Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

Compliance Tests of the Envirotech Hooded Quench Car No. 106 Operated on the Number 7, 8 and 9 batteries Located at the United States Steel Clairton Works

File No. 50.74

Compliance Tests of the Envirotech Hooded Quench Car No. 106 Operated on the Number 7, 8 and 9 batteries Located at the United States Steel Clairton Works

Clairton, PA 15025

Project No. 50.74

October 28, 1985

Prepared by:
Dr. R.G. Patterson

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File 50.74

Compliance Tests of the Envirotech Hooded Quench Car No. 106 Operated on the Number 7, 8 and 9 Coke Batteries Located at the United States Steel Clairton Works

INTRODUCTION

This report covers test work performed by Air Pollution Technology, Inc. (APT) in cooperation with United States Steel Corporation (USSC) and Envirotech Corporation (EVT) on the Envirotech Hooded Quench Car No. 106 (HQC) operating on the No. 7, 8 and 9 coke batteries located at the USSC's Clairton Cokeworks. The purposes of these tests were to measure the particulate and visible emissions from the HQC.

The EVT HQC system is designed to capture and remove particulates from the hot gases during coke-pushing operations. The basic HQC System consists of three major components.

1. A self propelled Control Car, which houses all induced draft and gas cleaning equipment. This car carries the Aeronetics Hot Water Scrubber that provides both the draft required to capture the gases at the system inlet and the fine water drops required to collect particulates in the gas stream during the scrubbing process.
2. A One-Spot Hooded Quench Car, which consists of a tilting coke box covered by a fixed hood to contain the gases so that they can be drawn into and through the control car for cleaning. The hood encloses the quench car on three sides and the top, with the side facing the ovens open to receive the coke pushed.
3. Minor modifications, as required, to the existing coke quide to prevent gases from escaping to the atmosphere during the coke push. Wings are added to the face of the coke quide on both sides of the coke discharge opening. The wings align with the open face of the quench car hood when the car is positioned for the push.

The Aeronetics hot water scrubber, considered the "heart" of the system, incorporates a two-phase adjustible jet nozzle in which water is ejected to perform the dual functions of gas

movement and gas scrubbing. The water/vapor combination in the scrubber is referred to as a two-phase phenomenon.

The Aeronetics scrubber directs pressurized hot water to provide the energy for moving large quantities of gas through the scrubbing system. The nozzle's jet ejector effect transfers momentum from the liquid to the gas. Additionally, the jet nozzle atomizes the liquid and accelerates it to velocities of more than 1,000 feet per second, thereby creating a large velocity differential between the drops and the suspended particles in the gas stream. This relative velocity causes inertial impaction between the drops and the particles. As inertial impaction occurs, the particles are deposited on the drops, which are then removed from the gas stream by means of an entrainment separator. The cleaned gas exits into the atmosphere and the particulated liquid flows into a drain.

Recently, EVT made several modifications to the basic HOC system to improve the particle collection efficiency. They are as follows:

1. The effectiveness of the quench car hood was increased by extending the transition duct into the hood so as to cause more symmetrical gas flow within the hood. This increases the efficiency of fugitive emissions capture.
2. The collection efficiency was increased by pre-conditioning the gas prior to entering the Aronetics scrubbers by spraying water into the gas stream. This increases the liquid to gas (L/G) ratio in the scrubber throat.

The particle mass concentration was measured at the outlet of the HQC with an EPA Method 5 sampling train. The visible emissions observations were done simultaneously with the particulate mass concentration measurements at the request of the Allegheny County Health Department Bureau of Air Pollution Control (BOAPC). The compliance test results presented in this report are for tests completed on October 9 and 10, 1985. All tests were completed while the car was receiving and transporting coke from the Number 7, 8 and 9 coke batteries.

SUMMARY

The following points summarize the results of the compliance tests completed on the EVT Hooded Quench Car No. 106. Three compliance tests were conducted during normal coking conditions.

1. The average particulate mass emission rate was 0.012 lb/ton of coke for the three compliance tests. This coke battery is subject to the LAER Standard which is 0.040 lb/ton of coke.

2. As requested, (Appendix G) visible emission readings were observed simultaneous during the particulate mass emission compliance testing with the test car attached to the HQC system. The test car added additional pressure drop to the system which decreases the gas flow rate and the ability of the HQC system to capture fugitive emissions.

   The approved testing protocol, Appendix F, provides for opacity observation to be made with disconnection of the test car. Such test car disconnection will improve the visible emission performance.

   The visible emission results, based on the above conditions, meets the intent of the Consent Degree visible emission requirements.

OBJECTIVES

The compliance tests reported here were completed under the joint USSC/EVT Compliance Test Program and were observed by the BOAPC. The test work was authorized by United States Steel Corporation and had the following objectives:

1. Measure the particulate mass emissions from the HQC according to the Compliance Test Protocol presented in Appendix F.

2. Observe the visible emissions from the HQC according to the Compliance Test Protocol presented in Appendix F.

3. Compliance test protocol presented in Appendix F complies with the USSC consent decree, as modified, for coke pushing emissions and has been approved by the Allegheny County Health Department, Bureau of Air Pollution Control, Pennsylvania Department of Environmental Resources and the Environmental Protection Agency.

Battery 7, 8 and 9 are considered a new source and are subject to the Lowest Achieviable Emission Rate (LAER) standard. Pursuant to the Consent Decree, as modified, the applicable LAER emissions standards for particulates, and as discussed with the regulatory agencies, are as follow:

1. Particulate mass emission less than or equal to 0.04 pounds per ton of coke pushed.

2. Visible emissions during push and travel less than 20 percent.

3. USSC has been informed by BOAPC, as shown in Appendix G, that opacity standards during travel should be less than 20% since USSC uses pushing emission control devices.

APPROACH

1. Carry out particulate mass and visible emission measurements on the HQC system. This involved the following:

   a. Two of the test personnel were on the test car to operate the particulate mass emission sampling apparatus. One of the personnel operated the sampling train control module. The other person measured the gas velocity head and converted that number into a sample train flowrate for the sample train operator. This helped the sample train operator maintain isokinetic sampling conditions. The second person also signaled the start, stop and change from push to travel modes for the sample train operator.
   b. One test person was assigned to measure the visible emissions from the HQC system during the push and travel cycles.
   c. One test person was assigned to ride in the cab of the HQC control car to record the car operating parameters.
   d. All process operating data were supplied by the Clairton Cokeworks Operations personnel.

2. Analyze all samples in a field lab set up in a construction trailer at the test site. The analyses were completed by the sample crew leader.

3. Reduce and analyze the test data.

4. Determine the particulate and visible emission performance of the HQC and compare these results with the LAER emission standards.

TEST PERSONNEL AND OBSERVERS

Following is a list of test personnel and observers:

Field Test Personnel:

Dr. Ronald G. Patterson, Testing Manager
Mr. Bruce C. DaRos, Field Test Crew Leader
Mr. Sherman Smith, Sampling Train Operator
Mr. Cary Milburn, Sampling Train Operator
Mr. Dan Petrovay, Visible Emissions Observer

Allegheny County Board of Air Pollution Control Observers:
Mr. William J. Logan, Air Pollution Control Technician
Mr. Thomas Kelly, Coke Oven Technician
Mr. Clarence Carey, Coke Oven Technician
Mr. Dan Nadzan, Coke Oven Technician

USSC Personnel:
Mr. Joseph Connelly, Project Engineer
Mr. Larry Gainer, Division Superintendent, Gas & Coke
Mr. Roy Weiskircher, Senior Environmental Engineer
Mr. Randy York, Environmental Consultant
Mr. Michael J. McKelvey, Field Construction Manager
Mr. James E. McKoy, BEC Visible Emissions Observer

EVT Personnel:
Mr. Patrick J. Reilly, Vice President and Project Manager
Mr. Ned H. Ford, Field Construction Manager
Mr. Ira Lapof, Field Construction Superintendent
Mr. Lee Trexler, Control Car Operator

Consultants to EVT:
Dr. Seymour Calvert, Environmental Engineering and Testing Consultant
Mr. Frank Lauer, Coking Consultant

TEST SITE AND OPERATING CONDITIONS

Metallurgical grade coke is produced by USSC at the Clairton Works by heating coal in an inert atmosphere at approximately 2,600°F for a period of 18 to 21 hours to drive off volatile compounds and impurities, such as sulfur.

Each coke battery consists of a number of ovens which are charged from the top with a coal mixture. The coal mixture is heated by circulating hot gas through flues which form the walls of the ovens. At the end of the heating cycle the coke is pushed from the oven into a coke quench car which transports the incandescent coke to the quench tower. After quenching, the coke is then transported to a wharf which acts as a surge bin for holding the coke and continously loading it onto a belt for conveyance to the coke storage system.

The EVT HQC system is designed to capture and remove particulates from the hot gases during coke-pushing operations. The basic HQC System consists of three major components as shown in Figure 1.

1. A self propelled Control Car, which houses all induced draft and gas cleaning equipment. This car carries the Aeronetics Hot Water Scrubber that provides both the draft required to capture the gases at the system

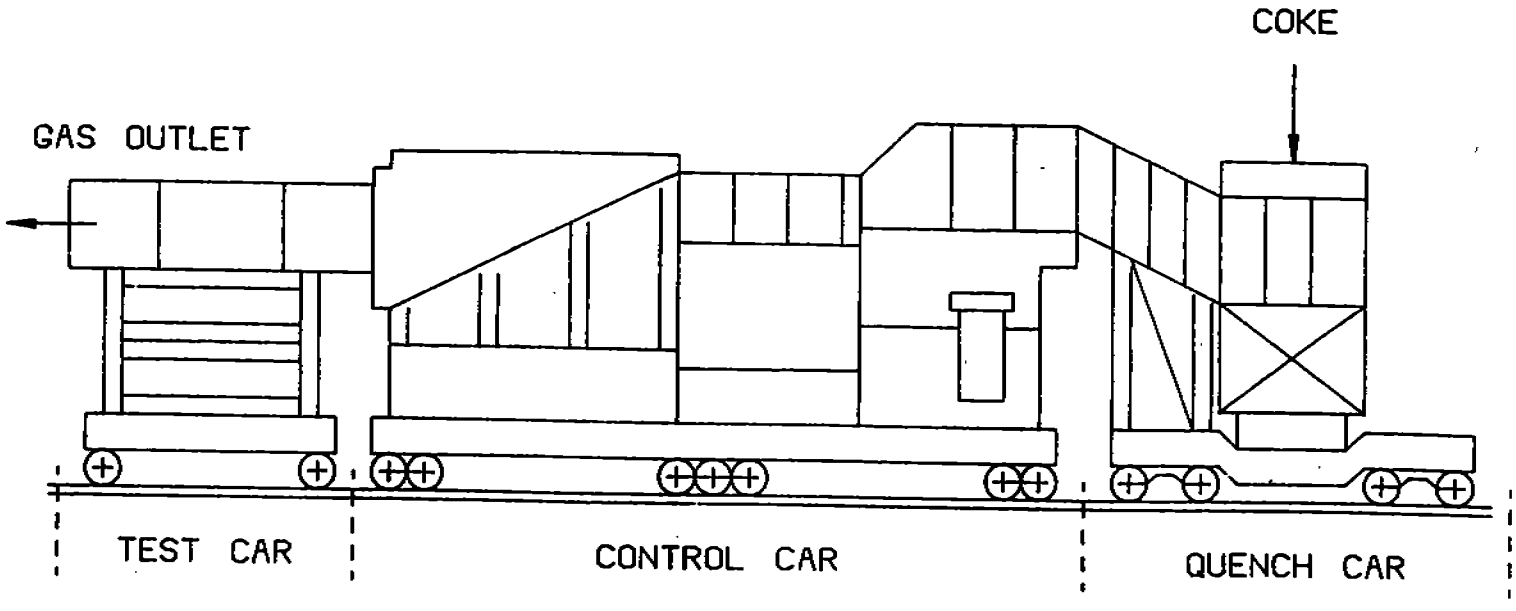

Figure 1. Envirotech Hooded Coke Quench Car System.

inlet and the fine water drops required to collect particulates in the gas stream during the scrubbing process.

2. A One-Spot Hooded Quench Car, which consists of a tilting coke box covered by a fixed hood to contain the gases so that they can be drawn into and through the control car for cleaning. The hood encloses the quench car on three sides and the top, with the side facing the ovens open to receive the coke pushed.
3. Minor modifications, as required, to the existing coke guide to prevent gases from escaping to the atmosphere during the coke push. Wings are added to the face of the coke quide on both sides of the coke discharge opening. The wings align with the open face of the quench car hood when the car is positioned for the push.

The Aeronetics hot water scrubber, considered the "heart" of the system, incorporates a two-phase adjustible jet nozzle in which water is ejected to perform the dual functions of gas movement and gas scrubbing. The flow of the water/vapor combination in the scrubber is referred to as a two-phase phenomenon.

The Aeronetics scrubber directs pressurized hot water to provide the energy for moving large quantities of gas through the scrubbing system. The nozzle's jet ejector effect transfers momentum from the liquid to the gas. Additionally, the jet nozzle atomizes the liquid and accelerates it to velocities of more than 1,000 feet per second, thereby creating a large velocity differential between the drops and the suspended particles in the gas stream. This relative velocity causes inertial impaction between the drops and the particles. As inertial impaction occurs, the particles are deposited on the drops, which are then removed from the gas stream by means of an entrainment separator. The cleaned gas exits into the atmosphere and the particulated liquid flows into a drain.

Recently, EVT made several modifications to the basic HOC system to improve the particle collection efficiency. They are as follow:

1. The effectiveness of the quench car hood was increased by extending the transition duct into the hood so as to cause more symmetrical gas flow within the hood. This increases the efficiency of fugitive emissions capture.
2. The collection efficiency was increased by pre-conditioning the gas prior to entering the Aronetics scrubbers by spraying water into the gas stream. This increases the liquid to gas (L/G) ratio in the scrubber throat.

Process condition data for the HQC System were recorded for each traverse point as shown in Appendix A. Table 1 shows the average data for the HQC system for each of the compliance tests. During this test series the average production rate for coke batteries 7, 8 and 9 was 11 tons of coke per oven.

TESTS RESULTS

The results from the compliance tests run on the HQC System as described on page 1 are presented in this section:

Test Number	Date	Test Type	Coking Conditions
1301	10/09/85	Compliance	Normal
1302	10/10/85	"	"
1303	10/10/85	"	"

Table 2 summarizes the test conditions for each of the tests. Tables 3 through 5 show the particulate emission results for the compliance tests. Table 5 compares the particulate emission rate in lb/ton of coke pushed to the LAER emission standard for each of the tests. The results of the visible emission observations are summarized in Table 6.

TEST METHODS

The tests results presented in this report were completed according to the Compliance Test Protocol shown in Appendix F. The particulate emission tests were completed with the Method 5 particulate emission sampling system modified as approved for these tests, as shown in Figure 2. The probe, cyclone and filter holder were Teflon lined or coated. Two impinger trains were used in parallel to acommodate the high sample flowrate required to collect a sample volume greater than 30 dscf.

The 24 sampling locations are shown in Figure 3. A cyclonic flow test completed on July 23, 1985 showed an average cyclonic flow angle of 0.2 degrees for all points during push and travel. The results of the cyclonic flow test are shown in Appendix I. All sample analysis was completed in a field laboratory set up in a construction trailer near the test site.

All fugitive visible emission observations were completed simultaneously with the particulate emission tests. The test car was attached during the visible emission observations. This increased the pressure drop that the Aeronetics nozzle had to overcome, which decreased the gas flowrate and the ability of the HQC System to capture fugitive emissions during these tests.

TABLE 1. AVERAGE HQC SYSTEM PROCESS CONDITION DATA

Test Number	1301		1302		1303	
	Push	Travel	Push	Travel	Push	Travel
Nozzle Water Flowrate, gpm	430	170	430	170	430	170
Water Temp, deg F	414	413	408	408	408	408
Water Press, psig	318	313	320	317	315	311
Annubar Vel Head, in. WC	0.0	0.0	0.0	0.0	0.0	0.0
Scrubber Temp In, deg F	0	0	0	0	0	0
Scrubber Temp Out, deg F	159	151	159	151	160	152
Quench H2O Flowrate, gpm*	400	0	400	0	400	0

* The quench water flowrate was assumed to be 400 gpm from the pump specifications, since there is no flowmeter on this system.

TABLE 2. SUMMARY OF COMPLIANCE TEST CONDITIONS

Test Number	1301		1302		1303	
	Push	Travel	Push	Travel	Push	Travel
Avg Gas Vel, fps	64.5	39.7	67.7	40.0	65.0	38.2
Avg Gas Flow rate, acfm	124287	76614	130457	77034	125224	73559
Avg Gas Flow rate, dscfm	74102	46227	77120	46189	73375	43669
Gas Temp, deg F	159	151	159	151	160	152
Gas Press, in. Hg	29.50	29.50	29.37	29.37	29.32	29.32
Samp. Vol., dscf (corr.)	24.33	15.53	23.98	14.26	24.33	12.39
% Isokinetic	91	107	91	107	93	103
		Total		Total		Total
Samp. Vol., dscf (corr.)		39.86		38.24		36.73
Dry Gas Comp.						
CO2 (vol %)		1.0		0.8		0.8
O2 (vol %)		20.0		20.0		20.0
CO (vol %)		0.0		0.0		0.0
N2 (vol %)		79.0		79.2		79.2
Moisture, vol%						
M-5		29.52		30.69		29.77
Sat.		29.14		29.35		30.32
Mol Wt,						
Dry		28.96		28.93		28.93
Wet		25.77		25.72		25.67
Front-half Part., mg		28.40		37.17		20.16
Back-half Part., mg		1.75		0.65		1.50
Total DER Part, mg		30.15		37.82		21.66

TABLE 3. TOTAL PENNSYLVANIA DER PARTICULATES*

Test Number	Number of Pushes	Part. Conc. gr/dscf	Part. Rate, lbs/hr	Part. Rate, lb/ton coke	Allowable, lb/ton coke
1301	24	0.0117	1.25	0.0124	0.0400
1302	24	0.0153	1.83	0.0157	0.0400
1303	24	0.0091	0.89	0.0090	0.0400
Avg		0.012	1.32	0.012	0.040

* Includes total front-half, plus insoluble back-half

TABLE 4. FRONT-HALF PARTICULATES*

Test Number	Number of Pushes	Part. Conc. gr/dscf	Part. Rate, lbs/hr	Part. Rate, lb/ton coke
1301	24	0.0110	1.18	0.0117
1302	24	0.0150	1.80	0.0154
1303	24	0.0085	0.83	0.0083
Avg		0.011	1.27	0.012

* Includes filter and front-half acetone and water washes

TABLE 5. BACK-HALF PARTICULATES*

Test Number	Number of Pushes	Part. Conc. gr/dscf	Part. Rate, lbs/hr	Part. Rate, lb/ton coke
1301	24	0.00068	0.073	0.00072
1302	24	0.00026	0.031	0.00027
1303	24	0.00063	0.062	0.00062
Avg		0.00052	0.055	0.00054

* Includes 0.22 micron filter catch of impinger solution

TABLE 6. SUMMARY OF VISISBLE EMISSION OBSERVATIONS

Test No.	1301		1302		1303	
Point No.	Opac >20%	Sec >20%	Opac >20%	Sec >20%	Opac >20%	Sec >20%
1.6 P						
T						
1.5 P						
T						
1.4 P						
T						
1.3 P					55	3.5
T						
1.2 P						
T						
1.1 P						
T			25	4.8		
2.6 P						
T						
2.5 P						
T						
2.4 P			20	1.6	35	3.7
T			20	1.3		
2.3 P						
T			20	2.5		
2.2 P						
T						
2.1 P						
T			25	4.3		
3.6 P			20	1.9		
T						
3.5 P						
T						
3.4 P					35	4.2
T						
3.3 P						
T			20	1.2	20	2.8
3.2 P						
T						
3.1 P						
T			25	4.0		
4.6 P						
T						
4.5 P						
T						
4.4 P						
T						
4.3 P					20	1.1
T						
4.2 P						
T						
4.1 P						
T			20	1.5		
No./test	0		9		5	
Sec/test		0		23.1		15.28

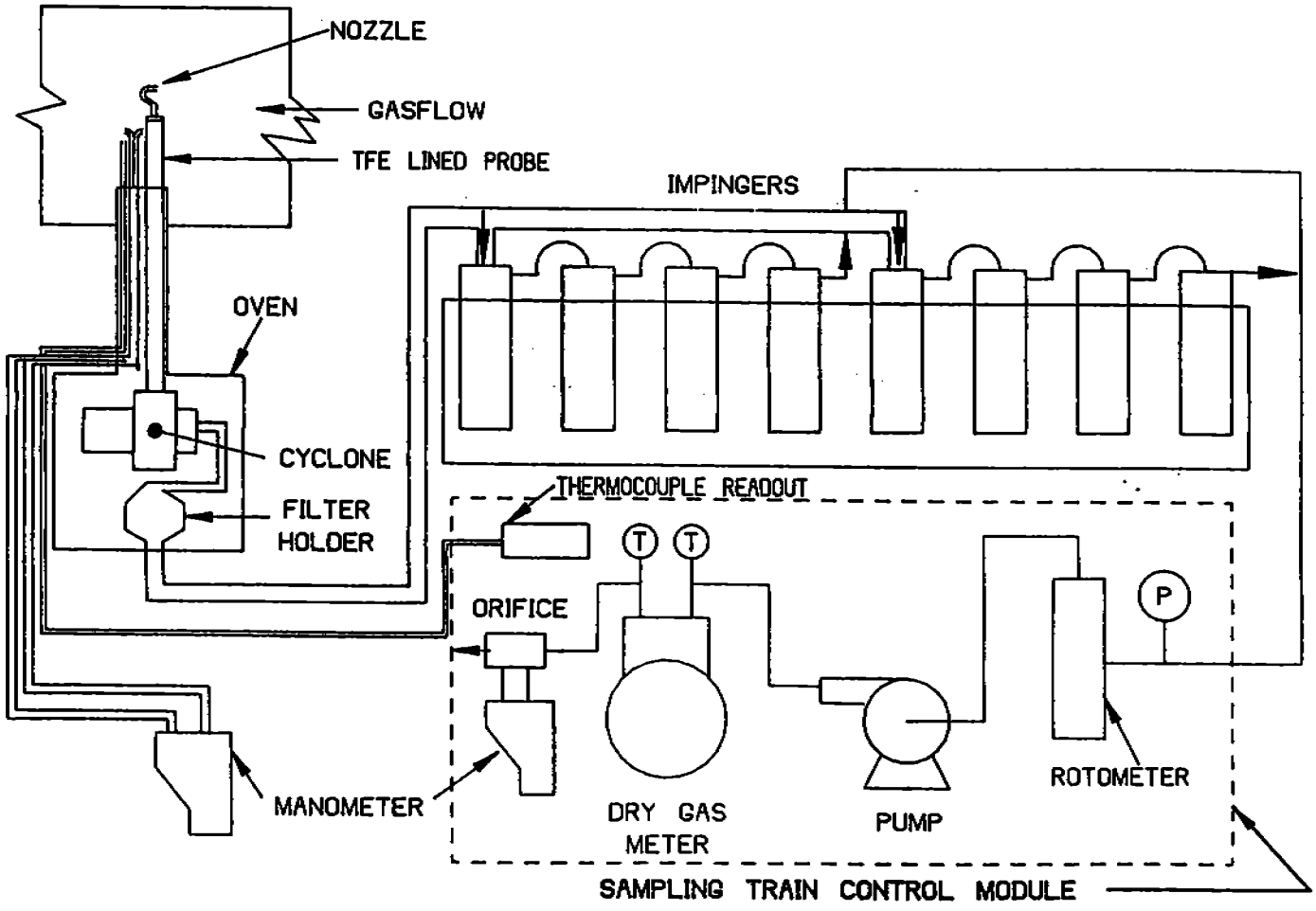

Figure 2. Method 5 Sampling Apparatus.

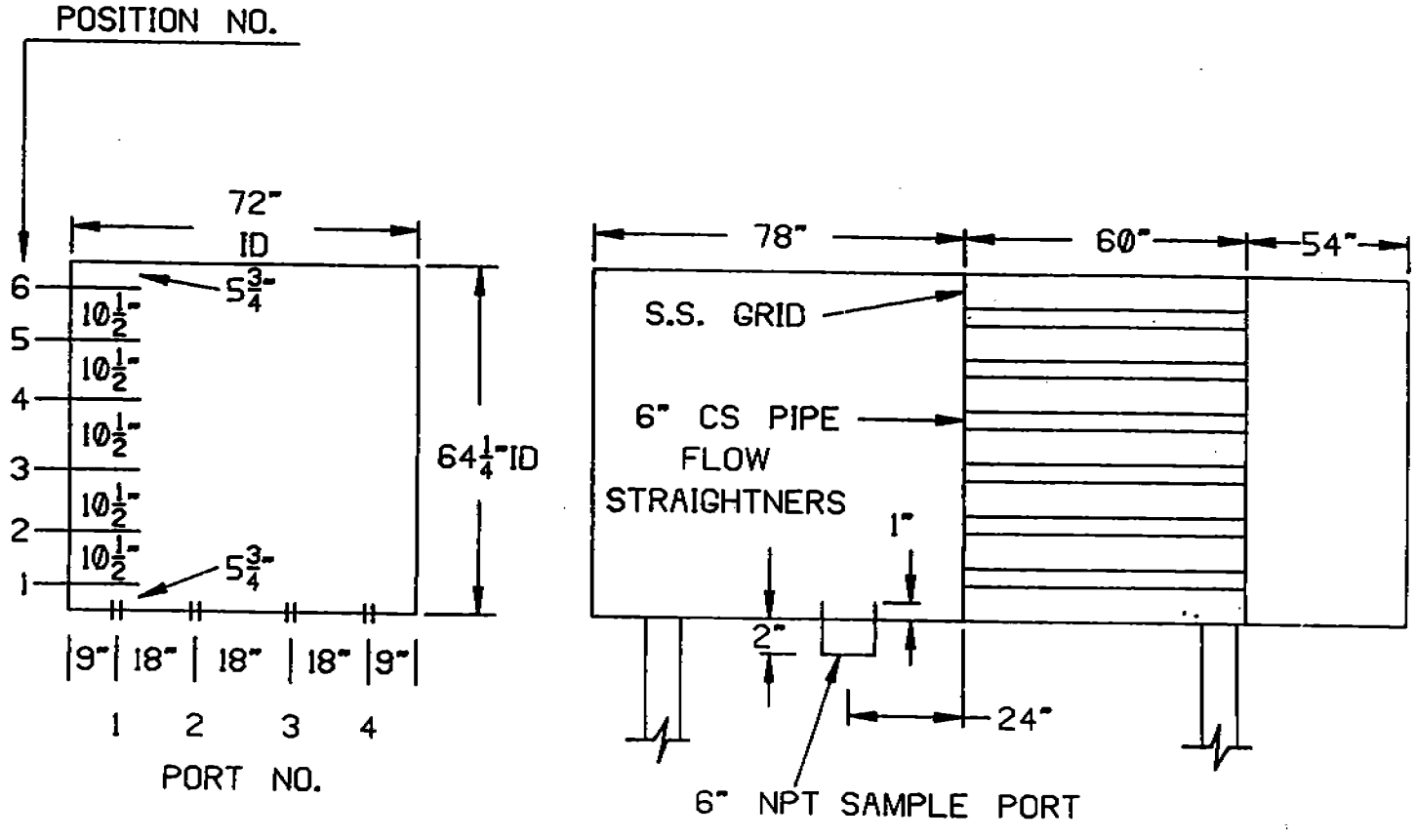

Figure 3. Test Car Duct Sampling Arrangement.

APPENDIX B

SAMPLE TRAIN DATA SHEETS

Plant US STEEL - CLAIRTON, PA
Date 10-9-85
Sample Location HCQC - TEST CAR
Sample Type M-5
Run Number 13.1
Operator SMITH & MCGUIRN
Ambient Temperature 75°
Barometric Pressure 29.54 @ SP
Static Pressure, (H_2O)
Filter Number(s) RA102G-043
N/A

Leak Check: Initial at 19" Hg, .011 CFM
Final at 17" Hg, .010 CFM
Pitot Leak Check: ok

Impinger Volume

	Initial	Final	Net Gain
TRAIN A	100	255	155
	100	110	10
	200	2	2
TRAIN B	100	255	155
	100	110	10
	200	2	2
Silica Gel		6140	6275
		6360	6470
SASS Condensate			
Total Volume			

Probe Length and Type 5 ft TFE
Nozzel Size & I.D. .3515
Pitot Coefficient & I.D. .325 (1-BSWT)
Assumed Moisture
Molecular Weight, Dry, (M_d)
Meter Box Number ABT 14 LG (MBD)
Meter Coefficient
α Factor
K =
$K(Nd)^4$ = ___ x (___)^4 = ___
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right)$ (P)

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft³	Velocity head (ΔP), in. H_2O	Rotameter Desired	Rotameter Actual	Time	Temperature °F Probe	Impinger	Orifice ΔH	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
	Init.	457.465												
1.6	:42 320	458.500	1.2		32.4	159	272	72°	1.1	275	85	84	8"	
	1:20 :38	459.180	.50		20.6	153	275	72°	.54	275	86	84	4"	
1.5	:42 326	459.970	.50		20.6	160	271	72°	.55	272	86	85	4"	
	1:40 :58	460.630	.20		12.7	151	272	72°	.21	272	86	85	2"	
1.4	:43 335	461.475	.65		23.6	158	270	72°	.70	272	86	85	5"	
	1:01 :18	461.715	.25		14.2	152	273	72°	.29	272	86	85		
1.3	:43 340	462.640	.80		26.3	160	271	72°	.83	270	86	85	6"	
	1:34 :51	463.375	.30		15.7	153	271	72°	.35	270	87	85	3"	
AVG.														

7602/5/81/Rev.1
REV 2 7-85

Comments:

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft 3	Velocity Head (ΔP_s), In. H_2O	Rotometer Desired	Rotometer Actual	Temperature °F Stack	Probe	Impinger	Orifice ΔH	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	ΔH
	Init.													
1.2	:42 347	464.290	.80	28	26.8	153	272	72°	.85	270	87	86	6	
	:52 :10	464.440	.30		15.7	151	272	72°	.35	270	87	86	2	
1.1	:41 352	465.520	1.5		36.5	160	271	72°	1.3	271	87	86	10	
	:51 :70	466.780	.50		20.6	151	271	72°	.54	271	87	86	4	
2.6	:41 359	467.925	1.5		36.5	159	271	71°	1.3	270	88	87	10	
	1:21 :38	468.610	.50		20.6	152	271	71°	.53	270	88	87	4	
2.5	:42 405	469.650	1.2		32.4	160	271	71°	1.15	270	88	88	8	
	1:39 :57	470.665	.30		15.7	151	271	71°	.33	270	88	88	2	
2.4	:42 411	471.560	1.5		36.5	159	271	71°	1.3	270	89	88	10	
	1:01 :19	471.915	.50		20.6	151	271	71°	.51	270	89	89	4	
2.3	:42 417	473.050	1.8	39.9	38.0	160	271	71°	1.35	270	90	89	11	
	1:25 :43	473.945	.70		24.6	153	271	71°	.72	270	90	89	5	
2.2	:42 432	474.970	1.0		29.5	155	272	71°	1.0	270	91	91	7	
	:53 :11	475.150	.50		20.6	148	270	71°	.54	270	91	91	4	
2.1	:43 439	476.285	1.5		36.5	156	270	70°	1.25	270	91	91	10	
	1:46 1:03	477.345	.40		18.3	149	270	70°	.45	270	91	90	4	
AVG.														

REV 2 7-85

Run No. 13.1 Date 10-9-95 Sampling Location HCRC - TEST CAR

US STEEL - CLAIRTON, PA

Comments:

Traverse Point Number	Sampling Time, min / Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft³ Init.	Velocity Head (Δp), in. H_2O	Orifice ΔH Desired	Orifice ΔH Actual	Temperature °F Probe	Impinger	Orifice ΔH	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Leak Rate and VP
3.6	:42 446	478.210	1.0		29.5 160	270	70°	.99	270	90	91	7.5"	
	1:29 :27	479.150	.50		20.6 153	270	70°	.53	270	91	91	4"	
3.5	:42 453	480.100	.90		28.0 158	271	70°	.94	270	91	91	7"	
	1:46 1:03	481.120	.40		18.3 151	271	70°	.43	270	91	91	3"	
3.4	:44 501	~~481.910~~	.90		26.0 158	272	70°	.94	270	92	92	7"	
~~X~~	:44 0	~~482.055~~	NT										
3.3	:42 506	483.035	1.0		29.5 161	270	70°	1.0	270	92	93	7.5"	
	1:34 :52	483.880	.40		18.3 152	272	70°	.44	270	92	93	3.5"	
3.2	:46 513	484.925	.80		26.3 158	270	70°	.85	270	93	93	6"	
	:48 0		NT										
3.1	:43 518	485.920	1.0		29.5 159	270	70°	1.0	270	94	94	7"	
	1:48 1:05	486.975	.40		18.3 152	270	70°	.44	270	94	94	3"	
4.6	:44 526	487.710	.60		22.7 158	270	70°	.62	270	94	95	5"	
	1:16 :32	488.225	.20		14.1 150	270	70°	.26	270	94	95	2"	
4.5	:43 532	488.970	.50		20.0 159	270	70°	.53	270	95	95	4.5"	
	1:39 :56	489.710	.20		14.2 150	270	70°	.27	270	95	95	2"	
AVG.													

Rev 2 7-85

Run No. 13.1 Date 10-9-85 Sampling Location HCGC - TEST CAR

U.S. STEEL - CLAIRTON, PA

Comments: #1 Scrubber died at travel node

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft³	Velocity Head (Δp), in. H_2O	Rotometer Desired	Rotometer Actual	Temperature °F: Stack	Probe	Impinger	Orifice ΔH	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Avg $\sqrt{\Delta p}$
		Init.												
4.4	:42 536	490.510	.60		22.7	158	270	70°	.63	270	95	95	5	
	1:01 :19	490.770	.30		15.7	151	270	70°	.34	270	95	95		
4.3	:43 543	491.880	1.3		36.5	161	270	70°	1.3	270	95	95	10"	
	1:24 :41	492.705	.70		24.6	153	270	70°	.73	270	95	95	5.5"	
4.2	:48 550	493.960	1.5		36.5	157	270	70°	1.3	270	95	95	10"	
	:48 0	493.960	NT											
4.1	:42 557	494.960	1.2		32.4	158	270	70°	1.1	270	96	96	9"	
	1:30 :48	495.805	.50		20.6	150	270	70°	.52	270	96	96	4"	
		purge to 518.710												
AVG														

REV 2: 7-85

Run No. 13.1 Date 10-9-85 Sampling Location USSC - TEST CAR

US STEEL - CLAIRTON, PA

Comments:

Plant US STEEL - CLAIRTON, PA
Date 10-10-85
Sample Location HCQC - TEST CAR
Sample Type M-5
Run Number 13.2
Operator SMITH & MILBURN
Ambient Temperature 60°F @ 9:30A
Barometric Pressure 29.41 @ 11A
Static Pressure, (H_2O) -.55
Filter Number(s) RA102G-084
N/A

Leak Check: Initial at 15" Hg, .007 CFM
Final at 15" Hg, .005 CFM
Pitot Leak Check: ok

Impinger Volumes

	Initial	Final	Net Gain
[illegible]	[illegible]	205	105
	[illegible]	105	5
	[illegible]	1	1
[illegible]	[illegible]	310	210
	[illegible]	120	20
	[illegible]	2	2 (343)
	611.7	618.5	
	635.0	645.0	

SASS Condensate

Total Volume

Probe Length and Type 5 ft TFE
Nozzle Size & I.D. .3515
Pitot Coefficient & I.D. .825 (1-BENT)
Assumed Moisture
Molecular Weight, Dry, (M_d)
Meter Box Number APT 14 LG (MOD)
Meter Coefficient
α Factor
Y =
$K(Nd)^4$ = x ( )^4 =
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right)$ (P)

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft³	Velocity Head (ΔP_s), in. H_2O	Pyrometer Desired	Pyrometer Actual	Temperature °F Stack	Probe	Impinger	Orifice Δ H	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
		Init. 518.980												
1.6	:42 904	519.971	1.0		29.5	158	262	52°	.97	270	58	56	7.5"	
	:53 :11	520.160	.35		17.1	151	263	52°	.42	270	58	56		
1.5	:35 910	520.770	.45		19.5	159	264	52°	.47	270	58	57	4"	
	1:50 1:15	521.825	.30		15.7	149	264	52°	.35	270	58	57	3"	
1.4	:42 916	522.675	.70		24.6	161	262	52°	.69	270	60	57	6"	
	1:20 :38	523.210	.30		15.7	151	262	52°	.32	270	60	57	3"	
1.3	:42 922	524.110	.80		26.3	161	264	52°	.77	270	60	58	6.5"	
	1:39 :57	525.000	.35		17.1	152	264	52°	.40	270	60	58	3"	
AVG.														

7602/5/81/Rev 1
REV 2 7-85

Comments:

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min		Gas Meter Reading (V_m), ft³ Init.	[illegible]	[illegible]	[illegible]	Temperature °F Probe	Impinger	Orifice Δ H	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
1.2	:42	928	525.975	1.0	29.5	159	264	54°	.94	270	61	59	7.5"	
	1:00	:18	526.290	.40	18.3	151	264	54°	.46	270	61	59		
1.1	:42	934	527.400	1.5	36.5	161	264	54°	1.2	270	62	60	11"	
	1:33	:51	528.410	.60	22.7	151	264	54°	.61	270	62	60	5"	
2.6	:42	940	529.535	1.5	36.5	158	262	54°	1.2	270	63	61	11"	
	:53	:11	529.755	.50	20.6	149	262	54°	.49	270	63	61	4"	
2.5	:39	946	530.770	1.5	36.5	160	262	54°	1.2	270	64	62	11"	
	1:49	1:10	531.995	.45	19.5	150	263	54°	.48	270	64	62	4"	
2.4	:45	952	533.055	1.5	36.5	159	262	56°	1.2	270	65	63	11"	
	1:20	:35	533.790	.45	19.5	151	262	56°	.45	270	65	63	4"	
2.3	:40	958	534.845	1.5	36.5	160	263	56°	1.2	270	66	64	11"	
	1:37	:57	535.825	.45	19.5	150	263	56°	.45	268	66	64	4"	
2.2	:42	1004	536.840	1.2	32.4	160	263	60°	1.05	269	68	65		
	1:00	:18	537.145	.40	18.3	152	263	60°	.41	269	68	65		
2.1	:42	1010	538.220	1.5	36.5	161	263	60°	1.2	270	67	65	11"	
	1:31	:49	539.105	.50	20.6	152	263	60°	.50	270	68	65	4"	
AVG.														

REV 2 7-85

Run No. 13.2 10-10-85

Sampling Location HCCC - TEST CAR

[illegible] STEEL - [illegible], PA

Comments:

Traverse Point Number	Sampling Time, min	Clock Time (24-hr) Clock	Init.	Velocity Head (Vm), in. H2O	Desired	[illegible]	[illegible]	[illegible]	Impinger	Orifice ΔH	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum In. Hg.	Avg. √ΔP
3.6	:43	1015	540.110	7.5		3[illegible]	155	265	60°	1.2	270	68	66	11	
	:53	:10	540.410	.50		20.6	151	262	60°	.49	270	68	66	4"	
3.5	:33	1021	541.165	.90		23.0	160	263	60°	.88	270	69	67	7"	
	1:45	1:12	542.270	.35		17.1	148	263	60°	.39	270	69	67	3"	
3.4	:40	1027	543.135	.80		26.3	159	263	60°	.78	269	69	67	6.5	
	1:18	:38	543.655	.30		15.7	150	263	60°	.30	269	69	68	3"	
3.3	:41	1033	544.500	.75		25.4	161	263	60°	.73	270	70	68	6.5	
	1:41	1:00	545.345	.30		15.7	152	263	60°	.31	270	70	68	3"	
3.2	:41	1039	546.275	.90		28.0	158	263	60°	.88	270	70	69	7.5	
	:58	:17	546.550	.40		18.3	151	263	60°	.41	270	70	69	—	
3.1	:39	1044	547.460	1.0		29.5	162	264	60°	.92	269	71	70	8"	
	1:21	:42	548.105	.35		17.1	152	264	60°	.39	269	71	70	3"	
4.6	:40	1051	549.020	.90		28.0	158	264	60°	.87	269	72	70	7"	
	:47	:07	549.130	.25		14.2	150	264	60°	.30	269	72	71	—	
4.5	:40	1057	549.845	.50		20.6	153	264	60°	.51	269	72	72	4.5"	
#1	:40	Ø	549.845	NT											
AVG.															

Rev 2 7-85

Run No. 13.2 10-10-85

Sampling Location HCGC - TEST CAR

#1 - Scrubber shut-down during travel

Comments:

Traverse Point Number	Sampling Time, min	Clock Time (24-hr) Clock	Gas Meter Reading (Vm), ft³	Volumetric Flow Rate, ft³/min	Desired	Temperature °F						Gas Meter		Pump Vacuum, in. Hg	Avg. ΔP
			Init.	In. Hg		Out			Impinger	Δ H	Oven	In	Out		
4.4	:43	1103	550.955	1.5		36.5	160	263	60°	1.2	269	73	72	11"	
	1:17	:34	551.540	.45		19.5	151	265	60°	.45	269	73	72		
4.3	:44	1109	552.680	1.55		37.0	161	264	60°	1.25	270	74	73	11.5"	
*	:44	:8	552.680	NT											
4.2	:41	1116	553.770	1.5		36.5	158	264	62°	1.2	270	75	74	10"	
	:59	:18	554.110	.50		20.6	152	264	62°	.52	270	75	74		
4.1	:41	1121	555.190	1.5		36.5	160	262	62°	1.2	269	75	74	11"	
	1:22	:41	555.920	.50		20.6	152	264	62°	.51	269	75	74	4.5"	
			purge to 570.920												
AVG.															

7-85

Run No. 13.2 Date 10-10-85 Sampling Location [illegible]

*1 - Scrubber shut-off b/4 travel

Comments:

Plant US STEEL - CLAIRTON PA
Date 10-10-85
Sample Location HCGL - TEST CAR H-3-6
Sample Type M-5
Run Number 13.3
Operator SMITH & MILBURN
Ambient Temperature 65°
Barometric Pressure 29.36 @ 2 PM
Static Pressure, (H_2O) -.55
Filter Number(s) RAID 6085

Leak Check: Initial at 15" Hg, .005 CFM
Final at 13" Hg, .005 CFM
Pitot Leak Check: ok

Impinger Volume

	Initial	Final	Net Gain
Train A	[illegible]	232	132
	[illegible]	1[illegible]	10
	[illegible]	[illegible]	1
Train B	[illegible]	265	165
	[illegible]	1[illegible]	10
	[illegible]	0	0
		Silica Gel	
A	618.5	6[illegible]2	
B	6[illegible]	6520	

Total Volume

Probe Length and Type 5 ft TFE
Nozzel Size & I.D. .3515
Pitot Coefficient & I.D. .825
Assumed Moisture
Molecular Weight, Dry, (M_d)
Meter Box Number AFT 14 LG (MOD)
Meter Coefficient
α Factor
K =
$K(Nd)^4$ = ___ x (___)^4 = ___
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right) (P)$

Traverse Point Number	Sampling Time, min	Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft^3	Velocity Head (ΔP_s), in. H_2O	Rotometer Desired	Rotometer Actual	Temperature °F Stack	Probe	Impinger	Orifice Δ H	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
			Init. 571.150			29.5									
1.6	:40	131	572.060	1.0		26	160	264	70°	.96	241	81	80	8"	
	1:45	1:05	573.020	.30		15.7	152	267	70°	.33	242	81	80	3"	
1.5	:43	138	573.895	.70		24.6	159	265	70°	.70	255	81	80	6"	
	1:15	:32	574.300	.25		14.2	152	263	70°	.25	255	81	81		
1.4	:43	143	575.110	.60		22.7	162	263	72°	.60	260	81	81	5"	
	1:36	:53	575.840	.30		15.7	154	266	72°	.33	261	81	81	3"	
1.3	:48	203	576.830	.70		24.6	156	265	70°	.70	271	83	82		
	:48	0	576.830	NT											
AVG															

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REV 2 1-85

Comments:

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft³ Initl.	Velocity Head (ΔP_s), in. H_2O	Reformer Temp. Desired	Reformer Temp. Actual	Temperature of Stack	Temperature of Probe	Temperature of Impinger	Orifice ΔH	Temperature of Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
1.2	:41 / 211	577.745	.90		28.0	160	264	70°	.88	273	83	83	7"	
	1:38 / :57	578.660	.40		18.3	151	265	70°	.43	273	83	82	3"	
1.1	:41 / 217	579.725	1.5		36.5	160	263	70°	1.2	273	83	82	10.5"	
	1:13 / :32	580.320	.50		20.6	153	263	70°	.51	273	83	82	4"	
2.6	:42 / 224	581.420	1.5		36.5	158	263	70°	1.2	273	84	83	10."	
	:59 / :17	581.725	.50		20.6	151	263	70°	.53	273	84	83		
2.5	:41 / 230	582.665	1.0		29.5	162	266	70°	.94	273	84	83	8"	
	1:25 / :44	583.295	.30		15.7	153	263	70°	.34	273	84	83	3"	
2.4	:50 / 236	584.585	1.5		36.5	161	264	70°	1.2	270	84	83	11"	
	:50 / 0	584.585	NT											
2.3	:42 / 242	585.700	1.5		36.5	160	265	70°	1.2	271	84	84		
	1:43 / 1:01	586.685	.40		18.3	153	263	70°	.43	271	84	84	3.5"	
2.2	:41 / 248	587.740	1.5		36.5	160	263	70°	1.2	271	84	84	10.5"	
	1:17 / :36	588.390	.50		20.6	154	263	70°	.48	271	85	84	4"	
2.1	:41 / 254	589.455	1.5		36.5	161	265	70°	1.2	270	85	84	10.5"	
	1:36 / :55	590.425	.50		20.6	154	263	70°	.51	270	85	84	4"	
AUG.														

REV 2 7-85

Run No. 13.3 Date 10-10-85 Sampling Location HCGS - TEST GAS

US STEEL - CLAIRTON, PA

Comments:

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft³ Init.	Velocity Head (Δp), in. H_2O	Rotameter Desired	Rotameter Actual	Temperature °F Stack	Probe	Impinger	Orifice ΔH	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta p}$
2.6	:41 / 300	591.355	1.0		29.5	160	263	72°	.95	270	85	84	8"	
	:52 / :11	591.525	.30		15.7	151	265	72°	.36	270	85	84		
3.5	:42 / 307	592.490	1.0		29.5	162	265	72°	.96	271	85	84	8"	
	1:20 / :38	593.100	.40		18.3	150	265	72°	.43	271	85	84	3.5"	
3.4	:49 / 313	594.080	.70		24.6	169	264	72°	.71	269	86	85	6"	
	:49 / 0	~~594.080~~	NT											
3.3	:40 / 325	594.900	.70		24.6	161	263	74°	.71	269	86	85	6"	
	1:36 / :56	595.645	.25		14.2	151	264	74°	.28	269	86	85	3"	
3.2	:39 / 331	596.435	.80		26.3	160	264	74°	.77	270	87	85	7"	
	1:15 / :36	596.935	.30		15.7	152	264	74°	.28	270	87	86		
3.1	:42 / 337	597.885	1.0		29.5	160	264	74°	.95	270	87	86	8"	
	:42 / 0	597.885	NT											
4.6	:41 / 343	598.775	.70		24.6	158	265	74°	.72	270	87	86	6"	
	1:04 / :23	599.085	.25		14.2	151	265	74°	.29	270	87	87		
4.5	:43 / 348	~~600~~ 599.980	.60		22.7	161	263	74°	.59	270	87	87	5"	
	1:32 / :49	600.505	.25		14.2	152	263	74°	.25	270	87	87	25"	
AUG.														

REV. 2. 7-85

Run No. 13.3 Date 10-10-85 Sampling Location HORSE TEST CAR

U.S. STEEL - CLAIRTON, PA

Comments:

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft³ Init.	Velocity Head (P_v), in. H_2O	Rotameter Desired	Rotameter Actual	Rotameter Actual	Temperature °F Probe	Temperature °F Impinger	Temperature °F Orifice Δ H	Temperature °F Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
4.4	:41 355	601.440	2.10		29.5	158	264	76°	.95	269	88	87	7.5	
	:57 :16	601.700	.90		18.3	150	264	76°	.45	269	88	87		
4.3	:43 359	602.820	1.5		36.5	162	264	74°	1.2	269	88	87	11"	
	1:23 :40	603.525	.50		20.6	152	264	74°	.49	269	88	88	4"	
4.2	:42 406	604.625	1.5		36.5	162	264	74	1.2	269	88	88	11"	
	:47 0	604.625	NT											
4.1	:44 410	605.645	1.0		29.5	160	264	74°	.96	269	89	88	8"	
	1:49 1:05	606.690	.40		18.3	151	264	74°	.45	269	89	88	3.5"	
		purge to 632.390												
AVG.														

RF 2 7-85

Run No. 13.3 Date 10-10-85 Sampling Location HCQC - TEST CAR

US STEEL - CLARITON, PA

Comments:

APPENDIX E

DATA REDUCTION

EVT Coke Quench Car Tests RGP06.27.85 File: DAT 1301

FIELD DATA

Plant	USS - Clairton, PA
Date	10-09-85
Car No.	H-3-6
Battery No.	7,8 & 9
Sample Location	HCQC - Test Car
Sample Type	M-5
Run Number	13.1
Operator	Smith & Milburn
No. of Ovens Tested	24
No. of Ovens Tested/hr	9.2
Coke Prd'n Rate, tons/oven	11
Ambient Temp, deg F	75
Barometric Pressure, in Hg	29.54
Static Pressure, in H2O	-0.55
Stack Area, ft2	32.125
Filter Type	RA934AH
Top Filter Number	RA102G-083
Bottom Filter Number	N/A
Probe Length & Type	5 ft - TFE Lined
Nozzle Size	0.3515
Pitot Coefficient	0.825
Meter Box Number	APT 14 LG Mod
DGM Coeff's A1	0.0025
A2	1.0253
A3	0.0079
Orfice Coeff's B	0.4754
A	0.3949
Cal Press, in Hg	30

	in Hg	CFM
Leak Check Initial	19	0.011
Final	17	0.010

Water Volume:

Location	Initial	Final	Net Gain
Imp A1	100	255	155
Imp A2	100	110	10
Imp A3	0	2	2
Sil Gel A	614	624.5	10.5
Imp B1	100	255	155
Imp B2	100	110	10
Imp B3	0	2	2
Sil Gel B	636.8	647	10.2
Total Volume			354.7

Combined Impinger pH 3.2

	Point No.	Oven No.	Start Time	Sample Time sec Total	Sample Time sec DGM Start	Gas Metr ft3	Rotometer	Orifice del P in. WC
						457.465		
P	1.6	B-18/8	3:20	80	42	458.500	32.4	1.10
T					38	459.180	20.6	0.54
P	1.5	B-18/9	3:26	100	42	459.970	20.6	0.55
T					58	460.630	12.7	0.21
P	1.4	A-18/7	3:35	61	43	461.475	23.6	0.70
T					18	461.715	14.2	0.29
P	1.3	A-18/8	3:40	94	43	462.640	26.3	0.83
T					51	463.375	15.7	0.35
P	1.2	B-18/7	3:47	52	42	464.290	26.3	0.85
T					10	464.440	15.7	0.35
P	1.1	A-20/9	3:52	111	41	465.520	36.5	1.30
T					70	466.780	20.6	0.54
P	2.6	B-20/8	3:59	81	43	467.925	36.5	1.30
T					38	468.610	20.6	0.53
P	2.5	B-20/9	4:05	99	42	469.650	32.4	1.15
T					57	470.665	15.7	0.33
P	2.4	A-20/7	4:11	61	42	471.560	36.5	1.30
T					19	471.915	20.6	0.51
P	2.3	A-20/8	4:17	85	42	473.050	38.0	1.35
T					43	473.945	24.6	0.72
P	2.2	B-20/7	4:32	53	42	474.970	29.5	1.00
T					11	475.150	20.6	0.54
P	2.1	A-22/9	4:39	106	43	476.285	36.5	1.25
T					63	477.345	18.3	0.45
P	3.6	B-22/8	4:46	89	42	478.210	29.5	0.99
T					47	479.150	20.6	0.53
P	3.5	B-22/9	4:53	105	42	480.100	28.0	0.94
T					63	481.120	18.3	0.43
P	3.4	A-22/7	5:01	44	44	482.055	28.0	0.94
T					0	482.055		
P	3.3	A-22/8	5:06	94	42	483.035	29.5	1.00
T					52	483.880	18.3	0.44
P	3.2	B-22/7	5:13	48	48	484.925	26.3	0.85
T					0	484.925		
P	3.1	A-24/9	5:18	108	43	485.920	29.5	1.00
T					65	486.975	18.3	0.44
P	4.6	B-24/8	5:26	76	44	487.710	22.7	0.62
T					32	488.225	14.7	0.26
P	4.5	B-24/9	5:32	99	43	488.970	20.6	0.53
T					56	489.710	14.7	0.27
P	4.4	A-24/7	5:38	61	42	490.510	22.7	0.63
T					19	490.770	15.7	0.34
P	4.3	A-24/8	5:43	84	43	491.880	36.5	1.30
T					41	492.705	24.6	0.73
P	4.2	B-24/7	5:50	48	48	493.960	36.5	1.30
T					0	493.960		
P	4.1	A-26/9	5:57	90	42	494.960	32.4	1.10
T					48	495.805	20.6	0.52
	Total	(Time in minutes)			32.15	38.34		
	Push				17.17	23.380	File: DAT	1301
	Travel				14.98	14.960	Page 2 of 8	

	Point No.	Temperature, deg F						
		Stack	Probe	Oven	Imping A	Imping B	GM In	GM Out
P	1.6	159	272	275	72	72	85	84
T		153	275	275	72	72	86	84
P	1.5	160	271	272	72	72	86	85
T		151	272	272	72	72	86	85
P	1.4	158	270	272	72	72	86	85
T		152	273	272	72	72	86	85
P	1.3	160	271	270	72	72	86	85
T		153	271	270	72	72	87	85
P	1.2	158	272	270	72	72	87	86
T		151	272	270	72	72	87	86
P	1.1	160	271	271	72	72	87	86
T		151	271	271	72	72	87	86
P	2.6	159	271	270	71	71	88	87
T		152	271	270	71	71	88	87
P	2.5	160	271	270	71	71	88	88
T		151	271	270	71	71	88	88
P	2.4	159	271	270	71	71	89	88
T		151	271	270	71	71	89	89
P	2.3	160	271	270	71	71	90	89
T		153	271	270	71	71	90	89
P	2.2	155	272	270	71	71	91	91
T		148	270	270	71	71	91	91
P	2.1	156	270	270	70	70	91	91
T		149	270	270	70	70	91	90
P	3.6	160	270	270	70	70	90	91
T		153	270	270	70	70	91	91
P	3.5	158	271	270	70	70	91	91
T		151	271	270	70	70	91	91
P	3.4	158	272	270	70	70	92	92
T								
P	3.3	161	270	270	70	70	92	93
T		152	272	270	70	70	92	93
P	3.2	158	270	270	70	70	93	93
T								
P	3.1	159	270	270	70	70	94	94
T		152	270	270	70	70	94	94
P	4.6	158	270	270	70	70	94	95
T		150	270	270	70	70	94	95
P	4.5	159	270	270	70	70	95	95
T		150	270	270	70	70	95	95
P	4.4	158	270	270	70	70	95	95
T		151	270	270	70	70	95	95
P	4.3	161	270	270	70	70	95	95
T		153	270	270	70	70	95	95
P	4.2	157	270	270	70	70	95	95
T								
P	4.1	158	270	270	70	70	96	96
T		150	270	270	70	70	96	96

P TW Avg 159
T TW Avg 151

	Point No.	Pump Vac in Hg	Vel Head in H2O	Sqrt del P	Duct Vel fps	Sep P In in H2O	Opacity > 20%	Seconds > 20%
P	1.6	8.0	1.20	1.10	69.72		10	0.0
T		4.0	0.50	0.71	44.79		0	0.0
P	1.5	4.0	0.50	0.71	45.04		5	0.0
T		2.0	0.20	0.45	28.28		0	0.0
P	1.4	5.0	0.65	0.81	51.27		5	0.0
T			0.25	0.50	31.64		0	0.0
P	1.3	6.0	0.80	0.89	56.97		5	0.0
T		3.0	0.30	0.55	34.69		0	0.0
P	1.2	6.0	0.80	0.89	56.88		0	0.0
T		2.5	0.30	0.55	34.64		0	0.0
P	1.1	10.0	1.50	1.22	78.02		0	0.0
T		4.0	0.50	0.71	44.71		0	0.0
P	2.6	10.0	1.50	1.22	77.95		10	0.0
T		4.0	0.50	0.71	44.75		0	0.0
P	2.5	8.5	1.20	1.10	69.78		0	0.0
T		2.5	0.30	0.55	34.64		0	0.0
P	2.4	10.0	1.50	1.22	77.95		15	0.0
T			0.50	0.71	44.71		5	0.0
P	2.3	11.0	1.80	1.34	85.46		5	0.0
T		5.0	0.70	0.84	52.99		0	0.0
P	2.2	7.0	1.00	1.00	63.44		5	0.0
T			0.50	0.71	44.60		0	0.0
P	2.1	10.0	1.50	1.22	77.76		0	0.0
T		3.0	0.40	0.63	39.93		0	0.0
P	3.6	7.5	1.00	1.00	63.70		10	0.0
T		4.0	0.50	0.71	44.79		0	0.0
P	3.5	7.0	0.90	0.95	60.33		0	0.0
T		3.0	0.40	0.63	39.99		0	0.0
P	3.4	7.0	0.90	0.95	60.33		15	0.0
T				0.00	0.00		0	0.0
P	3.3	7.5	1.00	1.00	63.75		0	0.0
T		3.5	0.40	0.63	40.03		0	0.0
P	3.2	6.0	0.80	0.89	56.88		10	0.0
T				0.00	0.00		0	0.0
P	3.1	7.0	1.00	1.00	63.65		0	0.0
T		3.0	0.40	0.63	40.03		0	0.0
P	4.6	5.0	0.60	0.77	49.26		10	0.0
T		2.0	0.20	0.45	28.26		0	0.0
P	4.5	4.5	0.50	0.71	45.01		0	0.0
T		2.0	0.20	0.45	28.26		0	0.0
P	4.4	5.0	0.60	0.77	49.26		5	0.0
T			0.30	0.55	34.64		0	0.0
P	4.3	10.0	1.50	1.22	78.08		0	0.0
T		5.5	0.70	0.84	52.99		0	0.0
P	4.2	10.0	1.50	1.22	77.83		5	0.0
T				0.00	0.00		0	0.0
P	4.1	9.0	1.20	1.10	69.67		0	0.0
T		4.0	0.50	0.71	44.68		0	0.0
P TW Avg				1.01				
T TW Avg				0.63				

	Point No.	Separator P, in. WC	Annubar in. WC	Tank T deg F	Jet Flow gpm	Jet P psig	Jet Temp deg F	Gas T In deg F
P	1.6			420	430	300	396	
T				420	170	290	396	
P	1.5			420	430	290	396	
T				420	170	290	396	
P	1.4			420	430	310	408	
T				420	170	310	408	
P	1.3			420	430	310	408	
T				420	170	310	408	
P	1.2			420	430	310	408	
T				420	170	310	408	
P	1.1			420	430	310	408	
T				420	170	310	408	
P	2.6			420	430	310	408	
T				420	170	310	408	
P	2.5			432	430	310	420	
T				432	170	310	420	
P	2.4			432	430	320	420	
T				432	170	320	420	
P	2.3			432	430	320	420	
T				432	170	310	420	
P	2.2			432	430	320	408	
T				432	170	320	408	
P	2.1			432	430	320	408	
T				432	170	320	408	
P	3.6			432	430	320	408	
T				432	170	320	408	
P	3.5			432	430	320	420	
T				432	170	310	420	
P	3.4			432	430	320	420	
T				432	170	320	420	
P	3.3			432	430	320	420	
T				432	170	320	420	
P	3.2			432	430	320	408	
T				432	170	320	420	
P	3.1			432	430	330	420	
T				432	170	320	420	
P	4.6			432	430	320	420	
T				432	170	320	420	
P	4.5			432	430	330	420	
T				432	170	320	420	
P	4.4			432	430	330	420	
T				432	170	330	420	
P	4.3			432	430	330	420	
T				432	170	320	420	
P	4.2			432	430	330	420	
T				432	170	320	420	
P	4.1			432	430	330	420	
T				432	170	320	420	
P TW Avg			0.00	429	430	318	414	0
T TW Avg			0.00		170	313	413	0

LABORATORY DATA

Orsat Analysis
Operator - Milburn

Run	1		2		3		Avg
Gas	Act %	Net %	Act %	Net %	Act %	Net %	Net %
CO2	1.0	1.0	1.0	1.0	1.0	1.0	1.0
O2	21.0	20.0	21.0	20.0	21.0	20.0	20.0
CO	21.0	0.0	21.0	0.0	21.0	0.0	0.0
N2	100.0	79.0	100.0	79.0	100.0	79.0	79.0
Molecular Weight, Dry			28.96				

Particulate Analysis

Front-half Filter Dry Catch, mg	16.75
Blank Filter Catch, mg	0.00
Front-half Aqueous Wash, mg	
Filterable	3.35
Non-filterable	2.68
Front-half Acetone Wash, mg	5.62
Impinger Catch, mg	
Filterable	1.75
Non-filterable	39.85
Back-half Acetone rinse, mg	3.10
Total Front-half Filterable, mg	20.10
Total Front-half Nonfilterable, mg	8.30
Total Front-half, mg	28.40
Total Back-half Filterable, mg	1.75
Total Pennsylvania DER Mass, mg	30.15
Total Back-half Solubles, mg	42.95

CALCULATIONS

Standard Temp, deg F	68
Standard Press, in Hg	29.92
Barometric Press, in Hg	29.54
Stack Press, in Hg	29.50
Vol of H2O Std, dscf	16.696
M-5 Stack Moist. Content, %	29.52
Sat Stack Moist. Content, %	29.14
Stack Moist. Cont. Used, %	29.14
Molecular Weight, Dry	28.96
Molecular Weight, Wet	25.77
Nozzle Dia, in	0.352
X-Area of Stack, ft2	32.125

	Push	Travel	Total
Time-avg Stack Temp, deg F	159	151	155
Meter Volume Corr, ft3	24.266	15.494	39.760
Meter Volume Std, dscf	24.326	15.533	39.859
Vol of H2O Std, dscf	10.004	6.388	16.392
Sample Time, min	17.17	14.98	32.15
Stack Vel, fps	64.48	39.75	
Percent Isokinetic, %	91	107	
Stack Gas Vol, acfm	124287	76614	
Stack Gas Vol, dscfm	74102	46227	
Stack Gas Density, lb/ft3	0.0563	0.0570	
DER Part. Emission Conc., gr/dscf		0.0117	
DER Part. Emission Rate, lb/ton coke		0.0124	
DER Part. Emission Rate, lb/hr		1.25	
Front-half Part. Conc., gr/dscf		0.0110	
Front-half Part. Rate, lb/ton coke		0.0117	
Front-half Part. Rate, lb/hr		1.18	
Back-half Filt. Conc., gr/dscf		0.0007	
Back-half Filt. Rate, lb/ton coke		0.0007	
Back-half Filt. Rate, lb/hr		0.07	
Back-half Soluble Conc., gr/dscf		0.0166	
Back-half Soluble Rate, lb/ton coke		0.0177	
Back-half Soluble Rate, lb/hr		1.78	

DUCT VELOCITIES AT SAMPLING PLANE

Push

Position	1	2	3	4
6	70	78	64	49
5	45	70	60	45
4	51	78	60	49
3	57	85	64	78
2	57	63	57	78
1	78	78	64	70

Position

Travel

Position	1	2	3	4
6	45	45	45	28
5	28	35	40	28
4	32	45	0	35
3	35	53	40	53
2	35	45	0	0
1	45	40	40	45

Position

EVT Coke Quench Car Tests RGP06.27.85 File: DAT 1302

FIELD DATA

Plant	USS - Clairton, PA
Date	10-10-85
Car No.	H-3-6
Battery No.	7,8 & 9
Sample Location	HCQC - Test Car
Sample Type	M-5
Run Number	13.2
Operator	Smith & Milburn
No. of Ovens Tested	24
No. of Ovens Tested/hr	10.6
Coke Prd'n Rate, tons/oven	11
Ambient Temp, deg F	60
Barometric Pressure, in Hg	29.41
Static Pressure, in H2O	-0.55
Stack Area, ft2	32.125
Filter Type	RA934AH
Top Filter Number	RA102G-084
Bottom Filter Number	N/A
Probe Length & Type	5 ft - TFE Lined
Nozzle Size	0.3515
Pitot Coefficient	0.825
Meter Box Number	APT 14 LG Mod
DGM Coeff's A1	0.0025
A2	1.0253
A3	0.0079
Orfice Coeff's B	0.4754
A	0.3949
Cal Press, in Hg	30

	in Hg	CFM
Leak Check Initial	15	0.007
Final	15	0.005

Water Volume:

Location	Initial	Final	Net Gain
Imp A1	100	205	105
Imp A2	100	105	5
Imp A3	0	1	1
Sil Gel A	611.7	618.5	6.8
Imp B1	100	310	210
Imp B2	100	120	20
Imp B3	0	2	2
Sil Gel B	635	645	10
Total Volume			359.8

Combined Impinger pH 4.0

	Point No.	Oven No.	Start Time	Sample Time sec Total	Sample Time sec DGM Start	Gas Metr ft3	Rotometer	Orifice del P in. WC
						518.980		
P	1.6	B-10/7	9:04	53	42	519.975	29.5	0.97
T					11	520.160	17.1	0.42
P	1.5	A-12/9	9:10	110	35	520.770	19.5	0.47
T					75	521.825	15.7	0.35
P	1.4	B-12/8	9:16	80	42	522.675	24.6	0.69
T					38	523.210	15.7	0.32
P	1.3	B-12/9	9:22	99	42	524.110	26.3	0.77
T					57	525.000	17.1	0.40
P	1.2	A-12/7	9:28	60	42	525.975	29.5	0.94
T					18	526.290	18.3	0.46
P	1.1	A-12/8	9:34	93	42	527.400	36.5	1.20
T					51	528.410	22.7	0.61
P	2.6	B-12/7	9:40	53	42	529.535	36.5	1.20
T					11	529.755	20.6	0.49
P	2.5	A-14/9	9:46	109	39	530.770	36.5	1.20
T					70	531.995	19.5	0.48
P	2.4	B-14/8	9:52	80	45	533.055	36.5	1.20
T					35	533.790	19.5	0.45
P	2.3	B-14/9	9:58	97	40	534.845	36.5	1.20
T					57	535.825	19.5	0.45
P	2.2	A-14/7	10:04	60	42	536.840	32.4	1.05
T					18	537.145	18.3	0.41
P	2.1	A-14/8	10:10	91	42	538.220	36.5	1.20
T					49	539.105	20.6	0.50
P	3.6	B-14/7	10:15	53	43	540.110	36.5	1.20
T					10	540.410	20.6	0.49
P	3.5	A-16/9	10:21	105	33	541.165	28.0	0.88
T					72	542.270	17.1	0.39
P	3.4	B-16/8	10:27	78	40	543.135	26.3	0.78
T					38	543.655	15.7	0.30
P	3.3	B-16/9	10:33	101	41	544.500	25.4	0.73
T					60	545.345	15.7	0.31
P	3.2	A-16/7	10:39	58	41	546.275	28.0	0.88
T					17	546.550	18.3	0.41
P	3.1	A-16/8	10:44	81	39	547.460	29.5	0.92
T					42	548.105	17.1	0.39
P	4.6	B-16/7	10:51	47	40	549.020	28.0	0.87
T					7	549.130	14.2	0.30
P	4.5	A-18/9	10:57	40	40	549.845	20.6	0.51
T					0	549.845		
P	4.4	B-18/8	11:03	77	43	550.955	36.5	1.20
T					34	551.540	19.5	0.45
P	4.3	B-18/9	11:09	44	44	552.680	37.0	1.25
T					0	552.680		
P	4.2	A-18/7	11:16	59	41	553.770	36.5	1.20
T					18	554.110	20.6	0.52
P	4.1	A-18/8	11:21	82	41	555.190	36.5	1.20
T					41	555.920	20.6	0.51
	Total	(Time in minutes)			30.17	36.94		
	Push				16.35	23.145	File: DAT	1302
	Travel				13.82	13.795	Page 2 of 8	

	Point No.	Temperature, deg F						
		Stack	Probe	Oven	Imping A	Imping B	GM In	GM Out
P	1.6	158	262	270	52	52	58	56
T		151	263	270	52	52	58	56
P	1.5	159	264	270	52	52	58	57
T		149	264	270	52	52	58	57
P	1.4	161	262	270	52	52	60	57
T		151	262	270	52	52	60	57
P	1.3	161	264	270	52	52	60	58
T		152	264	270	52	52	60	58
P	1.2	159	264	270	54	54	61	59
T		151	264	270	54	54	61	59
P	1.1	161	264	270	54	54	62	60
T		151	264	270	54	54	62	60
P	2.6	158	262	270	54	54	63	61
T		149	262	270	54	54	63	61
P	2.5	160	262	270	54	54	64	62
T		150	263	270	54	54	64	62
P	2.4	159	262	270	56	56	65	63
T		151	262	270	56	56	65	63
P	2.3	160	263	270	56	56	66	64
T		150	263	268	56	56	66	64
P	2.2	160	263	269	60	60	68	65
T		152	263	269	60	60	68	65
P	2.1	161	263	270	60	60	67	65
T		152	263	270	60	60	68	65
P	3.6	158	265	270	60	60	68	66
T		151	262	270	60	60	68	66
P	3.5	160	263	270	60	60	69	67
T		148	263	270	60	60	69	67
P	3.4	159	263	269	60	60	69	67
T		150	263	269	60	60	69	68
P	3.3	161	263	270	60	60	70	68
T		152	263	270	60	60	70	68
P	3.2	158	263	270	60	60	70	69
T		151	263	270	60	60	70	69
P	3.1	162	264	269	60	60	71	70
T		152	264	269	60	60	71	70
P	4.6	158	264	269	60	60	72	70
T		150	264	269	60	60	72	71
P	4.5	153	264	269	60	60	72	72
T								
P	4.4	160	263	269	60	60	73	72
T		151	265	269	60	60	73	72
P	4.3	161	264	270	60	60	74	73
T								
P	4.2	158	264	270	62	62	75	74
T		152	264	270	62	62	75	74
P	4.1	160	262	269	62	62	75	74
T		152	264	269	62	62	75	74
P TW Avg		159						
T TW Avg		151						

	Point No.	Pump Vac in Hg	Vel Head in H2O	Sqrt del P	Duct Vel fps	Sep P In in H2O	Opacity > 20%	Seconds > 20%
P	1.6	7.5	1.00	1.00	63.79		10	0.0
T			0.35	0.59	37.53		5	0.0
P	1.5	4.0	0.45	0.67	42.83		0	0.0
T		3.0	0.30	0.55	34.69		0	0.0
P	1.4	6.0	0.70	0.84	53.50		15	0.0
T		3.0	0.30	0.55	34.74		15	0.0
P	1.3	6.5	0.80	0.89	57.20		0	0.0
T		3.0	0.35	0.59	37.56		15	0.0
P	1.2	7.5	1.00	1.00	63.85		15	0.0
T			0.40	0.63	40.12		10	0.0
P	1.1	11.0	1.50	1.22	78.32		10	0.0
T		5.0	0.60	0.77	49.13		25	4.8
P	2.6	11.0	1.50	1.22	78.13		5	0.0
T		4.0	0.50	0.71	44.78		0	0.0
P	2.5	11.0	1.50	1.22	78.26		0	0.0
T		4.0	0.45	0.67	42.52		5	0.0
P	2.4	11.0	1.50	1.22	78.19		20	1.6
T		4.0	0.45	0.67	42.55		20	1.3
P	2.3	11.0	1.50	1.22	78.26		15	0.0
T		4.0	0.45	0.67	42.52		20	2.5
P	2.2		1.20	1.10	70.00		10	0.0
T			0.40	0.63	40.15		10	0.0
P	2.1	11.0	1.50	1.22	78.32		5	0.0
T		4.0	0.50	0.71	44.89		25	4.3
P	3.6	11.0	1.50	1.22	78.13		20	1.9
T		4.0	0.50	0.71	44.85		5	0.0
P	3.5	7.0	0.90	0.95	60.62		0	0.0
T		3.0	0.35	0.59	37.43		5	0.0
P	3.4	6.5	0.80	0.89	57.10		5	0.0
T		3.0	0.30	0.55	34.71		15	0.0
P	3.3	6.5	0.75	0.87	55.38		5	0.0
T		3.0	0.30	0.55	34.77		20	1.2
P	3.2	7.5	0.90	0.95	60.52		10	0.0
T			0.40	0.63	40.12		15	0.0
P	3.1	8.0	1.00	1.00	64.00		0	0.0
T		3.0	0.35	0.59	37.56		25	4.0
P	4.6	7.0	0.90	0.95	60.52		10	0.0
T			0.25	0.50	31.69		0	0.0
P	4.5	4.5	0.50	0.71	44.93		10	0.0
T				0.00	0.00		5	0.0
P	4.4	11.0	1.50	1.22	78.26		10	0.0
T			0.45	0.67	42.55		10	0.0
P	4.3	11.5	1.55	1.24	79.62		5	0.0
T				0.00	0.00		10	0.0
P	4.2	10.0	1.50	1.22	78.13		15	0.0
T			0.50	0.71	44.89		15	0.0
P	4.1	11.0	1.50	1.22	78.26		0	0.0
T		4.5	0.50	0.71	44.89		20	1.5
P TW Avg				1.06				
T TW Avg				0.63				

	Point No.	Separator P, in. WC	Annubar in. WC	Tank T deg F	Jet Flow gpm	Jet P psig	Jet Temp deg F	Gas T In deg F
P	1.6			432	430	310	408	
T				432	170	300	408	
P	1.5			432	430	320	408	
T				432	170	320	408	
P	1.4			432	430	320	408	
T				432	170	310	408	
P	1.3			432	430	320	408	
T				432	170	320	408	
P	1.2			432	430	320	408	
T				432	170	310	408	
P	1.1			432	430	320	408	
T				432	170	320	408	
P	2.6			432	430	320	408	
T				432	170	310	408	
P	2.5			432	430	320	408	
T				432	170	320	408	
P	2.4			432	430	320	408	
T				432	170	310	408	
P	2.3			432	430	320	408	
T				432	170	320	408	
P	2.2			432	430	320	408	
T				432	170	310	408	
P	2.1			432	430	320	408	
T				432	170	320	408	
P	3.6			432	430	320	408	
T				432	170	310	408	
P	3.5			432	430	320	408	
T				432	170	320	408	
P	3.4			432	430	320	408	
T				432	170	310	408	
P	3.3			432	430	320	408	
T				432	170	320	408	
P	3.2			432	430	320	408	
T				432	170	310	408	
P	3.1			432	430	320	408	
T				432	170	320	408	
P	4.6			432	430	320	408	
T				432	170	320	408	
P	4.5			432	430	320	408	
T				432	170	320	408	
P	4.4			432	430	320	408	
T				432	170	310	408	
P	4.3			432	430	320	408	
T				432	170	320	408	
P	4.2			432	430	320	408	
T				432	170	310	408	
P	4.1			432	430	320	408	
T				432	170	320	408	
P TW Avg			0.00	432	430	320	408	0
T TW Avg			0.00		170	317	408	0

LABORATORY DATA

Orsat Analysis
Operator - Milburn

Run	1		2		3		Avg
Gas	Act %	Net %	Act %	Net %	Act %	Net %	Net %
CO2	0.8	0.8	0.8	0.8	0.8	0.8	0.8
O2	20.8	20.0	20.8	20.0	20.8	20.0	20.0
CO	20.8	0.0	20.8	0.0	20.8	0.0	0.0
N2	100.0	79.2	100.0	79.2	100.0	79.2	79.2
Molecular Weight, Dry			28.93				

Particulate Analysis

Front-half Filter Dry Catch, mg	28.48
Blank Filter Catch, mg	0.00
Front-half Aqueous Wash, mg	
Filterable	0.40
Non-filterable	3.75
Front-half Acetone Wash, mg	4.54
Impinger Catch, mg	
Filterable	0.65
Non-filterable	46.98
Back-half Acetone rinse, mg	2.88
Total Front-half Filterable, mg	28.88
Total Front-half Nonfilterable, mg	8.29
Total Front-half, mg	37.17
Total Back-half Filterable, mg	0.65
Total Pennsylvania DER Mass, mg	37.82
Total Back-half Solubles, mg	49.86

CALCULATIONS

Standard Temp, deg F	68
Standard Press, in Hg	29.92
Barometric Press, in Hg	29.41
Stack Press, in Hg	29.37
Vol of H2O Std, dscf	16.936
M-5 Stack Moist. Content, %	30.69
Sat Stack Moist. Content, %	29.35
Stack Moist. Cont. Used, %	29.35
Molecular Weight, Dry	28.93
Molecular Weight, Wet	25.72
Nozzle Dia, in	0.352
X-Area of Stack, ft2	32.125

	Push	Travel	Total
Time-avg Stack Temp, deg F	159	151	155
Meter Volume Corr, ft3	24.030	14.287	38.318
Meter Volume Std, dscf	23.984	14.260	38.244
Vol of H2O Std, dscf	9.966	5.925	15.891
Sample Time, min	16.35	13.82	30.17
Stack Vel, fps	67.68	39.97	
Percent Isokinetic, %	91	107	
Stack Gas Vol, acfm	130457	77034	
Stack Gas Vol, dscfm	77120	46189	
Stack Gas Density, lb/ft3	0.0559	0.0567	
DER Part. Emission Conc., gr/dscf		0.0153	
DER Part. Emission Rate, lb/ton coke		0.0157	
DER Part. Emission Rate, lb/hr		1.83	
Front-half Part. Conc., gr/dscf		0.0150	
Front-half Part. Rate, lb/ton coke		0.0154	
Front-half Part. Rate, lb/hr		1.80	
Back-half Filt. Conc., gr/dscf		0.0003	
Back-half Filt. Rate, lb/ton coke		0.0003	
Back-half Filt. Rate, lb/hr		0.03	
Back-half Soluble Conc., gr/dscf		0.0201	
Back-half Soluble Rate, lb/ton coke		0.0207	
Back-half Soluble Rate, lb/hr		2.41	

DUCT VELOCITIES AT SAMPLING PLANE

Push

Position	1	2	3	4
6	64	78	78	61
5	43	78	61	45
4	54	78	57	78
3	57	78	55	80
2	64	70	61	78
1	78	78	64	78

Position

Travel

Position	1	2	3	4
6	38	45	45	32
5	35	43	37	0
4	35	43	35	43
3	38	43	35	0
2	40	40	40	45
1	49	45	38	45

Position

EVT Coke Quench Car Tests RGP06.27.85 File: DAT 1303

FIELD DATA

Plant		USS - Clairton, PA
Date		10-10-85
Car No.		H-3-6
Battery No.		7,8 & 9
Sample Location		HCQC - Test Car
Sample Type		M-5
Run Number		13.3
Operator		Smith & Milburn
No. of Ovens Tested		24
No. of Ovens Tested/hr		9.1
Coke Prd'n Rate, tons/oven		11
Ambient Temp, deg F		65
Barometric Pressure, in Hg		29.36
Static Pressure, in H2O		-0.55
Stack Area, ft2		32.125
Filter Type		RA934AH
Top Filter Number		RA102G-085
Bottom Filter Number		N/A
Probe Length & Type		5 ft - TFE Lined
Nozzle Size		0.3515
Pitot Coefficient		0.825
Meter Box Number		APT 14 LG Mod
DGM Coeff's	A1	0.0025
	A2	1.0253
	A3	0.0079
Orfice Coeff's	B	0.4754
	A	0.3949
Cal Press, in Hg		30

	in Hg	CFM
Leak Check Initial	15	0.005
Final	13	0.009

Water Volume:

Location	Initial	Final	Net Gain
Imp A1	100	232	132
Imp A2	100	110	10
Imp A3	0	1	1
Sil Gel A	618.5	624.2	5.7
Imp B1	100	265	165
Imp B2	100	110	10
Imp B3	0	0	0
Sil Gel B	645	652	7
Total Volume			330.7

Combined Impinger pH 4.0

	Point No.	Oven No.	Start Time	Sample Time sec Total	DGM Start	Gas Metr ft3	Rotometer	Orifice del P in. WC
						571.150		
P	1.6	A-26/9	1:31	105	40	572.060	29.5	0.96
T					65	573.020	15.7	0.33
P	1.5	B-26/8	1:38	75	43	573.895	24.6	0.70
T					32	574.300	14.2	0.25
P	1.4	B-26/9	1:43	96	43	575.110	22.7	0.60
T					53	575.840	15.7	0.33
P	1.3	B-26/7	2:03	48	48	576.830	24.6	0.70
T					0	576.830		
P	1.2	A-28/9	2:11	98	41	577.745	28.0	0.88
T					57	578.660	18.3	0.43
P	1.1	B-28/8	2:17	73	41	579.725	36.5	1.20
T					32	580.320	20.6	0.51
P	2.6	A-28/7	2:24	59	42	581.420	36.5	1.20
T					17	581.725	20.6	0.53
P	2.5	A-28/8	2:30	85	41	582.665	29.5	0.94
T					44	583.295	15.7	0.34
P	2.4	B-28/7	2:36	50	50	584.585	36.5	1.20
T					0	584.585		
P	2.3	A-30/9	2:42	103	42	585.700	36.5	1.20
T					61	586.685	18.3	0.43
P	2.2	B-30/8	2:48	77	41	587.740	36.5	1.20
T					36	588.390	20.6	0.48
P	2.1	B-30/9	2:54	96	41	589.455	36.5	1.20
T					55	590.425	20.6	0.51
P	3.6	A-30/7	3:00	52	41	591.355	29.5	0.95
T					11	591.525	15.7	0.36
P	3.5	A-30/8	3:07	80	42	592.490	29.5	0.96
T					38	593.100	18.3	0.43
P	3.4	B-30/7	3:13	49	49	594.080	24.6	0.71
T					0	594.080		
P	3.3	B-1/9	3:25	96	40	594.900	24.6	0.71
T					56	595.645	14.2	0.28
P	3.2	C-1/8	3:31	75	39	596.435	26.3	0.77
T					36	596.935	15.7	0.28
P	3.1	C-1/9	3:37	42	42	597.885	29.5	0.95
T					0	597.885		
P	4.6	A-1/7	3:43	64	41	598.775	24.6	0.72
T					23	599.085	14.2	0.29
P	4.5	A-1/8	3:48	92	43	599.980	22.7	0.59
T					49	600.505	14.2	0.25
P	4.4	B-1/7	3:55	57	41	601.440	29.5	0.95
T					16	601.700	18.3	0.45
P	4.3	C-1/8	3:59	83	43	602.820	36.5	1.20
T					40	603.525	20.6	0.49
P	4.2	C-1/7	4:06	42	42	604.625	36.5	1.20
T					0	604.625		
P	4.1	A-3/9	4:10	109	44	605.645	29.5	0.96
T					65	606.690	18.3	0.45
	Total	(Time in minutes)			30.10	35.54		
	Push				17.00	23.525	File: DAT	1303
	Travel				13.10	12.015	Page 2 of 8	

	Point No.	Temperature, deg F						
		Stack	Probe	Oven	Imping A	Imping B	GM In	GM Out
P	1.6	160	264	241	70	70	81	80
T		152	267	242	70	70	81	80
P	1.5	159	265	255	70	70	81	80
T		152	263	255	70	70	81	81
P	1.4	162	263	260	72	72	81	81
T		154	266	261	72	72	81	81
P	1.3	156	265	271	70	70	83	82
T								
P	1.2	160	264	273	70	70	83	83
T		151	265	273	70	70	83	82
P	1.1	160	263	273	70	70	83	82
T		153	263	273	70	70	83	82
P	2.6	158	263	273	70	70	84	83
T		151	263	273	70	70	84	83
P	2.5	162	266	273	70	70	84	83
T		153	263	273	70	70	84	83
P	2.4	161	264	270	70	70	84	83
T								
P	2.3	160	265	271	70	70	84	84
T		153	263	271	70	70	84	84
P	2.2	160	263	271	70	70	84	84
T		154	263	271	70	70	85	84
P	2.1	161	265	270	70	70	85	84
T		154	263	270	70	70	85	84
P	3.6	160	263	270	72	72	85	84
T		151	265	270	72	72	85	84
P	3.5	162	265	271	72	72	85	84
T		150	265	271	72	72	85	84
P	3.4	161	264	269	72	72	86	85
T								
P	3.3	161	263	269	74	74	86	85
T		151	264	269	74	74	86	85
P	3.2	160	264	270	74	74	87	85
T		152	264	270	74	74	87	86
P	3.1	160	264	270	74	74	87	86
T								
P	4.6	158	265	270	74	74	87	86
T		151	265	270	74	74	87	87
P	4.5	161	263	270	74	74	87	87
T		152	263	270	74	74	87	87
P	4.4	158	264	269	76	76	88	87
T		150	264	269	76	76	88	87
P	4.3	162	264	269	74	74	88	87
T		152	264	269	74	74	88	88
P	4.2	162	264	269	74	74	88	88
T								
P	4.1	160	264	269	74	74	89	88
T		151	264	269	74	74	89	88

P TW Avg 160
T TW Avg 152

	Point No.	Pump Vac in Hg	Vel Head in H2O	Sqrt del P	Duct Vel fps	Sep P In in H2O	Opacity > 20%	Seconds > 20%
P	1.6	8.0	1.00	1.00	64.01		0	0.0
T		3.0	0.30	0.55	34.83		0	0.0
P	1.5	6.0	0.70	0.84	53.51		15	0.0
T			0.25	0.50	31.80		0	0.0
P	1.4	5.0	0.60	0.77	49.66		0	0.0
T		3.0	0.30	0.55	34.89		5	0.0
P	1.3		0.70	0.84	53.38		55	3.5
T				0.00	0.00		15	0.0
P	1.2	7.0	0.90	0.95	60.72		10	0.0
T		3.0	0.40	0.63	40.19		10	0.0
P	1.1	10.5	1.50	1.22	78.39		15	0.0
T		4.0	0.50	0.71	45.00		0	0.0
P	2.6	10.0	1.50	1.22	78.27		10	0.0
T			0.50	0.71	44.93		10	0.0
P	2.5	8.0	1.00	1.00	64.11		15	0.0
T		3.0	0.30	0.55	34.86		10	0.0
P	2.4	11.0	1.50	1.22	78.46		35	3.7
T				0.00	0.00		10	0.0
P	2.3		1.50	1.22	78.39		0	0.0
T		3.5	0.40	0.63	40.25		0	0.0
P	2.2	10.5	1.50	1.22	78.39		15	0.0
T		4.0	0.50	0.71	45.04		5	0.0
P	2.1	10.5	1.50	1.22	78.46		0	0.0
T		4.0	0.50	0.71	45.04		0	0.0
P	3.6	8.0	1.00	1.00	64.01		15	0.0
T			0.30	0.55	34.80		10	0.0
P	3.5	8.0	1.00	1.00	64.11		5	0.0
T		3.5	0.40	0.63	40.15		5	0.0
P	3.4	6.0	0.70	0.84	53.60		35	4.2
T				0.00	0.00		0	0.0
P	3.3	6.0	0.70	0.84	53.60		10	0.0
T		3.0	0.25	0.50	31.77		20	2.8
P	3.2	7.0	0.80	0.89	57.25		10	0.0
T			0.30	0.55	34.83		10	0.0
P	3.1	8.0	1.00	1.00	64.01		0	0.0
T				0.00	0.00		5	0.0
P	4.6	6.0	0.70	0.84	53.47		10	0.0
T			0.25	0.50	31.77		0	0.0
P	4.5	5.0	0.60	0.77	49.62		0	0.0
T		2.5	0.25	0.50	31.80		15	0.0
P	4.4	7.5	1.00	1.00	63.90		5	0.0
T			0.40	0.63	40.15		5	0.0
P	4.3	11.0	1.50	1.22	78.52		20	1.1
T		4.0	0.50	0.71	44.97		0	0.0
P	4.2	11.0	1.50	1.22	78.52		15	0.0
T				0.00	0.00		0	0.0
P	4.1	8.0	1.00	1.00	64.01		0	0.0
T		3.5	0.40	0.63	40.19		0	0.0
P TW Avg				1.01				
T TW Avg				0.60				

	Point No.	Separator P, in. WC	Annubar in. WC	Tank T deg F	Jet Flow gpm	Jet P psig	Jet Temp deg F	Gas T In deg F
P	1.6			423	430	320	408	
T				423	170	310	408	
P	1.5			423	430	320	408	
T				423	170	320	408	
P	1.4			423	430	320	408	
T				423	170	310	408	
P	1.3			423	430	310	408	
T				423	170	310	408	
P	1.2			423	430	310	408	
T				423	170	310	408	
P	1.1			423	430	310	408	
T				423	170	310	408	
P	2.6			423	430	310	408	
T				423	170	300	408	
P	2.5			423	430	310	408	
T				423	170	310	408	
P	2.4			423	430	310	408	
T				423	170	300	408	
P	2.3			423	430	310	408	
T				423	170	310	408	
P	2.2			423	430	310	408	
T				423	170	300	408	
P	2.1			423	430	310	408	
T				423	170	310	408	
P	3.6			423	430	310	408	
T				423	170	300	408	
P	3.5			423	430	310	408	
T				423	170	310	408	
P	3.4			423	430	310	408	
T				423	170	300	408	
P	3.3			423	430	310	408	
T				423	170	310	408	
P	3.2			423	430	320	408	
T				423	170	320	408	
P	3.1			423	430	320	408	
T				423	170	310	408	
P	4.6			423	430	320	408	
T				423	170	310	408	
P	4.5			423	430	320	408	
T				423	170	310	408	
P	4.4			423	430	320	408	
T				423	170	320	408	
P	4.3			423	430	320	408	
T				423	170	310	408	
P	4.2			423	430	320	408	
T				423	170	320	408	
P	4.1			423	430	320	408	
T				423	170	320	408	
P TW Avg			0.00	423	430	315	408	0
T TW Avg			0.00		170	311	408	0

LABORATORY DATA

Orsat Analysis
Operator - Milburm

Run	1		2		3		Avg
Gas	Act %	Net %	Act %	Net %	Act %	Net %	Net %
CO2	0.8	0.8	0.8	0.8	0.8	0.8	0.8
O2	20.8	20.0	20.8	20.0	20.8	20.0	20.0
CO	20.8	0.0	20.8	0.0	20.8	0.0	0.0
N2	100.0	79.2	100.0	79.2	100.0	79.2	79.2
Molecular Weight, Dry			28.93				

Particulate Analysis

Front-half Filter Dry Catch, mg	7.13
Blank Filter Catch, mg	0.00
Front-half Aqueous Wash, mg	
Filterable	2.15
Non-filterable	6.10
Front-half Acetone Wash, mg	4.78
Impinger Catch, mg	
Filterable	1.50
Non-filterable	26.12
Back-half Acetone rinse, mg	2.97
Total Front-half Filterable, mg	9.28
Total Front-half Nonfilterable, mg	10.88
Total Front-half, mg	20.16
Total Back-half Filterable, mg	1.50
Total Pennsylvania DER Mass, mg	21.66
Total Back-half Solubles, mg	29.09

CALCULATIONS

Standard Temp, deg F	68
Standard Press, in Hg	29.92
Barometric Press, in Hg	29.36
Stack Press, in Hg	29.32
Vol of H2O Std, dscf	15.566
M-5 Stack Moist. Content, %	29.77
Sat Stack Moist. Content, %	30.32
Stack Moist. Cont. Used, %	29.77
Molecular Weight, Dry	28.93
Molecular Weight, Wet	25.67
Nozzle Dia, in	0.352
X-Area of Stack, ft2	32.125

	Push	Travel	Total
Time-avg Stack Temp, deg F	160	152	157
Meter Volume Corr, ft3	24.420	12.439	36.859
Meter Volume Std, dscf	24.331	12.394	36.725
Vol of H2O Std, dscf	10.313	5.253	15.566
Sample Time, min	17.00	13.10	30.10
Stack Vel, fps	64.97	38.16	
Percent Isokinetic, %	93	103	
Stack Gas Vol, acfm	125224	73559	
Stack Gas Vol, dscfm	73375	43669	
Stack Gas Density, lb/ft3	0.0556	0.0564	
DER Part. Emission Conc., gr/dscf		0.0091	
DER Part. Emission Rate, lb/ton coke		0.0090	
DER Part. Emission Rate, lb/hr		0.89	
Front-half Part. Conc., gr/dscf		0.0085	
Front-half Part. Rate, lb/ton coke		0.0083	
Front-half Part. Rate, lb/hr		0.83	
Back-half Filt. Conc., gr/dscf		0.0006	
Back-half Filt. Rate, lb/ton coke		0.0006	
Back-half Filt. Rate, lb/hr		0.06	
Back-half Soluble Conc., gr/dscf		0.0122	
Back-half Soluble Rate, lb/ton coke		0.0120	
Back-half Soluble Rate, lb/hr		1.20	

DUCT VELOCITIES AT SAMPLING PLANE

Push

Position	1	2	3	4
6	64	78	64	53
5	54	64	64	50
4	50	78	54	64
3	53	78	54	79
2	61	78	57	79
1	78	78	64	64

Position

Travel

Position	1	2	3	4
6	35	45	35	32
5	32	35	40	32
4	35	0	0	40
3	0	40	32	45
2	40	45	35	0
1	45	45	0	40

Position