.000
H2	0.000	0.859	2	0.000
CH4	0.000	0.859	16	0.000
C2H6	0.000	0.859	30	0.000
Ar	0.000	0.859	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.57	
DD.	Average Process Gas Velocity (ft/sec)	1.62E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	6.87E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	3.65E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.14E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	104.6	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0030	
JJ.	Front-Half Residue Weight (g)	0.0083	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0113	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0030	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	7.99E-01	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 1 BATTERY COMBUSTION STACK
TEST DATE: 4/20/00
TEST NO.: CLR- #1BS-M26A-3

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)	10.81	
QQ.	Concentration (mg/dscm)	6.51E+00	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)	7.64E-01	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	< 0.29	
TT.	Concentration (mg/dscm)	< 1.77E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	< 2.07E-02	[TT*0.02832*GG*60/454000]