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ADVANCED TECHNOLOGY SYSTEMS, INC.

ATS Project No. 00-063-P

September 12, 2000

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

RE: LETTER REPORT – HYDROCHLORIC ACID, CHLORINE GAS AND AMMONIA GAS EMISISONS TESTING CONDUCTED AT NO. 3 BATTERY COMBUSTION STACK ON JUNE 7 AND 8, 2000

Dear Mr. Graeser:

This letter, with attachments, constitutes the report that summarizes the results of the hydrochloric acid (HCl), chlorine gas (Cl_2) and ammonia gas (NH_3) emissions testing conducted at No. 3 Battery Combustion Stack by Advanced Technology Systems, Inc. (ATS). Three two-hour test runs were conducted on June 7 and 8, 2000 simultaneous with the compliance test program at this stack (particulate matter and visible emissions were measured as part of the compliance test program).

The test results have been summarized in the attached Table 1. Hydrochloric acid, chlorine gas and ammonia gas concentrations are listed in units of milligrams per dry standard cubic meter (mg/dscm). Hydrochloric acid, chlorine gas and ammonia 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, chlorine gas and ammonia gas emission testing was performed in accordance with U.S. EPA Reference Methods 1 through 4 and 26A, U.S. EPA Conditional Test Method 027 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.

Ammonia gas sampling was performed, where possible, in accordance with U.S. EPA Conditional Test Method 027. (The test procedures specified in Method 027 were modified slightly for this test program based on the expected exhaust gas temperatures of 450°F. The modifications were made after ATS consulted with Ms. Rima Howell of the U.S. EPA, who is the pertinent contact for Method 027. It should also be noted that the U.S. EPA had not promulgated Method 027 at the time of this test program, however, this method was apparently the only test method available from the U.S. EPA designed for measuring ammonia gas emissions from stationary sources.) 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, chlorine gas and ammonia 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 and NH_3 collection)
2.	Greenburg-Smith	100 mL 0.1 N sulfuric acid (for HCl & NH_3 collection)
3.	Greenburg-Smith	100 mL 0.1 N sulfuric acid (for HCl & NH_3 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 and NH_3)
B	Contents of Impinger No. 3 plus applicable distilled deionized water rinses (for HCl and NH_3)
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, Cl_2 and NH_3 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. Sample Fractions A and B and the 0.1 N sulfuric acid solution field blank were also analyzed for ammonium ion concentration using specific ion electrode analysis techniques. 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);
- 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;
- The ammonium ion concentration of the field blank was less than the analytical detection limit; and
- For all three test runs, the NH_3 collection efficiency of the sample train could not be calculated since the ammonium catch of Sample Fractions A and B were less than or just slightly greater 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:

R. P. Khosah

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

U.S. STEEL CLAIRTON WORKS
CLAIRTON, PENNSYLVANIA

TABLE 1

NO. 3 BATTERY COMBUSTION STACK
HYDROCHLORIC ACID, CHLORINE GAS AND AMMONIA GAS EMISSIONS DATA
JUNE 7 AND 8, 2000

		Run 1	Run 2	Run 3	Average
Test Date		6/7/00	6/7/00	6/8/00	
Emissions Data					
Hydrochloric Acid (HCl)					
Concentration	(mg/dscm)	1.39E+01	1.83E+01	1.50E+01	1.57E+01
Mass Emission Rate	(lb/hr)	2.03E+00	2.16E+00	2.11E+00	2.10E+00
Chlorine Gas (Cl_2)					
Concentration	(mg/dscm)	< 1.40E-01	< 1.47E-01	< 1.82E-01	< 1.56E-01
Mass Emission Rate	(lb/hr)	< 2.05E-02	< 1.73E-02	< 2.56E-02	< 2.11E-02
Ammonia Gas (NH_3)					
Concentration	(mg/dscm)	< 2.16E-02	2.48E-02	6.67E-02	< 3.77E-02
Mass Emission Rate	(lb/hr)	< 3.15E-03	2.92E-03	9.37E-03	< 5.15E-03
Exhaust Stack Conditions					
Volumetric Flow Rate	(acfm)	8.52E+04	6.79E+04	8.20E+04	7.84E+04
	(scfm)	4.55E+04	3.70E+04	4.38E+04	4.21E+04
	(dscfm)	3.91E+04	3.15E+04	3.75E+04	3.60E+04
Temperature	(°F)	516	497	515	509
Moisture Content	(%)	14.2	14.9	14.3	14.5
Sampling Conditions					
Test Times +	(EDT)	0825 to 1016 & 1205 to 1225	1248 to 1456	0813 to 1021	
Sampling Time *	(minutes)	120	120	120	
Sample Volume **	(dscf)	66.478	56.123	65.927	
Isokinetic Variation ***	(%)	95.1	99.6	98.2	

mg / dscm = milligrams per dry standard cubic meter
+: Delay from 1016 to 1205 EDTdue to mechanical problems with coke hot car
*: 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, Chlorine Gas and Ammonia Gas Emissions Testing Conducted at No. 3 Battery Combustion Stack on June 7 and 8, 2000

September 2000

APPENDIX

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

ATS
ADVANCED TECHNOLOGY SYSTEMS, INC.

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	06-07-2000	CONTROL BOX NO.	APEX- 4	HOT/COLD BOX NO.	1
PLANT SITE	Clairton, PA	TEST NO.	CLR - #3 BS - M26A - 1	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	489 QTZ
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg)	29.65	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.2	CALIBRATION DATE	09-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-03-P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EDT)	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	0825	458.352	0.07	1.24	1.24	5.00	244	507	68	67	249	60	5 min./pt.
	28.5			0.07	1.35	1.35	5.00	244	511	71	68	249	60	
	20.2			0.06	1.16	1.16	5.00	244	510	74	68	248	53	
	13.5			0.04	0.82	0.82	3.00	244	470	79	69	248	53	
	7.6			0.05	1.02	1.02	4.00	243	460	80	70	248	52	
	2.4	0855	474.592	0.03	0.61	0.61	2.00	243	505	83	71	249	52	
B	40.6	0859	474.592	0.07	1.34	1.34	5.00	243	501	78	73	249	52	
	28.5			0.07	1.34	1.34	5.00	243	528	79	73	249	52	
	20.2			0.07	1.32	1.32	5.00	243	553	82	73	247	51	
	13.5			0.06	1.13	1.13	4.00	245	562	84	73	247	49	
	7.6			0.05	0.94	0.94	4.00	245	554	85	74	247	49	
	2.4	0929	491.475	0.05	0.94	0.94	4.00	245	530	86	74	246	49	
	Page 1	Δ = 60	Δ = 33.123	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.06		1.09			515 (°F)		75 (°F)			Estimates:
	Test	Δ = 120	Δ = 68.123	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.065		1.19			516 (°F)		79 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4%	
O2	13%	
CO	—	
N2	83%	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.006	< 0.02
After	6.00	0.006	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	622.9	477.3	145.6
2.	100 mL 0.1 N H2SO4	641.2	575.0	66.2
3.	100 mL 0.1 N H2SO4	563.2	560.6	2.6
4.	100 mL 0.1 N NaOH	573.6	571.5	2.1
5.	100 mL 0.1 N NaOH	540.7	538.1	2.6
6.	~200 g Silica Gel	656.7	643.2	13.5
7.				
8.			Total =	232.69

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	06-07-2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	1
PLANT SITE	Clairton, PA	TEST NO.	CLR - #3BS - M26A - 1	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	489 QTZ
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg)	29.65	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.2	CALIBRATION DATE	09-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-063-P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EDT)	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	0933	491.475	0.09	1.77	1.77	6.00	244	520	80	76	247	49	5 min./pt.
	28.5			0.09	1.77	1.77	6.00	244	523	84	76	247	50	
	20.2			0.09	1.77	1.77	6.00	244	535	89	77	247	50	
	13.5			0.07	1.37	1.37	5.00	245	540	90	78	247	50	
	7.6			0.07	1.37	1.37	5.00	245	500	91	79	247	49	
	2.4	1003	510.462	0.05	0.99	0.99	4.00	245	499	90	79	247	49	
D	40.6	1006	510.462	0.09	1.78	1.78	6.00	245	527	86	79	247	49	
	28.5			0.09	1.78	1.78	6.00	245	551	87	79	247	49	STOPPED AT 1016
	20.2	1205		0.05	1.00	1.00	4.00	243	500	80	80	244	52	TRACK CLEANING
	13.5			0.04	0.80	0.80	4.00	243	502	84	80	244	52	UP - CAR BROKE DOWN
	7.6			0.04	0.80	0.80	4.00	243	513	86	81	245	50	STARTED AGAIN
	2.4			0.03	0.59	0.59	3.00	243	500	88	81	245	50	AT 1205 PM
		1225	526.475											
			35.000											Estimates:
	Page 2	Δ = 120	Δ = ~~35.013~~	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.07		1.28			517 (°F)		82 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4%	
O2	13%	
CO	—	
N2	83%	

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

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.				

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	06-07-2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	4
PLANT SITE	Clairton, PA	TEST NO.	CLR - #3BS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	468 QTZ
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg)	29.65	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.20	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-063-P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EDT)	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
XD	40.6	1248	527.161	0.05	1.01	1.01	4.00	247	501	82	82	248	61	5 min./pt.
	28.5			0.06	1.21	1.21	5.00	247	521	85	82	248	61	
	20.2			0.05	1.01	1.01	4.00	247	500	90	82	248	57	
	13.5			0.04	0.80	0.80	4.00	249	503	93	82	247	57	
	7.6			0.04	0.80	0.80	4.00	247	498	93	82	247	55	
	2.4	1318	542.031	0.03	0.60	0.60	3.00	247	518	93	83	247	54	
XC	40.6	1320	542.031	0.06	1.18	1.18	5.00	247	535	88	84	245	52	
	28.5			0.06	1.18	1.18	5.00	247	503	91	83	245	52	
	20.2			0.04	0.81	0.81	3.00	247	500	92	84	245	52	
	13.5			0.04	0.81	0.81	3.00	247	490	92	83	244	51	
	7.6			0.04	0.81	0.81	3.00	248	491	94	83	244	50	
	2.4	1350	556.836	0.03	0.60	0.60	3.00	248	493	94	84	244	49	
	Page 1	Δ = 60	Δ = 29.675	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.044		0.89			504 (°F)		87 (°F)			Estimates:
	Test	Δ = 120	Δ = 58.521	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.042		0.85			497 (°F)		88 (°F)			%H2O = 13

Dry Gas Composition

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

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.007	< 0.02
After	5.00	0.006	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	645.7	509.6	136.1
2.	100 mL 0.1 N H2SO4	628.8	575.8	53.0
3.	100 mL 0.1 N H2SO4	490.9	489.9	1.0
4.	100 mL 0.1 N NaOH	474.2	476.1	-1.9
5.	100 mL 0.1 N NaOH	551.9	546.0	5.9
6.	~200 g Silica Gel	628.1	614.3	13.8
7.				
8.			Total =	207.99

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	06-07-2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	4
PLANT SITE	Clairton, PA	TEST NO.	CLR - #3BS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	468 QTZ
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg)	29.65	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.20	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-063-P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EDT)	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
ØB	40.6	1354	556.836	0.04	0.81	0.81	4.00	245	500	88	84	243	49	5 min./pt.
	28.5			0.04	0.81	0.81	4.00	245	506	90	84	243	49	
	20.2			0.04	0.81	0.81	4.00	246	519	93	84	244	49	
	13.5			0.04	0.81	0.81	4.00	246	514	94	84	244	48	
	7.6			0.03	0.60	0.60	3.00	246	520	94	84	244	48	
	2.4	1424	570.610	0.03	0.60	0.60	3.00	246	498	94	84	243	49	
ØA	40.6	1426	570.610	0.04	0.81	0.81	4.00	246	488	88	85	243	51	
	28.5			0.04	0.83	0.83	4.00	246	490	90	84	243	51	
	20.2			0.05	1.03	1.03	5.00	247	470	94	84	244	50	
	13.5			0.05	1.05	1.05	5.00	247	468	94	84	244	50	
	7.6			0.04	0.84	0.84	4.00	247	455	96	84	243	49	
	2.4			0.03	0.63	0.63	3.00	246	468	96	84	243	49	
		1456	585.682											
														Estimates:
	Page 2	Δ = 60	Δ = 28.846	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.04		0.80			491 (°F)		88 (°F)			%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)

	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	06-08-2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - ~~#~~3BS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	488 QTZ -
TEST UNIT	No. ~~1~~3 Battery Combustion Stack	B.P. (in. Hg)	29.59	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.20	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-06~~2~~3-P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EDT)	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	0813	586.182	0.06	1.12	1.12	5.00	248	569	71	70	243	60	5 min./pt.
	28.5			0.06	1.12	1.12	5.00	248	542	72	70	243	56	
	20.2			0.06	1.15	1.15	5.00	248	471	76	70	243	53	
	13.5			0.04	0.85	0.85	4.00	247	438	80	70	243	53	
	7.6			0.04	0.83	0.83	4.00	247	465	82	71	244	54	
	2.4	0843	600.845	0.03	0.60	0.60	4.00	247	492	84	72	244	54	
B	40.6	0845	600.845	0.07	1.35	1.35	5.00	245	535	79	73	245	55	
	28.5			0.07	1.35	1.35	5.00	245	521	84	73	245	55	
	20.2			0.07	1.36	1.36	5.00	246	530	85	74	244	54	
	13.5			0.06	1.17	1.17	5.00	246	547	88	75	244	54	
	7.6			0.05	0.95	0.95	5.00	246	547	88	75	245	54	
	2.4	0915	618.180	0.05	0.99	0.99	5.00	246	512	88	75	245	54	
	Page 1	Δ= 60	Δ= 31.998	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.054		1.05			513 (°F)		77 (°F)			Estimates:
	Test	Δ=120	Δ= 67.951	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.06		1.16			515 (°F)		81 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	3.5%	
O2	12.5%	
CO	—	
N2	84%	

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

System Leak Check (60 sec)

2	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.008	< 0.02
After	7.00	0.006	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	609.1	480.8	128.3
2.	100 mL 0.1 N H2SO4	577.3	496.2	81.1
3.	100 mL 0.1 N H2SO4	583.1	580.7	2.4
4.	100 mL 0.1 N NaOH	542.2	541.6	0.6
5.	100 mL 0.1 N NaOH	530.2	523.8	6.4
6.	~ 200 g Silica Gel	632.5	617.4	15.1
7.				
8.		total =	233.9 g	

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	06-08-2000	CONTROL BOX NO.	APEX- 4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - #3BS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	488 QTZ
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg)	29.59	METER CORR. (Y)	1.0023	PROBE NO.	7 - 1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.20	CALIBRATION DATE	09-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 063 - P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EDT)	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	0918	618.180	0.09	1.75	1.75	7.00	245	525	85	76	246	54	5 min./pt.
	28.5			0.09	1.75	1.75	7.00	245	501	86	76	246	54	
	20.2			0.08	1.58	1.58	6.50	245	521	89	77	246	54	
	13.5			0.07	1.38	1.38	6.50	246	524	90	78	245	51	
	7.6			0.05	0.99	0.99	6.00	246	525	91	78	245	51	
	2.4	0948	636.257	0.03	0.61	0.61	4.00	247	490	91	79	246	50	
D	40.6	0951	636.257	0.08	1.60	1.60	6.50	247	525	86	80	246	50	
	28.5			0.08	1.60	1.60	6.50	247	532	89	80	246	50	
	20.2			0.08	1.60	1.60	6.50	247	528	92	80	246	49	
	13.5			0.07	1.39	1.39	6.00	245	518	93	81	246	49	
	7.6			0.04	0.79	0.79	5.00	245	505	93	81	246	49	
	2.4	1021	654.133	0.04	0.79	0.79	5.00	245	500	92	81	246	49	
														Estimates:
	Page 2	Δ = 60	Δ = 35.953	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.065		1.28			516 (°F)		84 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	13.5%	13.5%
O2	12.5%	12.5%
CO	—	—
N2	84%	84%

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

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: 05/17/00

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	05/01/00
27	0.190		0.190	0.190	0.190	KA	05/01/00
28	0.190		0.190	0.190	0.190	KA	05/01/00
29	0.190		0.190	0.190	0.190	KA	05/01/00
31	0.190		0.190	0.190	0.190	KA	05-19-99
4	0.219		0.219	0.219	0.219	KA	05/15/00
6	0.219		0.219	0.219	0.219	KA	05/15/00
7	0.219		0.219	0.219	0.219	KA	05/15/00
15	0.219		0.219	0.219	0.219	KA	05/15/00
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	05/01/00
22	0.344		0.344	0.344	0.344	KA	05/01/00
23	0.347		0.347	0.347	0.347	KA	03-10-98
24	0.375		0.375	0.375	0.375	KA	02/18/00
25	0.375		0.375	0.375	0.375	KA	03-12-96
26	0.406		0.406	0.406	0.406	KA	04-19-96
30	0.406		0.406	0.406	0.406	KA	07-20-98
47	0.415		0.415	0.415	0.415	KA	11-25-96
34	0.425		0.425	0.425	0.424	KA	06-10-97
55	0.425		0.425	0.425	0.424	KA	01/05/00
52	0.440		0.440	0.440	0.440	KA	05/01/00

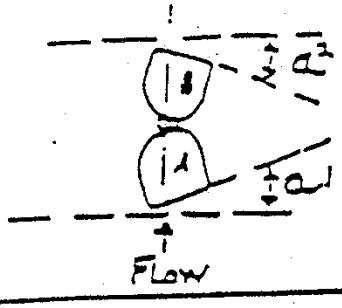
APEX GLASS NOZZLE CALIBRATION DATA SHEET Printed: 05/17/00

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

Caliper # XFS-59
Precheck: ✓
Post Check:

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

①

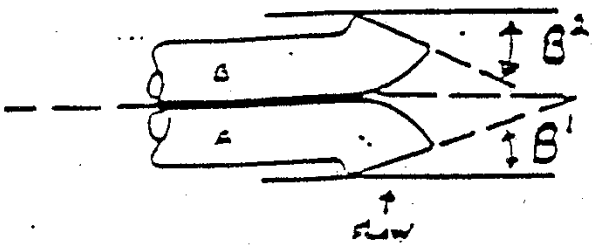


α^2 = 2°
α^1 = 1°
α^1, α^2 = <10°

β^1 = 1°
β^2 = 1°
β^1, β^2 = <5°

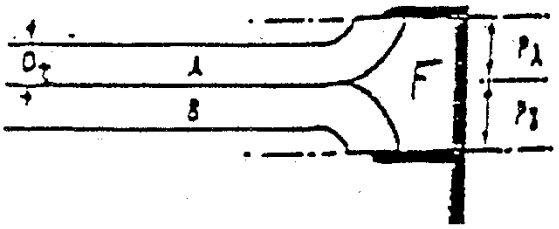
F = 1.000"

②



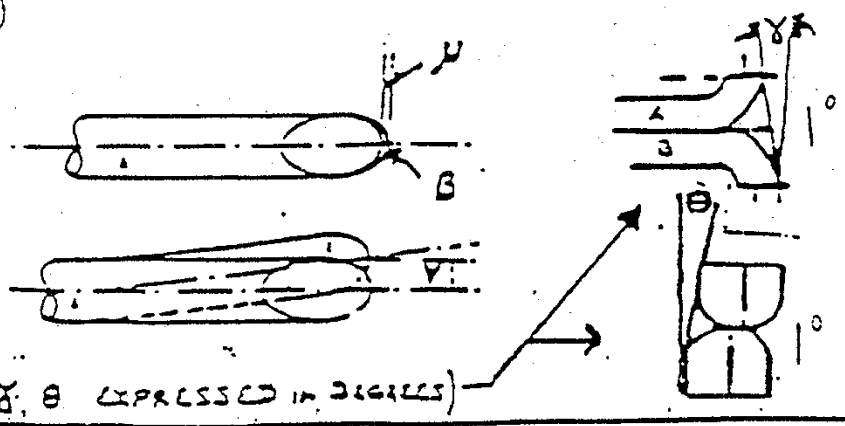
μ = 0.017" μ = ≤ 0.1250" (γ TAN x F)
V = 0.017" V = ≤0.03125" (θ TAN x F)
W = 0.480" W ≥ 0."
X = 0.910" X ≥ 0.750" (3/4" using 1/2" nozzle)
Y = 6.211" Y ≥ 3.0"
Z = 2.495" Z > 2.0"
D_t = 0.376" D_t > .1875"

③



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

④



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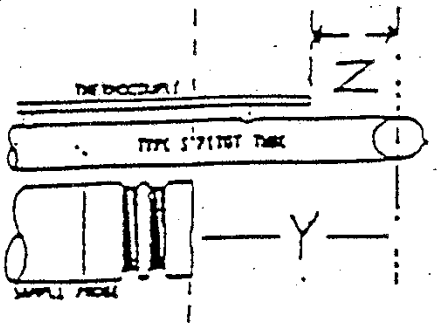

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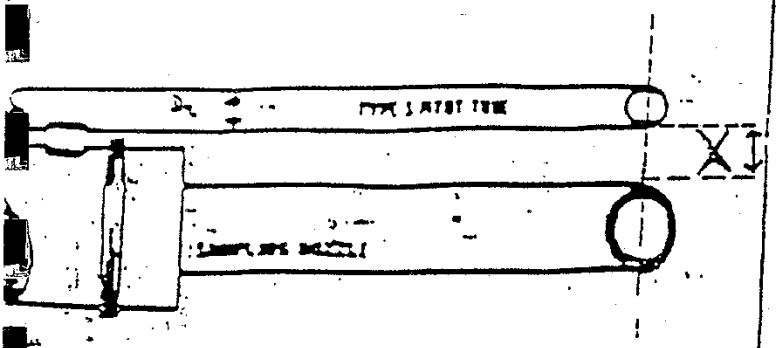

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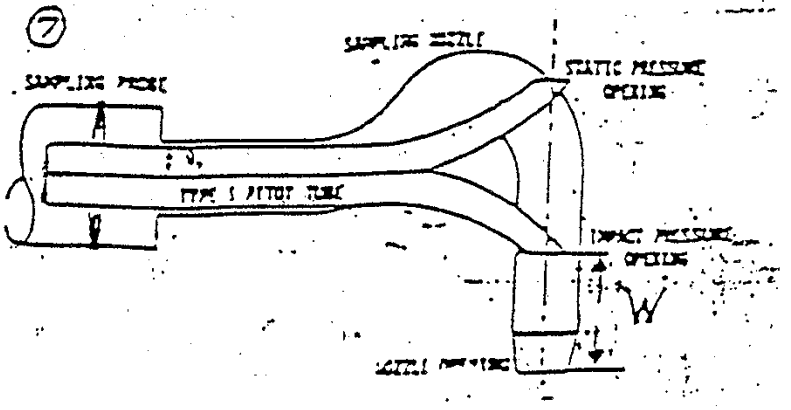

CERTIFICATE OF CALIBRATION

This certifies that your AL-20 AMERICAN WET TEST gas meter,
serial no. P-1146
has been calibrated with a bell prover.
AMERICAN 10 foot, # 3157
It is treaceable to the N.I.S.T., reference no. 1249811.

Calibration by Carl Poe Co., Inc.
99 Reinerman Houston, TX 77007
713-861-3816

2-8-96
Date

Mark Poe
Signature

DRY GAS METER CALIBRATION DATA SHEET

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

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

RUN NO.		WET TEST METER Gas Volume Vw (cf)	Elapsed Time (min.)	Meter Temp. Tw (°F)	DRY GAS METER Gas Volume Vd (dcf)	Inlet Temp. Ti (°F)	Outlet Temp. To (°F)	Orifice Diff. Pres. ΔH (in. H2O)	Vacuum (in. H2O)
1	START	0.000	0		318.302			1.0	8.0
	MIDWAY			71		88	78		
	STOP	5.000	9:20		323.417				
	DELTA *	5.000	9.33		5.115				
2	START	0.000	0		324.438			2.0	8.0
	MIDWAY			71		92	79		
	STOP	5.000	6:39		329.522				
	DELTA *	5.000	6.65		5.084				
3	START	0.000	0		331.850			3.0	8.0
	MIDWAY			71		95	80		
	STOP	5.000	5:25		336.644				
	DELTA *	5.000	5.42		5.094				
Dry Gas	START	0.056	0		336.713			0.0	1.0
Meter Leak	STOP	0.358	10:00		337.112				
Check	DELTA *	0.308	10.0		0.399				

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

*: Express final elapsed time in decimal format

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

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

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-4
CALIBRATION DATE 06-19-08
BAROMETRIC PRESSURE (in. Hg) 29.29

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		679.438			1.3	8.0
	MIDWAY			73		91	77		
	STOP	5.000	8:06		684.421				
	DELTA *	5.000	8.10		4.983				
2	START	0.000	0		684.421			1.3	8.0
	MIDWAY			73		94	78		
	STOP	5.000	8:06		689.424				
	DELTA *	5.000	8.10		4.997				
3	START	0.000	0		689.424			1.3	8.0
	MIDWAY			73		96	79		
	STOP	5.000	8:05		694.431				
	DELTA *	5.000	8.08		5.007				
Dry Gas Meter Leak Check	START	0.190	0		694.632			0.0	9.0
	STOP	0.330	10:00		694.848				
	DELTA *	0.140	10.0		0.216				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0076 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)	29.29	29.29	29.29	
Time (min)	8.10	8.10	8.08	
Tw (°F)	73	73	73	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	91	94	96	
To (°F)	77	78	79	
ΔH (in. H2O)	1.30	1.30	1.30	
Vm (dcf)	4.983	4.997	5.007	
Y (Pre-test)				1.0023
ΔH@ (in. H2O)	1.953	1.950	1.937	1.947
Y (Post-test)	1.0208	1.0217	1.0224	1.0216
ΔY (%)				1.9%

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

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

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

IH & Environmental Laboratory

UEC
USX Engineers
& Consultants, Inc.

July 7, 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 June 12, 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 - 06/26/2000
PAGE - 1

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. # : 3746 SITE LOCATION : US STEEL CLAIRTON WORKS/#3 BATTERY COM

TRACKING NUMBER: 2433 A

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	
20135	CLR-3BS-M26A-1A	CHLORIDE	06/07/00	*	*	*	06/26/00	56							2.0 mg/L	E
20136	CLR-3BS-M26A-1B	CHLORIDE	06/07/00	*	*	*	06/26/00	9.6							2.0 mg/L	E
20137	CLR-3BS-M26A-1C	CHLORIDE	06/07/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20138	CLR-3BS-M26A-1D	CHLORIDE	06/07/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20139	CLR-3BS-M26A-2A	CHLORIDE	06/07/00	*	*	*	06/26/00	68							2.0 mg/L	E
20140	CLR-3BS-M26A-2B	CHLORIDE	06/07/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20141	CLR-3BS-M26A-2C	CHLORIDE	06/07/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20142	CLR-3BS-M26A-2D	CHLORIDE	06/07/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20143	CLR-3BS-M26A-3A	CHLORIDE	06/08/00	*	*	*	06/26/00	61							2.0 mg/L	E
20144	CLR-3BS-M26A-3B	CHLORIDE	06/08/00	*	*	*	06/26/00	3.3							2.0 mg/L	E
20145	CLR-3BS-M26A-3C	CHLORIDE	06/08/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20146	CLR-3BS-M26A-3D	CHLORIDE	06/08/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20147	CLR-H2SO4-BLK	CHLORIDE	06/08/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E

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

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

REPORT OF TEST RESULTS

DATE - 06/26/2000

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. # : 3746 SITE LOCATION : US STEEL CLAIRTON WORKS/#3 BATTERY COM

TRACKING NUMBER: 2433 A

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	
20148	CLR-NAOH-BLK	CHLORIDE	06/08/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E

ANALYST : N. Kadyel Date: 6-26-00

APPROVED: Stephanie A. Guilyard Date: 7/7/00
Stephanie A. Guilyard, IHIT, Project Manager

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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.

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

IH & Environmental Laboratory

UEC
USX Engineers
& Consultants, Inc.

RECEIVED JUL 1 4 2000

July 7, 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 June 12, 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
AMMONIUM-WATER	EPA 350.2 (MOD)
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 - 06/27/2000

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. # : 3746 SITE LOCATION : US STEEL CLAIRTON WORKS/#3 BATTERY COM

TRACKING NUMBER: 2433

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	
20135	CLR-3BS-M26A-1A	AMMONIUM-WATER	06/07/00	*	*	*	06/26/00			< 0.1					0.1	E
20136	CLR-3BS-M26A-1B	AMMONIUM-WATER	06/07/00	*	*	*	06/26/00			< 0.1					0.1	E
20139	CLR-3BS-M26A-2A	AMMONIUM-WATER	06/07/00	*	*	*	06/26/00			0.1					0.1	E
20140	CLR-3BS-M26A-2B	AMMONIUM-WATER	06/07/00	*	*	*	06/26/00			< 0.1					0.1	E
20143	CLR-3BS-M26A-3A	AMMONIUM-WATER	06/08/00	*	*	*	06/26/00			0.3					0.1	E
20144	CLR-3BS-M26A-3B	AMMONIUM-WATER	06/08/00	*	*	*	06/26/00			< 0.1					0.1	E
20147	CLR-H2SO4-BLK	AMMONIUM-WATER	06/08/00	*	*	*	06/26/00			< 0.1					0.1	E
20148	CLR-NAOH-BLK	AMMONIUM-WATER	06/08/00	*	*	*	06/26/00			< 0.1					0.1	E

ANALYST: James J. Miller Date: 6-27-2000
APPROVED: Stephanie A. Guilyard Date: 7/7/00
Stephanie A. Guilyard, IHIT, Project Manager

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

ATS

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

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

CHAIN OF CUSTODY RECORD

PROJECT NUMBER 00-063-P ; P.O. # 3746
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC Ill and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS
No. 3 Battery Combustion Stack

Legend:
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 via ion chromatography			Ammonium ion via wet chemistry method						REMARKS OR OBSERVATIONS
	CLR-#3BS-M26A-1A	06-07-00	0825 →	1	Comp.	✓			✓						0.1N H_2SO_4 - Sample volume = 429.6 mL
	CLR-#3BS-M26A-1B	↓	1225 EDT	1	Comp.	✓			✓						0.1 N H_2SO_4 - sample volume = 143.3 mL
*	CLR-#3BS-M26A-1C	↓	↓	1	Comp.	✓								*	0.1N NaOH - sample volume = 131.9 mL
*	CLR-#3BS-M26A-1D	↓	↓	1	Comp.	✓								*	0.1 N NaOH - sample volume = 132.6 mL
	CLR-#3BS-M26A-2A	06-07-00	1248 →	1	Comp.	✓			✓						0.1N H_2SO_4 - Sample volume = 417.0 mL
	CLR-#3BS-M26A-2B	↓	1456 EDT	1	Comp.	✓			✓						0.1N H_2SO_4 - sample volume = 129.9 mL
	CLR-#3BS-M26A-2C	↓	↓	1	Comp.	✓								*	0.1N NaOH - sample volume = 116.6 mL
	CLR-#3BS-M26A-2D	↓	↓	1	Comp.	✓								*	0.1N NaOH - sample volume = 123.7 mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME		RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Stumbaugh	06-09-00	1615 EDT		[illegible]	06-09-00	1618	
Judy Dietrich	8:30 AM	6-12-00		Judy Dietrich	6-12-00		CHEST TEMP.
							TAG #

ATS 10/98

*: Please add 25 mg 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 00-063-P ; P.O. # 37446
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC IH and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS
No. 3 Battery Combustion Stack

ANALYSES TO BE CONDUCTED: Chloride ion via Ion chromatography; Ammonium ion via wet chemistry method

Legend:
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 via Ion chromatography	Ammonium ion via wet chemistry method	REMARKS OR OBSERVATIONS
CLR-#3BS-M26A-3A	06-08-00	0813 →	1	Comp.	✓	✓	0.1N H_2SO_4 - sample volume = 439.5 mL
CLR-#3BS-M26A-3B	↓	1021 EDT	1	Comp.	✓	✓	0.1N H_2SO_4 - sample volume = 141.9 mL
* CLR-#3BS-M26A-3C	↓	↓	1	Comp.	✓		* 0.1N NaOH - sample volume = 169.8 mL
* CLR-#3BS-M26A-3D	↓	↓	1	Comp.	✓		* 0.1N NaOH - sample volume = 151.2 mL
CLR-H2SO4-BLK	06-08-00	1400 EDT	1	Grab	✓	✓	0.1N H_2SO_4
* CLR-NAOH-BLK	↓	↓	1	Grab	✓		* 0.1N NaOH

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Shumsbock	06-09-00	1615 EDT	[illegible]	06-09-00	1617	
[illegible]	6-12-00	8:20 AM	[illegible]	6-12-00		CHEST TEMP.
						TAG #

ATS 10/98

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
NO. 3 BATTERY COMBUSTION STACK
JUNE 7 AND 8, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#3BS-M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	56	429.6	24.06	94.3
	1B	0.1 N H2SO4 - Impinger 3	9.6	143.3	1.38	
	1C	0.1 N NaOH - Impinger 4	< 2.0	131.9	< 0.26	NA
	1D	0.1 N NaOH - Impinger 5	< 2.0	132.6	< 0.27	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	68	417.0	28.36	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 2.0	129.9	< 0.26	
	2C	0.1 N NaOH - Impinger 4	< 2.0	116.6	< 0.23	NA
	2D	0.1 N NaOH - Impinger 5	< 2.0	123.7	< 0.25	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	61	439.5	26.81	98.3
	3B	0.1 N H2SO4 - Impinger 3	3.3	141.9	0.47	
	3C	0.1 N NaOH - Impinger 4	< 2.0	169.8	< 0.34	NA
	3D	0.1 N NaOH - Impinger 5	< 2.0	151.2	< 0.30	
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. 3 BATTERY COMBUSTION STACK
JUNE 7 AND 8, 2000
U.S. EPA CONDITIONAL TEST METHOD 027 SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#3BS-M26A-)	Sample Type	Ammonium Conc. (mg / L)	Sample Volume (mL)	Ammonium Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	< 0.1	429.6	< 0.04	NA
	1B	0.1 N H2SO4 - Impinger 3	< 0.1	143.3	< 0.01	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	0.1	417.0	0.04	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 0.1	129.9	< 0.01	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	0.3	439.5	0.13	100.0
	3B	0.1 N H2SO4 - Impinger 3	< 0.1	141.9	< 0.01	
Blank	Blank	0.1 N H2SO4	< 0.1			

<u>0.1 N H2SO4</u>

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

For ammonium concentrations less than the analytical detection limit (< 0.1) ---->
Ammonium catch = 0

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 6/7/00

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

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.65
B.	Process Gas Static Pressure (in. H2O)	-1.20
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	1.0023
»»»	Is the Duct Round (Y/N)?	Y
E.	Duct Diameter (in.) - for round duct	114
F.	Duct Width (in.) - for rectangular duct	0
G.	Duct Depth (in.) - for rectangular duct	0
H.	Nozzle Diameter (in.)	0.440
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.07
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.07
K.	Average ΔH (in. H2O) variation	1.19
L.	Average Process Gas Temperature (°F)	516
M.	Average Dry Gas Meter Temperature (°F)	79
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	4.0
	Oxygen (%)	13.0
	Nitrogen (%)	83.0
	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)	232.6
Q.	Metered Gas Volume (dcf)	68.123

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.56	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.74	[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)	539	[M+460]
X.	Dry Gas Volume Sampled (dscf)	66.478	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	10.967	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.2	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	14.2	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.142		18	2.549
CO2	0.040	0.858	44	1.511
O2	0.130	0.858	32	3.571
N2	0.830	0.858	28	19.949
CO	0.000	0.858	28	0.000
H2	0.000	0.858	2	0.000
CH4	0.000	0.858	16	0.000
C2H6	0.000	0.858	30	0.000
Ar	0.000	0.858	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.58	
DD.	Average Process Gas Velocity (ft/sec)	2.00E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	8.52E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	4.55E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.91E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	95.1	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0104	
JJ.	Front-Half Residue Weight (g)	0.0192	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0296	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0069	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	2.30E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 3 BATTERY COMBUSTION STACK

TEST DATE: 6/7/00
TEST NO.: CLR- #3BS-M26A-1

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		26.15	
QQ.	Concentration (mg/dscm)		1.39E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		2.03E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.26	
TT.	Concentration (mg/dscm)	<	1.40E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	2.05E-02	[TT*0.02832*GG*60/454000]

Ammonia Gas Acid (corrected for blank)

VV.	Total Catch (mg)	<	0.04	
WW.	Concentration (mg/dscm)	<	2.16E-02	[VV/(X*0.02832)]
XX.	Mass Flow Rate (lb/hr)	<	3.15E-03	[WW*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 6/7/00

TEST SITE: NO. 3 BATTERY COMBUSTION STACK — TEST NO.: CLR- #3BS-M26A-2

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.65	
B.	Process Gas Static Pressure (in. H2O)	-1.20	
C.	Pitot Tube Coefficient	0.84	
D.	Dry Gas Meter Calibration Factor	1.0023	
»»»	Is the Duct Round (Y/N)?	Y	
E.	Duct Diameter (in.) - for round duct	114	
F.	Duct Width (in.) - for rectangular duct	0	
G.	Duct Depth (in.) - for rectangular duct	0	
H.	Nozzle Diameter (in.)	0.440	
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.04	
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.04	
K.	Average ΔH (in. H2O) variation	0.85	
L.	Average Process Gas Temperature (°F)	497	
M.	Average Dry Gas Meter Temperature (°F)	88	
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)	207.9	
Q.	Metered Gas Volume (dcf)	58.521	

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.56	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.71	[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)	957	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	548	[M+460]
X.	Dry Gas Volume Sampled (dscf)	56.123	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.802	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.9	[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 (%)	14.9	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.149		18	2.676
CO2	0.040	0.851	44	1.498
O2	0.125	0.851	32	3.405
N2	0.835	0.851	28	19.904
CO	0.000	0.851	28	0.000
H2	0.000	0.851	2	0.000
CH4	0.000	0.851	16	0.000
C2H6	0.000	0.851	30	0.000
Ar	0.000	0.851	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.48	
DD.	Average Process Gas Velocity (ft/sec)	1.60E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	6.79E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	3.70E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.15E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	99.6	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0373	
JJ.	Front-Half Residue Weight (g)	0.0109	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0482	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0132	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	3.58E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 6/7/00

TEST SITE: NO. 3 BATTERY COMBUSTION STACK — TEST NO.: CLR- #3BS-M26A-2

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		29.16	
QQ.	Concentration (mg/dscm)		1.83E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		2.16E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.23	
TT.	Concentration (mg/dscm)	<	1.47E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	1.73E-02	[TT*0.02832*GG*60/454000]

Ammonia Gas Acid (corrected for blank)

VV.	Total Catch (mg)		0.04	
WW.	Concentration (mg/dscm)		2.48E-02	[VV/(X*0.02832)]
XX.	Mass Flow Rate (lb/hr)		2.92E-03	[WW*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 6/8/00

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

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.59	
B.	Process Gas Static Pressure (in. H2O)	-1.20	
C.	Pitot Tube Coefficient	0.84	
D.	Dry Gas Meter Calibration Factor	1.0023	
»»»	Is the Duct Round (Y/N)?	Y	
E.	Duct Diameter (in.) - for round duct	114	
F.	Duct Width (in.) - for rectangular duct	0	
G.	Duct Depth (in.) - for rectangular duct	0	
H.	Nozzle Diameter (in.)	0.440	
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.06	
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.06	
K.	Average ΔH (in. H2O) variation	1.16	
L.	Average Process Gas Temperature (°F)	515	
M.	Average Dry Gas Meter Temperature (°F)	81	
N.	Dry Gas Composition (should total to 100%)		
	Carbon Dioxide (%)	3.5	
	Oxygen (%)	12.5	
	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)	233.9	
Q.	Metered Gas Volume (dcf)	67.951	

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.50	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.68	[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)	975	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	541	[M+460]
X.	Dry Gas Volume Sampled (dscf)	65.927	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	11.028	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.3	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	14.3	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.143		18	2.580
CO2	0.035	0.857	44	1.319
O2	0.125	0.857	32	3.427
N2	0.840	0.857	28	20.149
CO	0.000	0.857	28	0.000
H2	0.000	0.857	2	0.000
CH4	0.000	0.857	16	0.000
C2H6	0.000	0.857	30	0.000
Ar	0.000	0.857	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.48	
DD.	Average Process Gas Velocity (ft/sec)	1.93E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	8.20E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	4.38E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.75E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	98.2	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0054	
JJ.	Front-Half Residue Weight (g)	0.0244	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0298	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0070	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	2.24E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 3 BATTERY COMBUSTION STACK

TEST DATE: 6/8/00
TEST NO.: CLR- #3BS-M26A-3

Hydrochloric Acid (corrected for blank)				
PP.	Total Catch (mg)		28.05	
QQ.	Concentration (mg/dscm)		1.50E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		2.11E+00	[QQ*0.02832*GG*60/454000]
Chlorine Gas Acid (corrected for blank)				
SS.	Total Catch (mg)	<	0.34	
TT.	Concentration (mg/dscm)	<	1.82E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	2.56E-02	[TT*0.02832*GG*60/454000]
Ammonia Gas Acid (corrected for blank)				
VV.	Total Catch (mg)		0.12	
WW.	Concentration (mg/dscm)		6.67E-02	[VV/(X*0.02832)]
XX.	Mass Flow Rate (lb/hr)		9.37E-03	[WW*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. 00-063-P

September 12, 2000

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

RE: LETTER REPORT – HYDROCHLORIC ACID, CHLORINE GAS AND AMMONIA GAS EMISISONS TESTING CONDUCTED AT NO. 3 BATTERY COMBUSTION STACK ON JUNE 7 AND 8, 2000

Dear Mr. Graeser:

This letter, with attachments, constitutes the report that summarizes the results of the hydrochloric acid (HCl), chlorine gas (Cl_2) and ammonia gas (NH_3) emissions testing conducted at No. 3 Battery Combustion Stack by Advanced Technology Systems, Inc. (ATS). Three two-hour test runs were conducted on June 7 and 8, 2000 simultaneous with the compliance test program at this stack (particulate matter and visible emissions were measured as part of the compliance test program).

The test results have been summarized in the attached Table 1. Hydrochloric acid, chlorine gas and ammonia gas concentrations are listed in units of milligrams per dry standard cubic meter (mg/dscm). Hydrochloric acid, chlorine gas and ammonia 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, chlorine gas and ammonia gas emission testing was performed in accordance with U.S. EPA Reference Methods 1 through 4 and 26A, U.S. EPA Conditional Test Method 027 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.

Ammonia gas sampling was performed, where possible, in accordance with U.S. EPA Conditional Test Method 027. (The test procedures specified in Method 027 were modified slightly for this test program based on the expected exhaust gas temperatures of 450°F. The modifications were made after ATS consulted with Ms. Rima Howell of the U.S. EPA, who is the pertinent contact for Method 027. It should also be noted that the U.S. EPA had not promulgated Method 027 at the time of this test program, however, this method was apparently the only test method available from the U.S. EPA designed for measuring ammonia gas emissions from stationary sources.) 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, chlorine gas and ammonia 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 and NH_3 collection)
2.	Greenburg-Smith	100 mL 0.1 N sulfuric acid (for HCl & NH_3 collection)
3.	Greenburg-Smith	100 mL 0.1 N sulfuric acid (for HCl & NH_3 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 and NH_3)
B	Contents of Impinger No. 3 plus applicable distilled deionized water rinses (for HCl and NH_3)
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, Cl_2 and NH_3 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. Sample Fractions A and B and the 0.1 N sulfuric acid solution field blank were also analyzed for ammonium ion concentration using specific ion electrode analysis techniques. 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);
- 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;
- The ammonium ion concentration of the field blank was less than the analytical detection limit; and
- For all three test runs, the NH_3 collection efficiency of the sample train could not be calculated since the ammonium catch of Sample Fractions A and B were less than or just slightly greater 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:

R. P. Khosah

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

U.S. STEEL CLAIRTON WORKS
CLAIRTON, PENNSYLVANIA

TABLE 1

NO. 3 BATTERY COMBUSTION STACK
HYDROCHLORIC ACID, CHLORINE GAS AND AMMONIA GAS EMISSIONS DATA
JUNE 7 AND 8, 2000

		Run 1	Run 2	Run 3	Average
Test Date		6/7/00	6/7/00	6/8/00	
Emissions Data					
Hydrochloric Acid (HCl)					
Concentration	(mg/dscm)	1.39E+01	1.83E+01	1.50E+01	1.57E+01
Mass Emission Rate	(lb/hr)	2.03E+00	2.16E+00	2.11E+00	2.10E+00
Chlorine Gas (Cl_2)					
Concentration	(mg/dscm)	< 1.40E-01	< 1.47E-01	< 1.82E-01	< 1.56E-01
Mass Emission Rate	(lb/hr)	< 2.05E-02	< 1.73E-02	< 2.56E-02	< 2.11E-02
Ammonia Gas (NH_3)					
Concentration	(mg/dscm)	< 2.16E-02	2.48E-02	6.67E-02	< 3.77E-02
Mass Emission Rate	(lb/hr)	< 3.15E-03	2.92E-03	9.37E-03	< 5.15E-03
Exhaust Stack Conditions					
Volumetric Flow Rate	(acfm)	8.52E+04	6.79E+04	8.20E+04	7.84E+04
	(scfm)	4.55E+04	3.70E+04	4.38E+04	4.21E+04
	(dscfm)	3.91E+04	3.15E+04	3.75E+04	3.60E+04
Temperature	(°F)	516	497	515	509
Moisture Content	(%)	14.2	14.9	14.3	14.5
Sampling Conditions					
Test Times +	(EDT)	0825 to 1016 & 1205 to 1225	1248 to 1456	0813 to 1021	
Sampling Time *	(minutes)	120	120	120	
Sample Volume **	(dscf)	66.478	56.123	65.927	
Isokinetic Variation ***	(%)	95.1	99.6	98.2	

mg / dscm = milligrams per dry standard cubic meter
+: Delay from 1016 to 1205 EDTdue to mechanical problems with coke hot car
*: 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, Chlorine Gas and Ammonia Gas Emissions Testing Conducted at No. 3 Battery Combustion Stack on June 7 and 8, 2000

September 2000

APPENDIX

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

ATS
ADVANCED TECHNOLOGY SYSTEMS, INC.

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	06-07-2000	CONTROL BOX NO.	APEX- 4	HOT/COLD BOX NO.	1
PLANT SITE	Clairton, PA	TEST NO.	CLR - #3 BS - M26A - 1	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	489 QTZ
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg)	29.65	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.2	CALIBRATION DATE	09-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-063-P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EDT)	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	0825	458.352	0.07	1.24	1.24	5.00	244	507	68	67	249	60	5 min./pt.
	28.5			0.07	1.35	1.35	5.00	244	511	71	68	249	60	
	20.2			0.06	1.16	1.16	5.00	244	510	74	68	248	53	
	13.5			0.04	0.82	0.82	3.00	244	470	79	69	248	53	
	7.6			0.05	1.02	1.02	4.00	243	460	80	70	248	52	
	2.4	0855	474.592	0.03	0.61	0.61	2.00	243	505	83	71	249	52	
B	40.6	0859	474.592	0.07	1.34	1.34	5.00	243	501	78	73	249	52	
	28.5			0.07	1.34	1.34	5.00	243	528	79	73	249	52	
	20.2			0.07	1.32	1.32	5.00	243	553	82	73	247	51	
	13.5			0.06	1.13	1.13	4.00	245	562	84	73	247	49	
	7.6			0.05	0.94	0.94	4.00	245	554	85	74	247	49	
	2.4	0929	491.475	0.05	0.94	0.94	4.00	245	530	86	74	246	49	
	Page 1	Δ = 60	Δ = 33.123	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.06		1.09			515 (°F)		75 (°F)			Estimates:
	Test	Δ = 120	Δ = 68.123	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.065		1.19			516 (°F)		79 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4%	
O2	13%	
CO	—	
N2	83%	

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.006	< 0.02
After	6.00	0.006	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	622.9	477.3	145.6
2.	100 mL 0.1 N H2SO4	641.2	575.0	66.2
3.	100 mL 0.1 N H2SO4	563.2	560.6	2.6
4.	100 mL 0.1 N NaOH	573.6	571.5	2.1
5.	100 mL 0.1 N NaOH	540.7	538.1	2.6
6.	~ 200 g Silica Gel	656.7	643.2	13.5
7.				
8.		total =		232.6 g

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE 06-07-2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO. 1
PLANT SITE	Clairton, PA	TEST NO. CLR-#3BS-M26A-1	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO. 489 QTZ
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg) 29.65	METER CORR. (Y)	1.0023	PROBE NO. 7-1
TEST CREW	JS, KA	STATIC P. (in. H2O) -1.2	CALIBRATION DATE	09-20-99	NOZZLE DIA. (in.) 0.440
PROJECT NO.	00-063-P	STACK DIA. (in.) 114	PORT SIZE & TYPE	4" Flanges	PITOT COEF. 0.84

Test Port	Traverse Point (in.)	Time (EDT)	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
	40.6	0933	491.475	0.09	1.77	1.77	6.00	244	520	80	76	247	49	5 min./pt.
	28.5			0.09	1.77	1.77	6.00	244	523	84	76	247	50	
	20.2			0.09	1.77	1.77	6.00	244	535	89	77	247	50	
	13.5			0.07	1.37	1.37	5.00	245	540	90	78	247	50	
	7.6			0.07	1.37	1.37	5.00	245	500	91	79	247	49	
	2.4	1003	510.462	0.05	0.99	0.99	4.00	245	499	90	79	247	49	
	40.6	1006	510.462	0.09	1.78	1.78	6.00	245	527	86	79	247	49	
	28.5			0.09	1.78	1.78	6.00	245	551	87	79	247	49	STOPPED AT 1016
	20.2	1205		0.05	1.00	1.00	4.00	243	500	80	80	244	52	TRACK CLEANING
	13.5			0.04	0.80	0.80	4.00	243	502	84	80	244	52	UP-CAR BROKE DOWN
	7.6			0.04	0.80	0.80	4.00	243	513	86	81	245	50	STARTED AGAIN
	2.4			0.03	0.59	0.59	3.00	243	500	88	81	245	50	AT 1205 PM
		1225	526.475											
			35.000											Estimates:
	Page 2	Δ = 120	Δ = ~~35.073~~	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.07		1.28			517 (°F)		82 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	4%	
O2	13%	
CO	—	
N2	83%	

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

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	06-07-2000	CONTROL BOX NO.	APEX-4
PLANT SITE	Clairton, PA	TEST NO.	CLR - #3 BS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg)	29.65	METER CORR. (Y)	1.0023
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.20	CALIBRATION DATE	9-20-99
PROJECT NO.	00 - 03 - P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges

HOT/COLD BOX NO.	4	FILTER NO.	468 QTZ
PROBE NO.	7-1	NOZZLE DIA. (in.)	0.440
PITOT COEF.	0.84		

Test Port	Traverse Point (in.)	Time (EDT)	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
D	40.6	1248	527.161	0.05	1.01	1.01	4.00	247	501	82	82	248	61	5 min./pt.
	28.5			0.06	1.21	1.21	5.00	247	521	85	82	248	61	
	20.2			0.05	1.01	1.01	4.00	247	500	90	82	248	57	
	13.5			0.04	0.80	0.80	4.00	249	503	93	82	247	57	
	7.6			0.04	0.80	0.80	4.00	247	498	93	82	247	55	
	2.4	1318	542.031	0.03	0.60	0.60	3.00	247	518	93	83	247	54	
BC	40.6	1320	542.031	0.06	1.18	1.18	5.00	247	535	88	84	245	52	
	28.5			0.06	1.18	1.18	5.00	247	503	91	83	245	52	
	20.2			0.04	0.81	0.81	3.00	247	500	92	84	245	52	
	13.5			0.04	0.81	0.81	3.00	247	490	92	83	244	51	
	7.6			0.04	0.81	0.81	3.00	248	491	94	83	244	50	
	2.4	1350	556.836	0.03	0.60	0.60	3.00	248	493	94	84	244	49	
	Page 1	Δ = 60	Δ = 29.675	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.044		0.89			504 (°F)		87 (°F)			Estimates:
	Test	Δ = 120	Δ = 58.521	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.042		0.85			497 (°F)		88 (°F)			%H2O = 13

Dry Gas Composition

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

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.007	< 0.02
After	5.00	0.006	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	645.7	509.6	136.1
2.	100 mL 0.1 N H2SO4	628.8	575.8	53.0
3.	100 mL 0.1 N H2SO4	490.9	489.9	1.0
4.	100 mL 0.1 N NaOH	474.2	476.1	-1.9
5.	100 mL 0.1 N NaOH	551.9	546.0	5.9
6.	~200 g Silica Gel	628.1	614.3	13.8
7.				
8.			Total=	267.99

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	06-07-2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	4
PLANT SITE	Clairton, PA	TEST NO.	CLR - #3BS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	468 QTZ
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg)	29.65	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.20	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-063-P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EDT)	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
ØB	40.6	1354	556.836	0.04	0.81	0.81	4.00	245	500	88	84	243	49	5 min./pt.
	28.5			0.04	0.81	0.81	4.00	245	506	90	84	243	49	
	20.2			0.04	0.81	0.81	4.00	246	519	93	84	244	49	
	13.5			0.04	0.81	0.81	4.00	246	514	94	84	244	48	
	7.6			0.03	0.60	0.60	3.00	246	520	94	84	244	48	
	2.4	1424	570.610	0.03	0.60	0.60	3.00	246	498	94	84	243	49	
ØA	40.6	1426	570.610	0.04	0.81	0.81	4.00	246	488	88	85	243	51	
	28.5			0.04	0.83	0.83	4.00	246	490	90	84	243	51	
	20.2			0.05	1.03	1.03	5.00	247	470	94	84	244	50	
	13.5			0.05	1.05	1.05	5.00	247	468	94	84	244	50	
	7.6			0.04	0.84	0.84	4.00	247	455	96	84	243	49	
	2.4			0.03	0.63	0.63	3.00	246	468	96	84	243	49	
		1456	585.682											
														Estimates:
	Page 2	Δ = 60	Δ = 28.846	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.04		0.80			491 (°F)		88 (°F)			%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)

	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	06-08-2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - #3 BS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	488 QTZ -
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg)	29.59	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS KA	STATIC P. (in. H2O)	-1.20	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 063 - P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EDT)	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	0813	586.182	0.06	1.12	1.12	5.00	248	569	71	70	243	60	5 min./pt.
	28.5			0.06	1.12	1.12	5.00	248	542	72	70	243	56	
	20.2			0.06	1.15	1.15	5.00	248	471	76	70	243	53	
	13.5			0.04	0.85	0.85	4.00	247	438	80	70	243	53	
	7.6			0.04	0.83	0.83	4.00	247	465	82	71	244	54	
	2.4	0843	600.845	0.03	0.60	0.60	4.00	247	492	84	72	244	54	
B	40.6	0845	600.845	0.07	1.35	1.35	5.00	245	535	79	73	245	55	
	28.5			0.07	1.35	1.35	5.00	245	521	84	73	245	55	
	20.2			0.07	1.36	1.36	5.00	246	530	85	74	244	54	
	13.5			0.06	1.17	1.17	5.00	246	547	88	75	244	54	
	7.6			0.05	0.95	0.95	5.00	246	547	88	75	245	54	
	2.4	0915	618.180	0.05	0.99	0.99	5.00	246	512	88	75	245	54	
	Page 1	Δ = 60	Δ = 31.998	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			
	Totals	min	dcf	0.054		1.05			513 (°F)		77 (°F)			Estimates:
	Test	Δ = 120	Δ = 67.951	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.06		1.16			515 (°F)		81 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	3.5%	
O2	12.5%	
CO	—	
N2	84%	

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

System Leak Check (60 sec)

2	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.00	0.008	< 0.02
After	7.00	0.006	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	669.1	480.8	128.3
2.	100 mL 0.1 N H2SO4	577.3	496.2	81.1
3.	100 mL 0.1 N H2SO4	583.1	580.7	2.4
4.	100 mL 0.1 N NaOH	542.2	541.6	0.6
5.	100 mL 0.1 N NaOH	530.2	523.8	6.4
6.	~ 200 g Silica Gel	632.5	617.4	15.1
7.				
8.		total =	233.9 g	

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	06-08-2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - #3 BS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	488 QTZ
TEST UNIT	No. 3 Battery Combustion Stack	B.P. (in. Hg)	29.59	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS, KA	STATIC P. (in. H2O)	-1.20	CALIBRATION DATE	09-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-063-P	STACK DIA. (in.)	114	PORT SIZE & TYPE	4" Flanges	PITOT COEF.	0.84

Test Port	Traverse Point (in.)	Time (EDT)	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	0918	618.180	0.09	1.75	1.75	7.00	245	525	85	76	246	54	5 min./pt.
	28.5			0.09	1.75	1.75	7.00	245	501	86	76	246	54	
	20.2			0.08	1.58	1.58	6.50	245	521	89	77	246	54	
	13.5			0.07	1.38	1.38	6.50	246	524	90	78	245	51	
	7.6			0.05	0.99	0.99	6.00	246	525	91	78	245	51	
	2.4	0948	636.257	0.03	0.61	0.61	4.00	247	490	91	79	246	50	
D	40.6	0951	636.257	0.08	1.60	1.60	6.50	247	525	86	80	246	50	
	28.5			0.08	1.60	1.60	6.50	247	532	89	80	246	50	
	20.2			0.08	1.60	1.60	6.50	247	528	92	80	246	49	
	13.5			0.07	1.39	1.39	6.00	245	518	93	81	246	49	
	7.6			0.04	0.79	0.79	5.00	245	505	93	81	246	49	
	2.4	1021	654.133	0.04	0.79	0.79	5.00	245	500	92	81	246	49	
														Estimates:
	Page 2	Δ = 60	Δ = 35.953	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.6
	Totals	min	dcf	0.065		1.28			516 (°F)		84 (°F)			%H2O = 13

Dry Gas Composition

	Run 1	Run 2
CO2	3.5%	3.5%
O2	12.5%	12.5%
CO	—	—
N2	84%	84%

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

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: 05/17/00

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	05/01/00
27	0.190		0.190	0.190	0.190	KA	05/01/00
28	0.190		0.190	0.190	0.190	KA	05/01/00
29	0.190		0.190	0.190	0.190	KA	05/01/00
31	0.190		0.190	0.190	0.190	KA	05-19-99
4	0.219		0.219	0.219	0.219	KA	05/15/00
6	0.219		0.219	0.219	0.219	KA	05/15/00
7	0.219		0.219	0.219	0.219	KA	05/15/00
15	0.219		0.219	0.219	0.219	KA	05/15/00
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	05/01/00
22	0.344		0.344	0.344	0.344	KA	05/01/00
23	0.347		0.347	0.347	0.347	KA	03-10-98
24	0.375		0.375	0.375	0.375	KA	02/18/00
25	0.375		0.375	0.375	0.375	KA	03-12-96
26	0.406		0.406	0.406	0.406	KA	04-19-96
30	0.406		0.406	0.406	0.406	KA	07-20-98
47	0.415		0.415	0.415	0.415	KA	11-25-96
34	0.425		0.425	0.425	0.424	KA	06-10-97
55	0.425		0.425	0.425	0.424	KA	01/05/00
52	0.440		0.440	0.440	0.440	KA	05/01/00

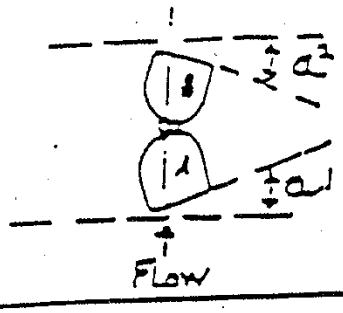
APEX GLASS NOZZLE CALIBRATION DATA SHEET Printed: 05/17/00

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

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

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

①

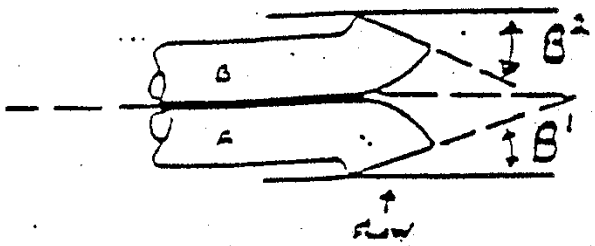


$a^1 =$ 2°
$a^2 =$ 1°
$a^1, a^2 = <10°$

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

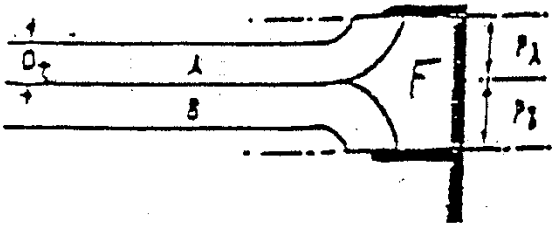
$F =$ 1.000"

②



$\mu =$ 0.017" $\mu = \leq 0.1250"$ ($\gamma_{TAN} \times F$)
$Y =$ 0.017" $Y = \leq 0.03125"$ ($\theta_{TAN} \times F$)
$W =$ 0.480" $W \geq 0"$
$X =$ 0.910" $X \geq 0.750"$ (3/4" using 1/2" scale)

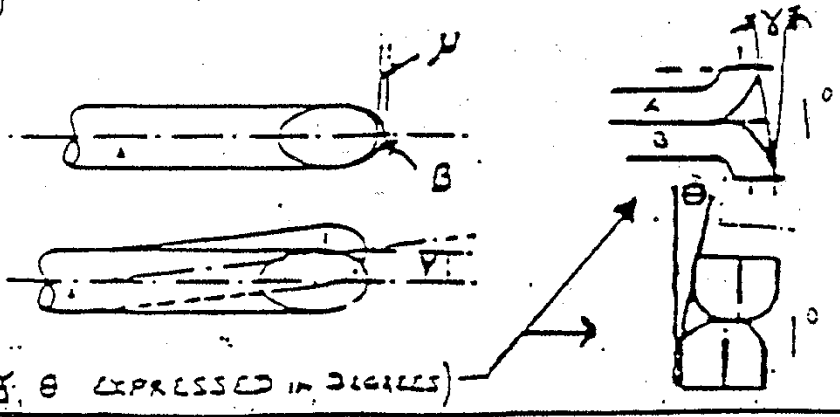
③



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

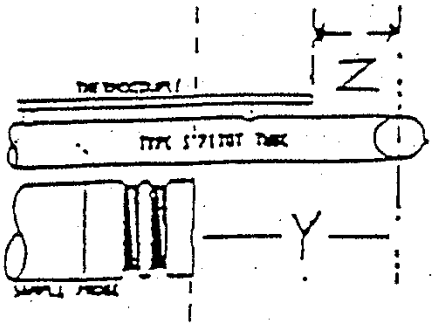
$Y =$ 6.211" $Y \geq 3.0"$
$Z =$ 2.495" $Z > 2.0"$
$D_t =$ 0.376" $D_t > .1875"$

④

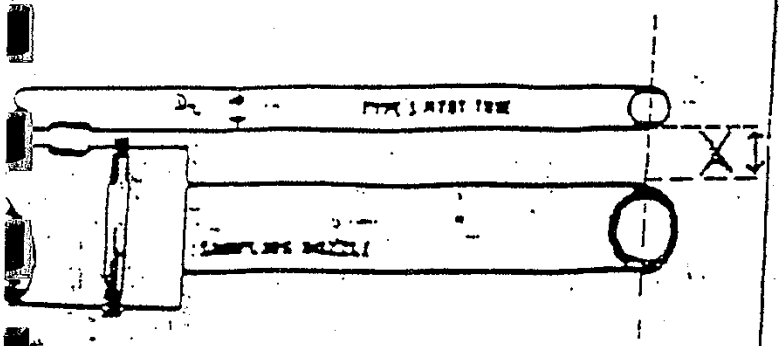


(γ, θ EXPRESSED IN DEGREES)

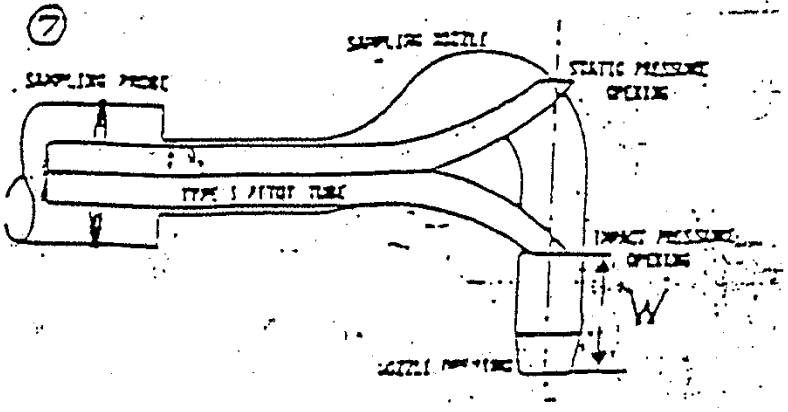
⑥



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-4
CALIBRATION DATE 09-24-99
BAROMETRIC PRESSURE (in. Hg) 29.10

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

RUN NO.		WET TEST METER			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		318.302			1.0	8.0
	MIDWAY			71		88	78		
	STOP	5.000	9:20		323.417				
	DELTA *	5.000	9.33		5.115				
2	START	0.000	0		324.438			2.0	8.0
	MIDWAY			71		92	79		
	STOP	5.000	6:39		329.522				
	DELTA *	5.000	6.65		5.084				
3	START	0.000	0		331.550			3.0	8.0
	MIDWAY			71		95	80		
	STOP	5.000	5:25		336.644				
	DELTA *	5.000	5.42		5.094				
Dry Gas	START	0.050	0		336.713			0.0	1.0
Meter Leak	STOP	0.358	10:00		337.112				
Check	DELTA *	0.308	10.0		0.399				

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

*: Express final elapsed time in decimal format

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

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

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-4
CALIBRATION DATE 06-19-00
BAROMETRIC PRESSURE (in. Hg) 29.29

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		679.438			1.3	8.0
	MIDWAY			73		91	77		
	STOP	5.000	8:06		684.421				
	DELTA *	5.000	8.10		4.983				
2	START	0.000	0		684.421			1.3	8.0
	MIDWAY			73		94	78		
	STOP	5.000	8:06		689.424				
	DELTA *	5.000	8.10		4.997				
3	START	0.000	0		689.424			1.3	8.0
	MIDWAY			73		96	79		
	STOP	5.000	8:05		694.431				
	DELTA *	5.000	8.08		5.007				
Dry Gas Meter Leak Check	START	0.190	0		694.632			0.0	9.0
	STOP	0.330	10:00		694.848				
	DELTA *	0.140	10.0		0.216				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0076 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)	29.29	29.29	29.29	
Time (min)	8.10	8.10	8.08	
Tw (°F)	73	73	73	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	91	94	96	
To (°F)	77	78	79	
ΔH (in. H2O)	1.30	1.30	1.30	
Vm (dcf)	4.983	4.997	5.007	
Y (Pre-test)				1.0023
ΔH@ (in. H2O)	1.953	1.950	1.937	1.947
Y (Post-test)	1.0208	1.0217	1.0224	1.0216
ΔY (%)				1.9%

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

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

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

IH & Environmental Laboratory

UEC
USX Engineers
& Consultants, Inc.

July 7, 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 June 12, 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 - 06/26/2000
PAGE - 1

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. # : 3746 SITE LOCATION : US STEEL CLAIRTON WORKS/#3 BATTERY COM

TRACKING NUMBER: 2433 A

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	
20135	CLR-3BS-M26A-1A	CHLORIDE	06/07/00	*	*	*	06/26/00	56							2.0 mg/L	E
20136	CLR-3BS-M26A-1B	CHLORIDE	06/07/00	*	*	*	06/26/00	9.6							2.0 mg/L	E
20137	CLR-3BS-M26A-1C	CHLORIDE	06/07/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20138	CLR-3BS-M26A-1D	CHLORIDE	06/07/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20139	CLR-3BS-M26A-2A	CHLORIDE	06/07/00	*	*	*	06/26/00	68							2.0 mg/L	E
20140	CLR-3BS-M26A-2B	CHLORIDE	06/07/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20141	CLR-3BS-M26A-2C	CHLORIDE	06/07/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20142	CLR-3BS-M26A-2D	CHLORIDE	06/07/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20143	CLR-3BS-M26A-3A	CHLORIDE	06/08/00	*	*	*	06/26/00	61							2.0 mg/L	E
20144	CLR-3BS-M26A-3B	CHLORIDE	06/08/00	*	*	*	06/26/00	3.3							2.0 mg/L	E
20145	CLR-3BS-M26A-3C	CHLORIDE	06/08/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20146	CLR-3BS-M26A-3D	CHLORIDE	06/08/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E
20147	CLR-H2SO4-BLK	CHLORIDE	06/08/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E

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

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

REPORT OF TEST RESULTS

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. # : 3746 SITE LOCATION : US STEEL CLAIRTON WORKS/#3 BATTERY COM

TRACKING NUMBER: 2433 A

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	
20148	CLR-NAOH-BLK	CHLORIDE	06/08/00	*	*	*	06/26/00	<2.0							2.0 mg/L	E

ANALYST : N. Kadyel Date: 6-26-00

APPROVED: Stephanie A. Guilyard Date: 7/7/00

Stephanie A. Guilyard, IHIT, Project Manager

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

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

IH & Environmental Laboratory

UEC
USX Engineers
& Consultants, Inc.

RECEIVED JUL 1 4 2000

July 7, 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 June 12, 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
AMMONIUM-WATER	EPA 350.2 (MOD)
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 - 06/27/2000
PAGE - 1

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. # : 3746 SITE LOCATION : US STEEL CLAIRTON WORKS/#3 BATTERY COM

TRACKING NUMBER: 2433

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	
20135	CLR-3BS-M26A-1A	AMMONIUM-WATER	06/07/00	*	*	*	06/26/00			< 0.1					0.1	E
20136	CLR-3BS-M26A-1B	AMMONIUM-WATER	06/07/00	*	*	*	06/26/00			< 0.1					0.1	E
20139	CLR-3BS-M26A-2A	AMMONIUM-WATER	06/07/00	*	*	*	06/26/00			0.1					0.1	E
20140	CLR-3BS-M26A-2B	AMMONIUM-WATER	06/07/00	*	*	*	06/26/00			< 0.1					0.1	E
20143	CLR-3BS-M26A-3A	AMMONIUM-WATER	06/08/00	*	*	*	06/26/00			0.3					0.1	E
20144	CLR-3BS-M26A-3B	AMMONIUM-WATER	06/08/00	*	*	*	06/26/00			< 0.1					0.1	E
20147	CLR-H2SO4-BLK	AMMONIUM-WATER	06/08/00	*	*	*	06/26/00			< 0.1					0.1	E
20148	CLR-NAOH-BLK	AMMONIUM-WATER	06/08/00	*	*	*	06/26/00			< 0.1					0.1	E

ANALYST James L. Miller Date: 6-27-2000
APPROVED: Stephanie A. Guilyard Date: 7/7/00
Stephanie A. Guilyard, IHIT, Project Manager

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

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

ATS

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

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

CHAIN OF CUSTODY RECORD

PROJECT NUMBER ϕϕ-ϕ63-P ; P.O. # 3746
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC Ill and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS
No.3 Battery Combustion Stack

ANALYSES TO BE CONDUCTED

Legend:
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 via ion chromatography	Ammonium ion via wet chemistry method							REMARKS OR OBSERVATIONS
	CLR-#3BS-M26A-1A	ϕ6-ϕ7-ϕϕ	ϕ825 →	1	Comp.	✓	✓							ϕ.1N H_2SO_4 - Sample volume = 429.6 mL
	CLR-#3BS-M26A-1B	↓	1225 EDT	1	Comp.	✓	✓							ϕ.1N H_2SO_4 - sample volume = 143.3 mL
*	CLR-#3BS-M26A-1C	↓	↓	1	Comp.	✓							*	ϕ.1N NaOH - sample volume = 131.9 mL
*	CLR-#3BS-M26A-1D	↓	↓	1	Comp.	✓							*	ϕ.1N NaOH - sample volume = 132.6 mL
	CLR-#3BS-M26A-2A	ϕ6-ϕ7-ϕϕ	1248 →	1	Comp.	✓	✓							ϕ.1N H_2SO_4 - Sample volume = 417.ϕ mL
	CLR-#3BS-M26A-2B	↓	1456 EDT	1	Comp.	✓	✓							ϕ.1N H_2SO_4 - sample volume = 129.9 mL
	CLR-#3BS-M26A-2C	↓	↓	1	Comp.	✓							*	ϕ.1N NaOH - sample volume = 116.6 mL
	CLR-#3BS-M26A-2D	↓	↓	1	Comp.	✓							*	ϕ.1N NaOH - sample volume = 123.7 mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME		RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Sunstrom	ϕ6-ϕ9-ϕϕ	1615 EDT		[illegible]	06-09-00	1618	
Judy Drotleff	8:30 AM	6-12-00		Judy Drotleff	6-12-00		CHEST TEMP.
							TAG #

ATS 10/98

*: Please add 25 mg 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 00-063-P ; P.O. # 3746
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB UEC IH and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS
No. 3 Battery Combustion Stack

ANALYSES TO BE CONDUCTED: Chloride ion via ion chromatography; Ammonium ion via wet chemistry method

Legend:
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 via ion chromatography	Ammonium ion via wet chemistry method	REMARKS OR OBSERVATIONS
CLR-#3BS-M26A-3A	06-08-00	0813 →	1	Comp.	✓	✓	0.1N H_2SO_4 - sample volume = 439.5 mL
CLR-#3BS-M26A-3B	↓	1021 EDT	1	Comp	✓	✓	0.1N H_2SO_4 - sample volume = 141.9 mL
* CLR-#3BS-M26A-3C		↓	1	Comp.	✓		* 0.1N NaOH - sample volume = 169.8 mL
* CLR-#3BS-M26A-3D	↓	↓	1	Comp.	✓		* 0.1N NaOH - sample volume = 151.2 mL
CLR-H2SO4-BLK	06-08-00	1400 EDT	1	Grab	✓	✓	0.1N H_2SO_4
* CLR-NAOH-BLK	↓	↓	1	Grab	✓		* 0.1N NaOH

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Shemshock	06-09-00	1615 EDT	[illegible]	06-09-00	1617	
[illegible]	6-12-00	8:20 AM	[illegible]	6-12-00		CHEST TEMP.
						TAG #

ATS 10/98

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
NO. 3 BATTERY COMBUSTION STACK
JUNE 7 AND 8, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#3BS-M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	56	429.6	24.06	94.3
	1B	0.1 N H2SO4 - Impinger 3	9.6	143.3	1.38	
	1C	0.1 N NaOH - Impinger 4	< 2.0	131.9	< 0.26	NA
	1D	0.1 N NaOH - Impinger 5	< 2.0	132.6	< 0.27	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	68	417.0	28.36	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 2.0	129.9	< 0.26	
	2C	0.1 N NaOH - Impinger 4	< 2.0	116.6	< 0.23	NA
	2D	0.1 N NaOH - Impinger 5	< 2.0	123.7	< 0.25	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	61	439.5	26.81	98.3
	3B	0.1 N H2SO4 - Impinger 3	3.3	141.9	0.47	
	3C	0.1 N NaOH - Impinger 4	< 2.0	169.8	< 0.34	NA
	3D	0.1 N NaOH - Impinger 5	< 2.0	151.2	< 0.30	
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. 3 BATTERY COMBUSTION STACK
JUNE 7 AND 8, 2000
U.S. EPA CONDITIONAL TEST METHOD 027 SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#3BS-M26A-)	Sample Type	Ammonium Conc. (mg / L)	Sample Volume (mL)	Ammonium Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	< 0.1	429.6	< 0.04	NA
	1B	0.1 N H2SO4 - Impinger 3	< 0.1	143.3	< 0.01	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	0.1	417.0	0.04	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 0.1	129.9	< 0.01	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	0.3	439.5	0.13	100.0
	3B	0.1 N H2SO4 - Impinger 3	< 0.1	141.9	< 0.01	
Blank	Blank	0.1 N H2SO4	< 0.1			

<u>0.1 N H2SO4</u>

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

For ammonium concentrations less than the analytical detection limit (< 0.1) ---->
Ammonium catch = 0

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 3 BATTERY COMBUSTION STACK

TEST DATE: 6/7/00
TEST NO.: CLR- #3BS-M26A-1

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.65
B.	Process Gas Static Pressure (in. H2O)	-1.20
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	1.0023
»»»	Is the Duct Round (Y/N)?	Y
E.	Duct Diameter (in.) - for round duct	114
F.	Duct Width (in.) - for rectangular duct	0
G.	Duct Depth (in.) - for rectangular duct	0
H.	Nozzle Diameter (in.)	0.440
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.07
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.07
K.	Average ΔH (in. H2O) variation	1.19
L.	Average Process Gas Temperature (°F)	516
M.	Average Dry Gas Meter Temperature (°F)	79
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	4.0
	Oxygen (%)	13.0
	Nitrogen (%)	83.0
	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)	232.6
Q.	Metered Gas Volume (dcf)	68.123

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.56	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.74	[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)	539	[M+460]
X.	Dry Gas Volume Sampled (dscf)	66.478	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	10.967	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.2	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	14.2	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.142		18	2.549
CO2	0.040	0.858	44	1.511
O2	0.130	0.858	32	3.571
N2	0.830	0.858	28	19.949
CO	0.000	0.858	28	0.000
H2	0.000	0.858	2	0.000
CH4	0.000	0.858	16	0.000
C2H6	0.000	0.858	30	0.000
Ar	0.000	0.858	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.58	
DD.	Average Process Gas Velocity (ft/sec)	2.00E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	8.52E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	4.55E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.91E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	95.1	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0104	
JJ.	Front-Half Residue Weight (g)	0.0192	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0296	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0069	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	2.30E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 6/7/00

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

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		26.15	
QQ.	Concentration (mg/dscm)		1.39E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		2.03E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.26	
TT.	Concentration (mg/dscm)	<	1.40E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	2.05E-02	[TT*0.02832*GG*60/454000]

Ammonia Gas Acid (corrected for blank)

VV.	Total Catch (mg)	<	0.04	
WW.	Concentration (mg/dscm)	<	2.16E-02	[VV/(X*0.02832)]
XX.	Mass Flow Rate (lb/hr)	<	3.15E-03	[WW*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 3 BATTERY COMBUSTION STACK

TEST DATE: 6/7/00
TEST NO.: CLR- #3BS-M26A-2

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.65
B.	Process Gas Static Pressure (in. H2O)	-1.20
C.	Pitot Tube Coefficient	0.84
D.	Dry Gas Meter Calibration Factor	1.0023
»»»	Is the Duct Round (Y/N)?	Y
E.	Duct Diameter (in.) - for round duct	114
F.	Duct Width (in.) - for rectangular duct	0
G.	Duct Depth (in.) - for rectangular duct	0
H.	Nozzle Diameter (in.)	0.440
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.04
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.04
K.	Average ΔH (in. H2O)	0.85
L.	Average Process Gas Temperature (°F)	497
M.	Average Dry Gas Meter Temperature (°F)	88
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)	207.9
Q.	Metered Gas Volume (dcf)	58.521

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.56	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.71	[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)	957	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	548	[M+460]
X.	Dry Gas Volume Sampled (dscf)	56.123	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.802	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.9	[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 (%)	14.9	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.149		18	2.676
CO2	0.040	0.851	44	1.498
O2	0.125	0.851	32	3.405
N2	0.835	0.851	28	19.904
CO	0.000	0.851	28	0.000
H2	0.000	0.851	2	0.000
CH4	0.000	0.851	16	0.000
C2H6	0.000	0.851	30	0.000
Ar	0.000	0.851	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.48	
DD.	Average Process Gas Velocity (ft/sec)	1.60E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	6.79E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	3.70E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.15E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	99.6	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0373	
JJ.	Front-Half Residue Weight (g)	0.0109	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0482	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0132	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	3.58E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 6/7/00

TEST SITE: NO. 3 BATTERY COMBUSTION STACK — TEST NO.: CLR- #3BS-M26A-2

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		29.16	
QQ.	Concentration (mg/dscm)		1.83E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		2.16E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.23	
TT.	Concentration (mg/dscm)	<	1.47E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	1.73E-02	[TT*0.02832*GG*60/454000]

Ammonia Gas Acid (corrected for blank)

VV.	Total Catch (mg)		0.04	
WW.	Concentration (mg/dscm)		2.48E-02	[VV/(X*0.02832)]
XX.	Mass Flow Rate (lb/hr)		2.92E-03	[WW*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 3 BATTERY COMBUSTION STACK

TEST DATE: 6/8/00
TEST NO.: CLR- #3BS-M26A-3

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.59	
B.	Process Gas Static Pressure (in. H2O)	-1.20	
C.	Pitot Tube Coefficient	0.84	
D.	Dry Gas Meter Calibration Factor	1.0023	
»»»	Is the Duct Round (Y/N)?	Y	
E.	Duct Diameter (in.) - for round duct	114	
F.	Duct Width (in.) - for rectangular duct	0	
G.	Duct Depth (in.) - for rectangular duct	0	
H.	Nozzle Diameter (in.)	0.440	
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.06	
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.06	
K.	Average ΔH (in. H2O) variation	1.16	
L.	Average Process Gas Temperature (°F)	515	
M.	Average Dry Gas Meter Temperature (°F)	81	
N.	Dry Gas Composition (should total to 100%)		
	Carbon Dioxide (%)	3.5	
	Oxygen (%)	12.5	
	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)	233.9	
Q.	Metered Gas Volume (dcf)	67.951	

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.50	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.68	[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)	975	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	541	[M+460]
X.	Dry Gas Volume Sampled (dscf)	65.927	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	11.028	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.3	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	14.3	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.143		18	2.580
CO2	0.035	0.857	44	1.319
O2	0.125	0.857	32	3.427
N2	0.840	0.857	28	20.149
CO	0.000	0.857	28	0.000
H2	0.000	0.857	2	0.000
CH4	0.000	0.857	16	0.000
C2H6	0.000	0.857	30	0.000
Ar	0.000	0.857	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.48	
DD.	Average Process Gas Velocity (ft/sec)	1.93E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	8.20E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	4.38E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.75E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	98.2	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0054	
JJ.	Front-Half Residue Weight (g)	0.0244	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0298	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0070	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	2.24E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 3 BATTERY COMBUSTION STACK

TEST DATE: 6/8/00
TEST NO.: CLR- #3BS-M26A-3

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		28.05	
QQ.	Concentration (mg/dscm)		1.50E+01	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		2.11E+00	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.34	
TT.	Concentration (mg/dscm)	<	1.82E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	2.56E-02	[TT*0.02832*GG*60/454000]

Ammonia Gas Acid (corrected for blank)

VV.	Total Catch (mg)		0.12	
WW.	Concentration (mg/dscm)		6.67E-02	[VV/(X*0.02832)]
XX.	Mass Flow Rate (lb/hr)		9.37E-03	[WW*0.02832*GG*60/454000]

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ADVANCED TECHNOLOGY SYSTEMS, INC.

ATS Project No. 00-009-P

September 12, 2000

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

RE: LETTER REPORT – HYDROCHLORIC ACID AND CHLORINE GAS EMISISONS TESTING CONDUCTED AT NO. 9 BATTERY COMBUSTION STACK ON FEBRUARY 23 AND 24, 2000

Dear Mr. Graeser:

This letter, with attachments, constitutes the report that summarizes the results of the hydrochloric acid (HCl) and chlorine gas (Cl_2) emissions testing conducted at No. 9 Battery Combustion Stack by Advanced Technology Systems, Inc. (ATS). Three two-hour test runs were conducted on February 23 and 24, 2000 simultaneous with the compliance test program at this stack (particulate matter and visible emissions were measured as part of the compliance test program).

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

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

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