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ADVANCED TECHNOLOGY SYSTEMS, INC.

ATS Project No. 00-092-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. 14 BATTERY COMBUSTION STACK ON JULY 26 AND 27, 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. 14 Battery Combustion Stack by Advanced Technology Systems, Inc. (ATS). Three two-hour test runs were conducted on July 26 and 27, 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 the first and third test runs, the NH_3 collection efficiency of the sample train was calculated to be greater than the minimum collection efficiency specified by the PA DEP (i.e., the ammonium catch of the Sample Fraction B was at most 10 percent of the ammonium catch from Sample Fraction A plus Sample Fraction B). For the second test run, 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

JPS/blc
Enclosure

U.S. STEEL CLAIRTON WORKS
CLAIRTON, PENNSYLVANIA

TABLE 1

NO. 14 BATTERY COMBUSTION STACK
HYDROCHLORIC ACID, CHLORINE GAS AND AMMONIA GAS EMISSIONS DATA
JULY 26 AND 27, 2000

		Run 1	Run 2	Run 3	Average
Test Date		7/26/00	7/27/00	7/27/00	
Emissions Data					
Hydrochloric Acid (HCl)					
Concentration	(mg/dscm)	6.40E+00	6.63E+00	7.62E+00	6.88E+00
Mass Emission Rate	(lb/hr)	7.80E-01	8.09E-01	9.11E-01	8.33E-01
Chlorine Gas (Cl_2)					
Concentration	(mg/dscm)	< 1.85E-01	< 1.67E-01	< 1.58E-01	< 1.70E-01
Mass Emission Rate	(lb/hr)	< 2.25E-02	< 2.04E-02	< 1.89E-02	< 2.06E-02
Ammonia Gas (NH_3)					
Concentration	(mg/dscm)	1.75E+00	7.61E-02	5.01E-01	7.76E-01
Mass Emission Rate	(lb/hr)	2.13E-01	9.29E-03	5.99E-02	9.41E-02
Exhaust Stack Conditions					
Volumetric Flow Rate	(acfm)	6.73E+04	6.88E+04	6.61E+04	6.74E+04
	(scfm)	3.81E+04	3.86E+04	3.78E+04	3.82E+04
	(dscfm)	3.25E+04	3.26E+04	3.20E+04	3.24E+04
Temperature	(°F)	460	465	449	458
Moisture Content	(%)	14.7	15.6	15.5	15.3
Sampling Conditions					
Test Times	(EDT)	0715 to 0923	0726 to 0930	0956 to 1204	
Sampling Time - PM *	(minutes)	120	120	120	
Sample Volume - PM **	(dscf)	51.934	53.012	52.845	
Isokinetic Variation - PM ***	(%)	98.9	100.8	102.4	

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

U.S. STEEL CLAIRTON WORKS
CLAIRTON, PENNSYLVANIA

Hydrochloric Acid, Chlorine Gas and Ammonia Gas Emissions Testing Conducted at No. 14 Battery Combustion Stack on July 26 and 27, 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	07-26-2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	3
PLANT SITE	Clairton, PA	TEST NO.	CLR-#14BS-M26A-1	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	484 QTZ
TEST UNIT	No. 14 Battery Combustion Stack	B.P. (in. Hg)	29.63	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS, DN, KA	STATIC P. (in. H2O)	-1.2	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-092-P	STACK DIA. (in.)	120	PORT SIZE & TYPE	4" Nipples	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	42.7	0715	456.901	0.04	0.76	0.76	4.4	250	515	069	069	250	071	5 min./pt.
	5 30.0	0720	459.3	0.03	0.57	0.57	4.0	265	510	073	069	250	054	
	10 21.3	0725	461.3	0.03	0.57	0.57	4.0	264	516	075	069	251	054	
	15 14.2	0730	463.4	0.03	0.57	0.57	4.0	266	522	077	070	252	057	
	20 8.0	0735	465.4	0.03	0.57	0.57	4.0	268	524	079	071	251	058	
	25 2.6	0740	467.3	0.03	0.57	0.57	4.0	268	458	080	071	253	058	
	30	0745 →	469.420	0.04										
B	42.7	0747	469.420	0.04	0.76	0.76	4.5	264	465	077	072	250	060	
	5 30.0	0752	471.8	0.03	0.59	0.59	3.8	262	499	080	072	262	057	
	10 21.3	0757	473.7	0.03	0.59	0.59	3.9	261	503	081	073	259	057	
	15 14.2	0802	475.9	0.03	0.59	0.59	3.9	260	508	082	073	253	057	
	20 8.0	0807	478.0	0.02	0.39	0.39	3.0	264	461	082	074	256	059	
	25 2.6	0812	479.9	0.01	0.20	0.20	2.0	265	259	081	074	263	065	
	Page 1	Δ = 12	dcf 481.090	(ΔP) avg =	(ΔH) avg =				(Tstack) avg = 78		(Tmeter) avg = 72			
	Totals	min 60	dcf 24.189	0.03		0.56	4.5	OK	478 (°F)		75 (°F)	OK		Estimates:
	Test	Δ = 120	Δ = 29.132	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.5
	Totals	min	dcf 53.321	0.035		0.69			460 (°F)		79 (°F)			%H2O = 14.7 14

Dry Gas Composition

	Run 1	Run 2
CO2	5.0	
O2	10.0	
CO	—	
N2	85.0	

18.95
19.12
19.5

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.0	< 0.02	< 0.02
After	7.0	0.01	< 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	575.3	459.7	115.6
2.	100 mL 0.1 N H2SO4	630.7	571.9	58.8
3.	100 mL 0.1 N H2SO4	562.9	562.8	0.1
4.	100 mL 0.1 N NaOH	548.9	547.5	1.4
5.	100 mL 0.1 N NaOH	506.5	503.1	3.4
6.	~200 g Silica Gel	646.3	636.0	10.3
7.				
8.		Total =		189.6

vel = 14.3 ft/s
ACFM = 67304
DSCFM = 32538
= $F_p C \sqrt{\Delta p}$
ISO = 99%

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	07-26-2000	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	3
PLANT SITE	Clairton, PA	TEST NO.	CLR - #~~13~~ 14 BS - M26A - 1	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	484-QTZ
TEST UNIT	No. ~~13~~ 14 Battery Combustion Stack	B.P. (in. Hg)	29.63	METER CORR. (Y)	1.0023	PROBE NO.	7-1
TEST CREW	JS, KA, DN	STATIC P. (in. H2O)	-1.7	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-~~085~~ 092-P	STACK DIA. (in.)	120	PORT SIZE & TYPE	4" Nipples	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	42.7	0820	481.090	0.05	0.98	0.98	5.5	260	458	080	075	267	060	5 min./pt.
	5 30.0	0825	483.9	0.05	0.98	0.98	5.6	260	518	085	075	269	056	
	10 21.3	0830	486.6	0.05	0.98	0.98	5.7	262	525	087	076	269	058	
	15 14.2	0835	489.0	0.03	0.60	0.60	4.2	265	530	087	077	270	061	
	20 8.0	0840	491.3	0.03	0.60	0.60	4.2	262	509	088	077	269	061	
	25 2.6	0845	493.7	0.02	0.40	0.40	3.2	261	271	088	078	270	062	
														Heater in Probe
D	30 42.7	0853	495.160	0.06	1.20	1.20	6.4	200	462	085	079	250	059	failed at
	35 30.0	0858	498.0	0.06	1.20	1.20	6.3	150	504	089	079	266	055	port change
	40 21.3	0903	500.8	0.05	1.0	1.0	6.0	130	510	090	080	268	058	
	45 14.2	0908	503.6	0.04	0.8	0.8	5.0	123	513	090	080	269	046	
	50 8.0	0913	506.5	0.04	0.78	0.78	5.0	120	310	091	081	268	060	
	55 2.6	0918	508.6	0.02	0.4	0.4	3.0	120	183	090	081	269	061	
	60	0923	510.222							87.5	78.2			
														Estimates:
	Page 2	Δ = 60	Δ = 29.132	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.5
	Totals	min	dcf	0.04		0.83			441 (°F)		82.8 (°F)			%H2O = 14

Dry Gas Composition

	Run 1	Run 2
CO2		
O2		
CO		
N2		

19.6
20.1
19.8

System Leak Check (60 sec)

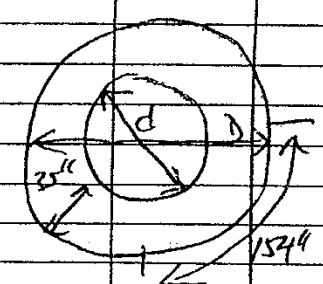
	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before			< 0.02
After			< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before		
After		

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

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.				



$\frac{\pi D}{4} = 154''$ $D = 196''$ $d = 196'' - 2(35'') = 126''$

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	07/27/00	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	4
PLANT SITE	Clairton, PA	TEST NO.	CLR - #14BS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	495 Qtz
TEST UNIT	No. 4 Battery Combustion Stack	B.P. (in. Hg)	29.54	METER CORR. (Y)	1.0023	PROBE NO.	7-3
TEST CREW	JS, DN, KA	STATIC P. (in. H2O)	-1.2	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-082-P	STACK DIA. (in.)	120	PORT SIZE & TYPE	4" Nipples	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
KD	0 42.7	0726	511.586	0.05	0.96	0.96	4.5	250	515	070	070	250	067	5 min./pt.
	5 30.0	0731	514.300	0.06	1.16	1.2	5.5	264	526	074	070	251	061	
	10 21.3	0736	517.2	0.05	0.96	0.96	5.0	273	531	077	071	254	062	
	15 14.2	0741	519.7	0.04	0.77	0.77	4.5	266	533	079	071	252	065	
	20 8.0	0746	522.1	0.04	0.77	0.77	4.5	269	375	081	072	251	065	
	25 2.6	0751	524.4	0.01	0.19	0.19	20.	264	183	080	073	252	067	
KC	30 42.7	0759	526.1	0.06	1.17	1.2	5.7	259	493	079	073	253	063	
	35 30.0	0804	528.8	0.06	1.17	1.2	5.8	268	513	082	073	253	058	
	40 21.3	0809	531.4	0.04	0.78	0.78	4.8	270	517	084	074	251	058	
	45 14.2	0814	533.8	0.06	1.17	1.2	6.0	271	520	085	075	257	058	
	50 8.0	0819	536.4	0.04	0.78	0.78	4.9	269	477	086	075	262	057	
	55 2.6	0824	539.1	0.01	0.20	0.20	2.5	271	246	084	076	266	061	
	Page 1	Δ = 60	dcf =	(ΔP) avg =	(ΔH) avg =				(Tstack) avg = 80.08	(Tmeter) avg = 72.5				
	Totals	min 60	dcf = 28.724	0.041		0.851			452.4 (°F)	76.3 (°F)				Estimates:
	Test	Δ = 120	Δ = 25.962	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =	(Tmeter) avg =				MW = 27.5
	Totals	min 120	dcf 54.686	0.036		0.75			464.6 (°F)	79.9 (°F)				%H2O = 14

Dry Gas Composition

	Run 1	Run 2
CO2	3.5	
O2	13.5	
CO	—	
N2	83.0	

19.29 ✓
19.5

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.0	20.02	< 0.02
After			< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
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	07/27/00	CONTROL BOX NO.	APEX- 4	HOT/COLD BOX NO.	4
PLANT SITE	Clairton, PA	TEST NO.	CLR - #14BS - M26A - 2	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	495 QTZ
TEST UNIT	No. 14 Battery Combustion Stack	B.P. (in. Hg)	29.54	METER CORR. (Y)	1.0023	PROBE NO.	7- 3
TEST CREW	JS, DN, KA	STATIC P. (in. H2O)	-1.2	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 092 - P	STACK DIA. (in.)	120	PORT SIZE & TYPE	4" Nipples	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~~B	42.7	0836	540.310	0.04	0.78	0.78	4.7	265	482	081	077	260	060	5 min./pt.
	30.0	0841	542.8	0.04	0.78	0.78	4.7	268	534	085	077	267	055	
	21.3	0846	545.2	0.05	1.02	1.0	6.0	268	541	087	077	267	056	
	14.2	0851	547.7	0.04	0.78	0.78	5.0	267	536	088	078	270	058	
	8.0	0856	550.2	0.02	0.40	0.40	3.5	267	460	088	078	268	062	
	2.6	0901	551.9	0.02	0.40	0.40	3.5	266	327	087	079	265	062	
~~B~~A	42.7	0905	553.7	0.04	0.80	0.80	5.2	262	472	085	079	260	060	
	30.0	0910	556.2	0.04	0.80	0.80	5.2	267	516	089	080	269	058	
	21.3	0915	558.7	0.03	0.60	0.60	4.5	269	520	090	080	269	057	
	14.2	0920	560.9	0.03	0.60	0.60	4.3	267	506	091	081	266	057	
	8.0	0925	563.1	0.02	0.40	0.40	3.5	267	488	091	081	267	060	
	2.6	0930	564.6	0.02	0.40	0.40	3.5	267	340	091	082	266	062	
			566.272							87.75	79.08			
														Estimates:
	Page 2	Δ= 60	Δ= 25.962	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.5
	Totals	min	dcf	0.032		0.645			476.8 (°F)		83.4 (°F)			%H2O = 14

Dry Gas Composition

	Run 1	Run 2
CO2		
O2	19.4	
CO	20.3	
N2		

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before			< 0.02
After	6.0	0.004	< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before		
After	OK	OK

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	610.3	490.2	120.1
2.	100 mL 0.1 N H2SO4	550.9	484.6	66.3
3.	100 mL 0.1 N H2SO4	531.4	524.5	6.9
4.	100 mL 0.1 N NaOH	546.3	545.1	1.2
5.	100 mL 0.1 N NaOH	541.2	539.7	1.5
6.	~ 200 g Silica Gel	680.0	667.7	12.3
7.				
8.			total	208.39 g

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	07/27/00	CONTROL BOX NO.	APEX-4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - #14BS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	496 QTZ
TEST UNIT	No. 14 Battery Combustion Stack	B.P. (in. Hg)	29.54	METER CORR. (Y)	1.0023	PROBE NO.	7-13
TEST CREW	JS, KA, DN	STATIC P. (in. H2O)	-1.2	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00-092-P	STACK DIA. (in.)	120	PORT SIZE & TYPE	4" Nipples	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	42.7	0956	566.523	0.04	0.81	0.81	4.2	250	486	082	081	250	081	5 min./pt.
	30.0	1001	569.4	0.04	0.81	0.81	4.4	250	508	086	081	250	072	
	21.3	1006	572.0	0.03	0.61	0.61	4.0	269	512	089	081	252	071	
	14.2	1011	574.3	0.03	0.61	0.61	4.1	266	515	090	081	252	071	
	8.0	1016	576.3	0.02	0.41	0.41	3.0	266	492	090	082	253	073	
	2.6	1021	577.9	0.01	0.20	0.20	2.5	264	231	090	082	256	072	
														Sunny
B	42.7	1029	579.162	0.05	1.02	1.0	6.0	265	470	089	083	253	070	
	30.0	1034	582.0	0.04	0.81	0.81	5.2	265	529	092	083	254	066	
	21.3	1039	584.6	0.04	0.81	0.81	5.2	268	536	093	083	247	067	
	14.2	1044	587.0	0.05	1.02	1.0	6.2	268	541	093	084	249	069	
	8.0	1049	590.0	0.02	0.41	0.41	3.5	264	454	093	084	250	072	
	2.6	1054	591.8	0.02	0.41	0.41	3.5	266	276	092	084	250	073	
	Page 1	Δ = 60	Δ = 593.383	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =	87.9	(Tmeter) avg = 82.4			
	Totals	min	dcf 26.860	0.031		0.658			(°F)	462.5	(°F)	86.2		Estimates:
	Test	Δ = 120	Δ = 55.326	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.5
	Totals	min	dcf	0.034		0.72			449 (°F)		88 (°F)			%H2O = 14

566.523

0.004

Dry Gas Composition

	Run 1	Run 2
CO2	5.0	
O2	10.0	
CO	—	
N2	85.0	

20.3

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before	5.0	0.004	< 0.02
After			< 0.02

Pitot Leak Check (15 sec)

	Positive	Negative
Before	OK	OK
After		

No.	Impinger Contents	Final	Initial	Δ (g)
1.	50 mL 0.1 N H2SO4	617.7	506.5	111.2
2.	100 mL 0.1 N H2SO4	624.9	551.4	73.5
3.	100 mL 0.1 N H2SO4	571.3	564.6	6.7
4.	100 mL 0.1 N NaOH	533.2	532.5	0.7
5.	100 mL 0.1 N NaOH	567.7	566.2	1.5
6.	~ 200 g Silica Gel	696.1	684.7	11.4
7.				
8.			total =	205.0 g

HIGH FLOW SOURCE SAMPLING DATA SHEET

CLIENT	U.S. Steel Clairton Works	TEST DATE	07/27/00	CONTROL BOX NO.	APEX- 4	HOT/COLD BOX NO.	5
PLANT SITE	Clairton, PA	TEST NO.	CLR - #4BS - M26A - 3	ORIFICE FACTOR (ΔH@)	2.003	FILTER NO.	496 QTZ
TEST UNIT	No. 14 Battery Combustion Stack	B.P. (in. Hg)	29.54	METER CORR. (Y)	1.0023	PROBE NO.	7- 3
TEST CREW	JS, KA, DN.	STATIC P. (in. H2O)	-1.2	CALIBRATION DATE	9-20-99	NOZZLE DIA. (in.)	0.440
PROJECT NO.	00 - 082 - P	STACK DIA. (in.)	120	PORT SIZE & TYPE	4" Nipples	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	42.7	1101	593.383	0.04	0.81	0.81	4.4	260	466	089	084	250	072	5 min./pt.
	30.0	1106	596.0	0.06	1.22	1.2	6.2	268	516	093	084	251	066	
	21.3	1111	598.2	0.05	1.03	1.0	6.0	266	520	094	084	254	066	
	14.2	1116	601.7	0.04	0.81	0.81	5.2	265	519	095	085	244	069	
	8.0	1121	604.1	0.02	0.41	0.41	3.2	266	464	094	085	246	072	
	2.6	1126	605.9	0.01	0.21	0.21	2.5	263	225	094	085	238	074	
D	42.7	1134	607.1	0.05	1.03	1.0B	5.5	259	482	092	086	240	070	
	30.0	1139	610.1	0.06	1.23	1.2	6.4	266	537	096	086	240	063	
	21.3	1144	612.7	0.04	0.81	0.81	5.0	269	541	097	087	246	065	
	14.2	1149	615.3	0.04	0.81	0.81	5.0	266	501	097	087	252	066	
	8.0	1154	618.0	0.03	0.61	0.61	4.1	266	355	097	088	248	069	
	2.6	1159	620.1	0.02	0.41	0.41	3.2	256	209	097	088	251	074	
		1204	621.849											
														Estimates:
	Page 2	Δ = 60	Δ = 28.466	(ΔP) avg =	(ΔH) avg =				(Tstack) avg =		(Tmeter) avg =			MW = 27.5
	Totals	min	dcf	0.037		0.77			445 (°F)		89 (°F)			%H2O = 14

Dry Gas Composition

	Run 1	Run 2
CO2	5	
O2	10	
CO		
N2		

20.65

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

System Leak Check (60 sec)

	Vacuum (in. Hg)	DGM Rate (cfm)	Required (cfm)
Before		OK	< 0.02
After	6.5	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			
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

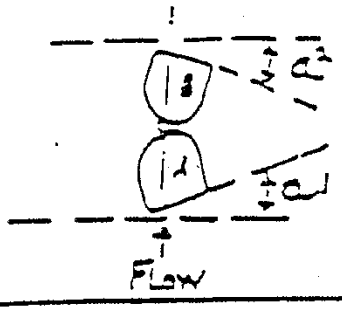
Printed: 05/17/00

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

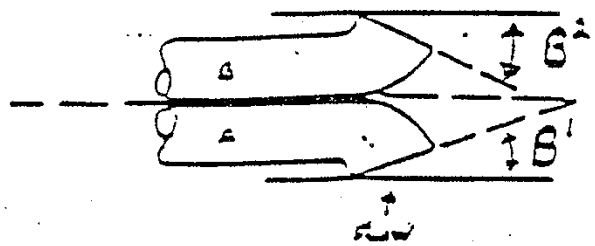
Probe #: M-1
Date: 01-10-'00
Initials: KBA

①



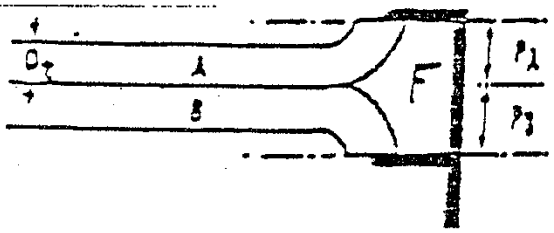
$\alpha^1 = 2^\circ$
$\alpha^2 = 1^\circ$ — $\alpha^1, \alpha^2 = <10^\circ$
$\beta^1 = 1^\circ$
$\beta^2 = 1^\circ$ — $\beta^1, \beta^2 = <5^\circ$
$F = 1.000''$

②



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

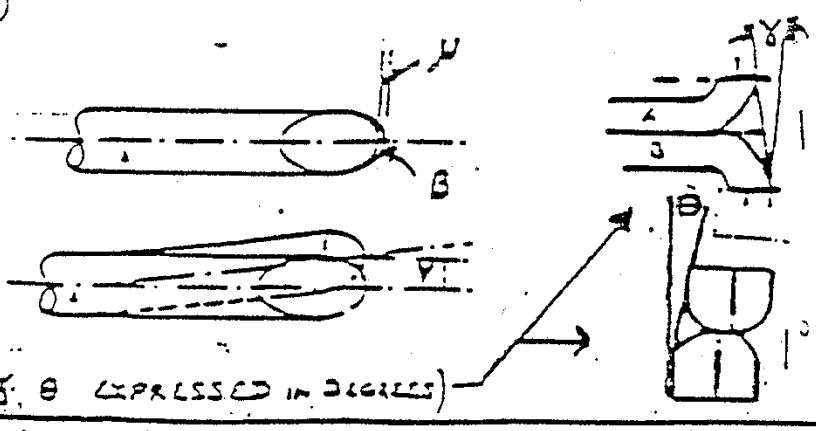
③



$1.05\ D_t < d < 1.50\ D_t$
$P_1 = P_3$
$2.10\ D_t < d < 3.00\ D_t$

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

④



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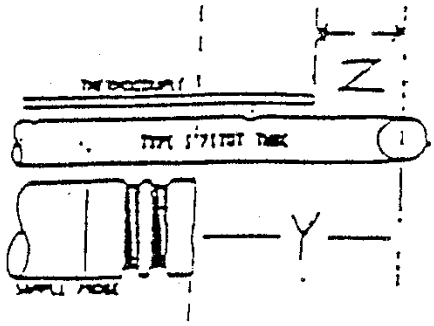

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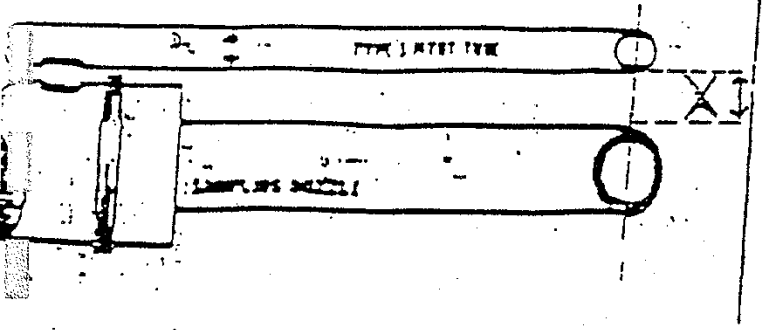

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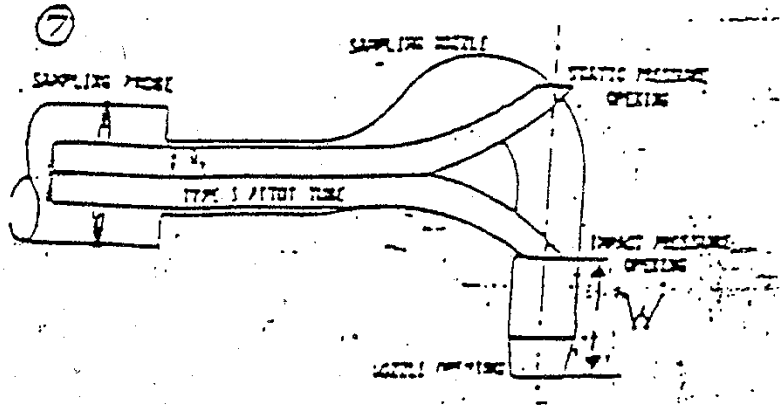
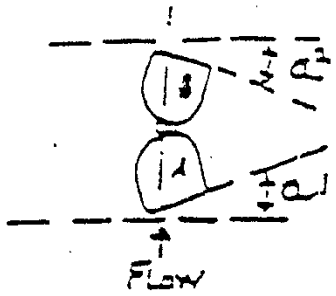


GEOMETRIC PITOT CALIBRATION

Caliper # XFS-59
Proofed: ✓
Post Check:

Probe #: 7-3
Date: 6-10-00
Initials: KBA

①

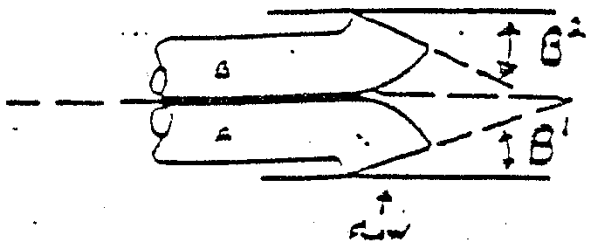


α^1 = 3°
α^2 = 3°
α^1, α^2 = <10°

β^1 = 2°
β^2 = 4°
β^1, β^2 = <5°

F = 0.945"

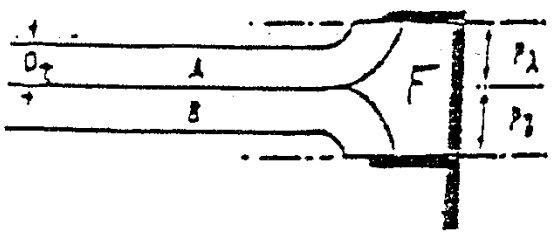
②



μ = 0.024" — μ = ≤ 0.1250" (γ TAN x F)
V = 0.016" — V = ≤ 0.03125" (θ TAN x F)
W = 0.487" — W ≥ 0"

X = 0.923" — X ≥ 0.750" (3/4" using 1.0" nozzle)

③



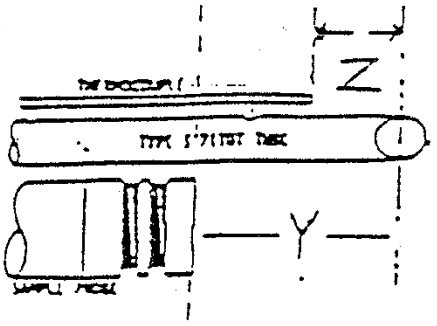
1.05 D_t < d < 1.50 D_t
$P_A = P_B$
2.10 D_t < d < 3.00 D_t

Y = 6.013" — Y ≥ 3.0"

Z = 2.499" — Z > 2.0"

D_t = 0.376" — D_t > .1875"

④



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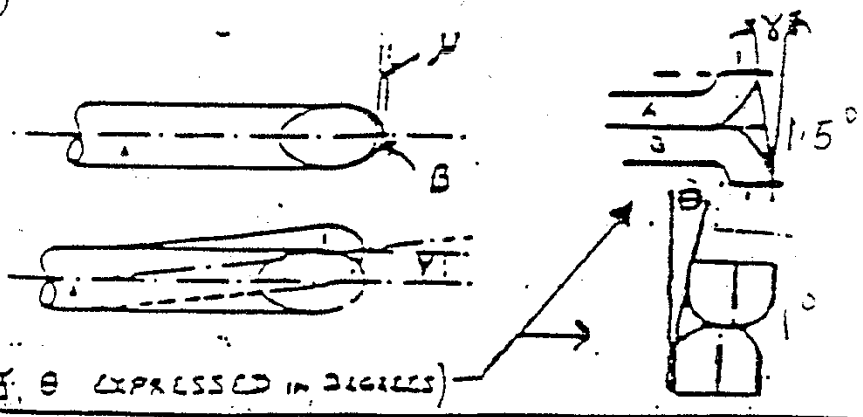
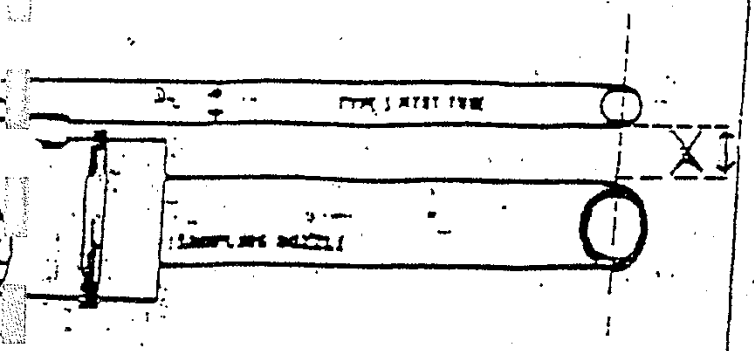


γ, θ EXPRESSED IN DEGREES

⑤



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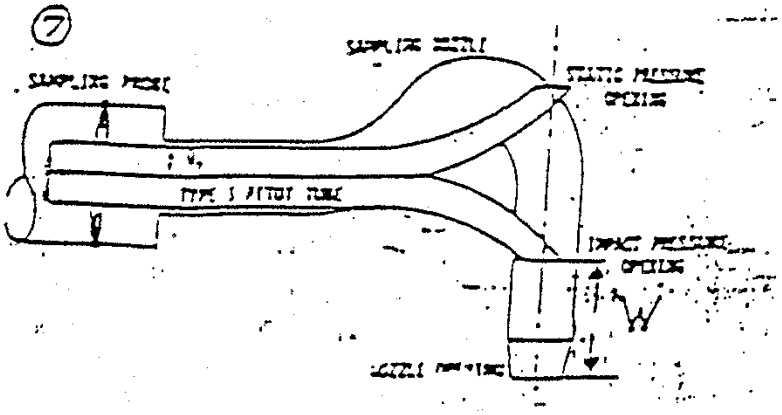

CERTIFICATE OF CALIBRATION

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

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

2-8-96
Date

Mark Poe
Signature

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-4
CALIBRATION DATE 09-20-99
BAROMETRIC PRESSURE (in. Hg) 29.10

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

RUN NO.		WET TEST METER Gas Volume Vw (cf)	Elapsed Time (min.)	Meter Temp. Tw (°F)	DRY GAS METER Gas Volume Vd (dcf)	Inlet Temp. Ti (°F)	Outlet Temp. To (°F)	Orifice Diff. Pres. ΔH (in. H2O)	Vacuum (in. H2O)
1	START	0.000	0		318.302			1.0	8.0
	MIDWAY			71		88	78		
	STOP	5.000	9:20		323.417				
	DELTA *	5.000	9.33		5.115				
2	START	0.000	0		324.438			2.0	8.0
	MIDWAY			71		92	79		
	STOP	5.000	6:39		329.522				
	DELTA *	5.000	6.65		5.084				
3	START	0.000	0		331.550			3.0	8.0
	MIDWAY			71		95	80		
	STOP	5.000	5:25		336.644				
	DELTA *	5.000	5.42		5.094				
Dry Gas Meter Leak Check	START	0.050	0		336.713			0.0	1.0
	STOP	0.358	10:00		337.112				
	DELTA *	0.308	10.0		0.399				

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

*: Express final elapsed time in decimal format

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

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

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

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

DRY GAS METER CALIBRATION DATA SHEET

CONTROL BOX NO. Apex-4
CALIBRATION DATE 08-08-00
BAROMETRIC PRESSURE (in. Hg) 29.14

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		819.170			1.0	8.0
	MIDWAY			77		99	84		
	STOP	5.000	9:07		824.101				
	DELTA *	5.000	9.12		4.931				
2	START	0.000	0		824.101			1.0	8.0
	MIDWAY			77		100	85		
	STOP	5.000	9:07		829.098				
	DELTA *	5.000	9.12		4.997				
3	START	0.000	0		829.098			1.0	8.0
	MIDWAY			77		101	86		
	STOP	5.000	9:07		834.128				
	DELTA *	5.000	9.12		5.030				
Dry Gas Meter Leak Check	START	0.180	0		834.320			0.0	8.0
	STOP	0.354	10:00		834.556				
	DELTA *	0.174	10.0		0.236				

{DELTA Vw (cf) - DELTA Vd (dcf)} / 10 (min.) = 0.0062 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)	29.14	29.14	29.14	
Time (min)	9.12	9.12	9.12	
Tw (°F)	77	77	77	
Vw (cf)	5.000	5.000	5.000	
Ti (°F)	99	100	101	
To (°F)	84	85	86	
ΔH (in. H2O)	1.00	1.00	1.00	
Vm (dcf)	4.931	4.997	5.030	
Y (Pre-test)				1.0023
ΔH@ (in. H2O)	1.919	1.915	1.912	1.915
Y (Post-test)	1.0388	1.0269	1.0220	1.0292
ΔY (%)				2.7%

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

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

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

RECEIVED AUG 1 6 2000

UEC
USX Engineers
& Consultants, Inc.

August 10, 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 July 28, 2000. Should you have any questions regarding this report, please contact us. An invoice will be issued shortly.

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

The results were derived with the following methods.

ANALYTE	METHOD
CHLORIDE	EPA 26A

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

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

Sincerely,

Stephanie A. Guilyard

Stephanie A. Guilyard, CHIT, 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 - 08/07/2000
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. # : 3796 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 3209 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	
26822	CLR-14BS-M26A-1A	CHLORIDE	07/26/00	*	*	*	08/04/00	23							2.0 mg/L	E
26823	CLR-14BS-M26-1B	CHLORIDE	07/26/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E
26824	CLR-14BS-M26A-1C	CHLORIDE	07/26/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E
26825	CLR-14BS-M26A-1D	CHLORIDE	07/26/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E
26826	CLR-14BS-M26A-2A	CHLORIDE	07/27/00	*	*	*	08/04/00	24							2.0 mg/L	E
26827	CLR-14BS-M26-2B	CHLORIDE	07/27/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E
26828	CLR-14BS-M26A-2C	CHLORIDE	07/27/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E
26829	CLR-14BS-M26A-2D	CHLORIDE	07/27/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E
26830	CLR-14BS-M26A-3A	CHLORIDE	07/27/00	*	*	*	08/04/00	27							2.0 mg/L	E
26831	CLR-14BS-M26A-3B	CHLORIDE	07/27/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E
26832	CLR-14BS-M26A-3C	CHLORIDE	07/27/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E
26833	CLR-14BS-M26A-3D	CHLORIDE	07/27/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E
26834	CLR-H2SO4-BLK	CHLORIDE	07/28/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

NOTES: * = Information not supplied by client. < = less than. A - FILTER OR SINGLE STAGE MONITOR C - TUBE OR 2 STAGE MONITOR E - LIQUIDS OR SOLIDS J - FILTER + TUBE
= Information not requested by client. N/A = Not Applicable. B - TUBE D - BULK MATERIALS OR WIPES I - FILTER + TUBE
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 - 08/07/2000

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. # : 3796 SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 3209 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	
26835	CLR-NAOH-BLK	CHLORIDE	07/28/00	*	*	*	08/04/00	<2.0							2.0 mg/L	E

COMMENTS: SAMPLES ARE BLANK CORRECTED.

ANALYST : N. Kotyel Date: 8-7-00

APPROVED: Stephanie A. Guilyard Date: 8/11/00
Stephanie A. Guilyard, IHIT, Project Manager

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

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

UEC
USX Engineers
& Consultants, Inc.

August 10, 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 July 28, 2000. Should you have any questions regarding this report, please contact us. An invoice will be issued shortly.

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

The results were derived with the following methods.

ANALYTE	METHOD
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

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 - 08/08/2000
PAGE - 1

Customer:

Advanced Technology Systems, Inc.
639 Alpha Drive
RIDC Park

Harmarville, PA 15238

CD-002D

ATTENTION: Mr. John Shimshock

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

CUSTOMER P.O. # : 3796
SITE LOCATION : US STEEL CLAIRTON WORKS

TRACKING NUMBER: 3209

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	
26822	CLR-14BS-M26A-1A	AMMONIUM-WATER	07/26/00	*	*	*	08/07/00			6.7					0.1	E
26823	CLR-14BS-M26-1B	AMMONIUM-WATER	07/26/00	*	*	*	08/07/00			0.4					0.1	E
26826	CLR-14BS-M26A-2A	AMMONIUM-WATER	07/27/00	*	*	*	08/07/00			0.3					0.1	E
26827	CLR-14BS-M26-2B	AMMONIUM-WATER	07/27/00	*	*	*	08/07/00			< 0.1					0.1	E
26830	CLR-14BS-M26A-3A	AMMONIUM-WATER	07/27/00	*	*	*	08/07/00			1.9					0.1	E
26831	CLR-14BS-M26A-3B	AMMONIUM-WATER	07/27/00	*	*	*	08/07/00			0.1					0.1	E
26834	CLR-H2SO4-BLK	AMMONIUM-WATER	07/28/00	*	*	*	08/07/00			< 0.1					0.1	E

ANALYST James L. Miller Date: 8-8-2000
APPROVED Stephanie A Guilyard Date: 8/11/00
Stephanie A. Guilyard, IHIT, Project Manager

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= 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 00-092-P; P.O. #3796
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB ATS Air and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS
No. 14 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-#14BS-M26A-1A	07-26-00	0715 →	1	Comp.	✓	✓						0.1 N H_2SO_4 - Sample volume = 398.2 mL
	CLR-#14BS-M26A-1B	↓	0923 EDT	1	Comp.	✓	✓						0.1 N H_2SO_4 - Sample volume = 125.8 mL
*	CLR-#14BS-M26A-1C	↓	↓	1	Comp.	✓						*	0.1 N NaOH - Sample volume = 135.7 mL
*	CLR-#14BS-M26A-1D	↓	↓	1	Comp.	✓						*	0.1 N NaOH - Sample volume = 141.3 mL
	CLR-#14BS-M26A-2A	07-26-00	0726 →	1	Comp.	✓	✓						0.1 N H_2SO_4 - Sample volume = 443.3 mL
	CLR-#14BS-M26A-2B	↓	0930 EDT	1	Comp.	✓	✓						0.1 N H_2SO_4 - Sample volume = 139.7 mL
*	CLR-#14BS-M26A-2C	↓	↓	1	Comp.	✓						*	0.1 N NaOH - Sample volume = 125.7 mL
*	CLR-#14BS-M26A-2D	↓	↓	1	Comp.	✓						*	0.1 N NaOH - Sample volume = 137.0 mL

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Shenkwalter	07-28-00	1000 EDT	Kelly Gi	07-28-00	1001	
[illegible]	7-28-00	8:00 p.m	[illegible]	7-28-00	5:25 pm	CHEST TEMP.
			James J. Miller	8-4-2000	1430	
						TAG #

ATS 10/98

ATS

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

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

CHAIN OF CUSTODY RECORD

PROJECT NUMBER ϕϕ-492-P ; P.O. # 3796
PROJECT NAME U.S. Steel Clairton Works
ANALYTICAL LAB VEC IH and Environmental Laboratories
DELIVER TO Sample Receiving
COMMENTS
No. 14 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			Ammonia ion via wet chemistry method						REMARKS OR OBSERVATIONS
	CLR-#14BS-M26A-3A	ϕ7-27-ϕϕ	ϕ956 →	1	Comp.	✓			✓						ϕ.1 N H_2SO_4 - sample volume = 411ϕ.6 ml
	CLR-#14BS-M26A-3B	↓	12ϕ4 EDT	1	Comp.	✓			✓						ϕ.1 N H_2SO_4 - sample volume = 136.2 ml
*	CLR-#14BS-M26A-3C		↓	1	Comp.	✓								*	ϕ.1 N NaOH - sample volume = 117.9 ml
*	CLR-#14BS-M26A-3D	↓	↓	1	Comp.	✓								*	ϕ.1 N NaOH - sample volume = 114.ϕ ml
	CLR-H2SO4-BLK	ϕ7-28-ϕϕ	ϕ9ϕϕ EDT	1	Grab	✓			✓						ϕ.1 N H_2SO_4
	CLR-NaOH-BLK	↓	↓	1	Grab	✓								*	ϕ.1 N NaOH

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	ICE CHEST #
John P. Shandrick	ϕ7-28-ϕϕ	1ϕϕϕ EDT	Kelly Cy	07-28-00	1001	
Judy Aitchis	7-28-00	3:20 pm	Judy Aitchis	7-28-00	5:25 pm	CHEST TEMP.
			James J. Miller	8-4-2000	1430	
						TAG #

ATS 10/98

U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
NO. 14 BATTERY COMBUSTION STACK
JULY 26 AND 27, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#14BS -M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	23	398.2	9.16	100.0
	1B	0.1 N H2SO4 - Impinger 3	< 2.0	125.8	< 0.25	
	1C	0.1 N NaOH - Impinger 4	< 2.0	135.7	< 0.27	NA
	1D	0.1 N NaOH - Impinger 5	< 2.0	141.3	< 0.28	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	24	403.3	9.68	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 2.0	139.7	< 0.28	
	2C	0.1 N NaOH - Impinger 4	< 2.0	125.7	< 0.25	NA
	2D	0.1 N NaOH - Impinger 5	< 2.0	137.0	< 0.27	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	27	410.6	11.09	100.0
	3B	0.1 N H2SO4 - Impinger 3	< 2.0	136.2	< 0.27	
	3C	0.1 N NaOH - Impinger 4	< 2.0	117.9	< 0.24	NA
	3D	0.1 N NaOH - Impinger 5	< 2.0	114.0	< 0.23	
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. 14 BATTERY COMBUSTION STACK
JULY 26 AND 27, 2000
U.S. EPA REFERENCE METHOD 26A SAMPLING
CALCULATION OF THE IMPINGER COLLECTION EFFICIENCIES

Test No.	Sample ID (CLR-#14BS -M26A-)	Sample Type	Chloride Conc. (mg / L)	Sample Volume (mL)	Chloride Catch (mg)	Collection Efficiency (%)
1	1A	0.1 N H2SO4 - Impingers 1 & 2	23	398.2	9.16	100.0
	1B	0.1 N H2SO4 - Impinger 3	< 2.0	125.8	< 0.25	
	1C	0.1 N NaOH - Impinger 4	< 2.0	135.7	< 0.27	NA
	1D	0.1 N NaOH - Impinger 5	< 2.0	141.3	< 0.28	
2	2A	0.1 N H2SO4 - Impingers 1 & 2	24	403.3	9.68	100.0
	2B	0.1 N H2SO4 - Impinger 3	< 2.0	139.7	< 0.28	
	2C	0.1 N NaOH - Impinger 4	< 2.0	125.7	< 0.25	NA
	2D	0.1 N NaOH - Impinger 5	< 2.0	137.0	< 0.27	
3	3A	0.1 N H2SO4 - Impingers 1 & 2	27	410.6	11.09	100.0
	3B	0.1 N H2SO4 - Impinger 3	< 2.0	136.2	< 0.27	
	3C	0.1 N NaOH - Impinger 4	< 2.0	117.9	< 0.24	NA
	3D	0.1 N NaOH - Impinger 5	< 2.0	114.0	< 0.23	
Blank	Blank	0.1 N H2SO4	< 2.0			
Blank	Blank	0.1 N NaOH	< 2.0			

<u>0.1 N H2SO4</u>

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

<u>0.1 N NaOH</u>

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

For chloride concentrations less than the analytical detection limit (< 2.0) ---->
Chloride catch = 0

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 7/26/00

TEST SITE: NO. 14 BATTERY COMBUSTION STACK — TEST NO.: CLR- #14BS-M26A-1

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.63
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	120
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	0.69
L.	Average Process Gas Temperature (°F)	460
M.	Average Dry Gas Meter Temperature (°F)	79
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	5.0
	Oxygen (%)	10.0
	Nitrogen (%)	85.0
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
O.	Sample Time (min)	120
P.	Total H2O Mass Collected in Impingers (g)	189.6
Q.	Metered Gas Volume (dcf)	53.321

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.54	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.68	[A+(K/13.6)]
T.	Duct Area (ft.^2)	7.85E+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)	920	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	539	[M+460]
X.	Dry Gas Volume Sampled (dscf)	51.934	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	8.940	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	14.7	[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 (%)	14.7	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.147		18	2.643
CO2	0.050	0.853	44	1.877
O2	0.100	0.853	32	2.730
N2	0.850	0.853	28	20.305
CO	0.000	0.853	28	0.000
H2	0.000	0.853	2	0.000
CH4	0.000	0.853	16	0.000
C2H6	0.000	0.853	30	0.000
Ar	0.000	0.853	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.56	
DD.	Average Process Gas Velocity (ft/sec)	1.43E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	6.73E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	3.81E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.25E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	98.9	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0049	
JJ.	Front-Half Residue Weight (g)	0.0247	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0296	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0088	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	2.45E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 14 BATTERY COMBUSTION STACK

TEST DATE: 7/26/00
TEST NO.: CLR- #14BS-M26A-1

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		9.42	
QQ.	Concentration (mg/dscm)		6.40E+00	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		7.80E-01	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.27	
TT.	Concentration (mg/dscm)	<	1.85E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	2.25E-02	[TT*0.02832*GG*60/454000]

Ammonia Gas Acid (corrected for blank)

VV.	Total Catch (mg)		2.57	
WW.	Concentration (mg/dscm)		1.75E+00	[VV/(X*0.02832)]
XX.	Mass Flow Rate (lb/hr)		2.13E-01	[WW*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 7/27/00

TEST SITE: NO. 14 BATTERY COMBUSTION STACK — TEST NO.: CLR- #14BS-M26A-2

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.54
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	120
F.	Duct Width (in.) - for rectangular duct	0
G.	Duct Depth (in.) - for rectangular duct	0
H.	Nozzle Diameter (in.)	0.440
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.04
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic variation	0.04
K.	Average ΔH (in. H2O)	0.75
L.	Average Process Gas Temperature (°F)	465
M.	Average Dry Gas Meter Temperature (°F)	80
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	3.5
	Oxygen (%)	13.5
	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)	208.3
Q.	Metered Gas Volume (dcf)	54.686

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.45	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.60	[A+(K/13.6)]
T.	Duct Area (ft.^2)	7.85E+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)	925	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	540	[M+460]
X.	Dry Gas Volume Sampled (dscf)	53.012	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.821	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	15.6	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	15.6	[Calculated %H2O <= Theoretical Max. %H2O]

CC. Process Gas Molecular Weight:

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.156		18	2.814
CO2	0.035	0.844	44	1.299
O2	0.135	0.844	32	3.645
N2	0.830	0.844	28	19.607
CO	0.000	0.844	28	0.000
H2	0.000	0.844	2	0.000
CH4	0.000	0.844	16	0.000
C2H6	0.000	0.844	30	0.000
Ar	0.000	0.844	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.36	
DD.	Average Process Gas Velocity (ft/sec)	1.46E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	6.88E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	3.86E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.26E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	100.8	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0103	
JJ.	Front-Half Residue Weight (g)	0.0097	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0200	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0058	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	1.63E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA
TEST SITE: NO. 14 BATTERY COMBUSTION STACK

TEST DATE: 7/27/00
TEST NO.: CLR- #14BS-M26A-2

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		9.95	
QQ.	Concentration (mg/dscm)		6.63E+00	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		8.09E-01	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.25	
TT.	Concentration (mg/dscm)	<	1.67E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	2.04E-02	[TT*0.02832*GG*60/454000]

Ammonia Gas Acid (corrected for blank)

VV.	Total Catch (mg)		0.11	
WW.	Concentration (mg/dscm)		7.61E-02	[VV/(X*0.02832)]
XX.	Mass Flow Rate (lb/hr)		9.29E-03	[WW*0.02832*GG*60/454000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 7/27/00

TEST SITE: NO. 14 BATTERY COMBUSTION STACK — TEST NO.: CLR- #14BS-M26A-3

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.54
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	120
F.	Duct Width (in.) - for rectangular duct	0
G.	Duct Depth (in.) - for rectangular duct	0
H.	Nozzle Diameter (in.)	0.440
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for flows	0.03
J.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2 - for isokinetic	0.03
K.	Average ΔH (in. H2O) variation	0.72
L.	Average Process Gas Temperature (°F)	449
M.	Average Dry Gas Meter Temperature (°F)	88
N.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	5.0
	Oxygen (%)	10.0
	Nitrogen (%)	85.0
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
O.	Sample Time (min)	120
P.	Total H2O Mass Collected in Impingers (g)	205.0
Q.	Metered Gas Volume (dcf)	55.326

Calculated Parameters (excluding analytical data)

R.	Absolute Process Gas Pressure (in. Hg)	29.45	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.59	[A+(K/13.6)]
T.	Duct Area (ft.^2)	7.85E+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)	909	[L+460]
W.	Average Absolute Dry Gas Meter Temperature (R)	548	[M+460]
X.	Dry Gas Volume Sampled (dscf)	52.845	[Q*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf)	9.666	[P*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	15.5	[100*Y/(X+Y)]
AA.	Theoretical Maximum Percent H2O in Gas Stream (%) (empirical equation derived from EPA QA Handbook Vol. III, S3.3.6, T6.1A)	#N/A	[100*Saturated Water Vapor Pressure / Stack Pressure]
BB.	Actual Percent H2O in Gas Stream (%)	15.5	[Calculated %H2O <= Theoretical Max. %H2O]
CC.	Process Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	= Wt./Mol
H2O	0.155		18	2.783
CO2	0.050	0.845	44	1.860
O2	0.100	0.845	32	2.705
N2	0.850	0.845	28	20.120
CO	0.000	0.845	28	0.000
H2	0.000	0.845	2	0.000
CH4	0.000	0.845	16	0.000
C2H6	0.000	0.845	30	0.000
Ar	0.000	0.845	40	0.000

	Process Gas Molecular Weight (lb/lb-mol)	27.47	
DD.	Average Process Gas Velocity (ft/sec)	1.40E+01	[85.49*C*[(I*V)/(R*CC)]^0.5]
EE.	Process Gas Volumetric Flow Rate (acfm)	6.61E+04	[DD*T*60]
FF.	Process Gas Volumetric Flow Rate (scfm)	3.78E+04	[EE*(528/V)*(R/29.92)]
GG.	Process Gas Volumetric Flow Rate (dscfm)	3.20E+04	[FF*(1-(BB/100))]
HH.	Isokinetic Variation (%)	102.4	[100*V*{(0.002669*P)+(Q*D*S/W)}] /

Particulate Matter Results (corrected for blank)

II.	Filter Weight (g)	0.0106	
JJ.	Front-Half Residue Weight (g)	0.0147	
KK.	Back-Half H2O-Condensibles Weight (g)	0.0000	
LL.	Total Weight (g)	0.0253	[II+JJ+KK]
NN.	Concentration (gr/dscf)	0.0074	[(7000/454)*LL/X]
OO.	Mass Flow Rate (lb/hr)	2.02E+00	[NN*GG*60/7000]

PROCESS GAS TESTING CALCULATIONS - ISOKINETIC SAMPLING

CLIENT: U.S. STEEL CLAIRTON WORKS - CLAIRTON, PA — TEST DATE: 7/27/00

TEST SITE: NO. 14 BATTERY COMBUSTION STACK — TEST NO.: CLR- #14BS-M26A-3

Hydrochloric Acid (corrected for blank)

PP.	Total Catch (mg)		11.40	
QQ.	Concentration (mg/dscm)		7.62E+00	[PP/(X*0.02832)]
RR.	Mass Flow Rate (lb/hr)		9.11E-01	[QQ*0.02832*GG*60/454000]

Chlorine Gas Acid (corrected for blank)

SS.	Total Catch (mg)	<	0.24	
TT.	Concentration (mg/dscm)	<	1.58E-01	[SS/(X*0.02832)]
UU.	Mass Flow Rate (lb/hr)	<	1.89E-02	[TT*0.02832*GG*60/454000]

Ammonia Gas Acid (corrected for blank)

VV.	Total Catch (mg)		0.75	
WW.	Concentration (mg/dscm)		5.01E-01	[VV/(X*0.02832)]
XX.	Mass Flow Rate (lb/hr)		5.99E-02	[WW*0.02832*GG*60/454000]