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Work Assignment 4

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Final Report

Determination of the Efficiency of a Mesh-Pad Mist Eliminator

Candidate Plant
Precision Machine and Hydraulics, Inc.
Worthington, West Virginia

Prepared for

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SECTION 1.0
INTRODUCTION

During the week of September 19, 1988, an emission measurement program was conducted at the Precision Machine and Hydraulics, Inc., plant in Worthington, West Virginia. The primary purpose of this program was to collect data to determine the efficiency of a mesh-pad mist eliminator. Based on this determination, it may be necessary to develop a regulatory alternative for this type of system.

The principal reason for selecting Precision Machine and Hydraulic was the plant's use of a mesh-pad mist eliminator containing two mesh pads to control chromic acid emissions from a plating tank. The capture and control system on the plating tank consists of a single-sided lateral hood ducted to the mesh-pad mist eliminator prior to ducting to the atmosphere. In order to assess the control efficiency of the system, hexavalent chromium (Cr^{+6}) emissions were measured at two locations along the duct. These locations are identified in Figure 1-1 as: 1) inlet to the mesh-pad mist eliminator and 2) outlet from the mesh-pad mist eliminator.

The emission samples were collected using the Modified Method 13B (MM13B) sample train. This method will be discussed in Section 4.0. The samples were analyzed for Cr^{+6} concentration using the diphenylcarbazide colorimetric method. This method will also be discussed later in Section 4.0.

The test was planned and conducted by the U.S. EPA, Emission Measurement Branch located in Research Triangle Park, North Carolina. Midwest Research Institute located in Raleigh, North Carolina was responsible for monitoring the process operation, and PEER Consultants, P.C., located in Dayton, Ohio provided analytical support and was responsible for the preparation of draft and final reports.

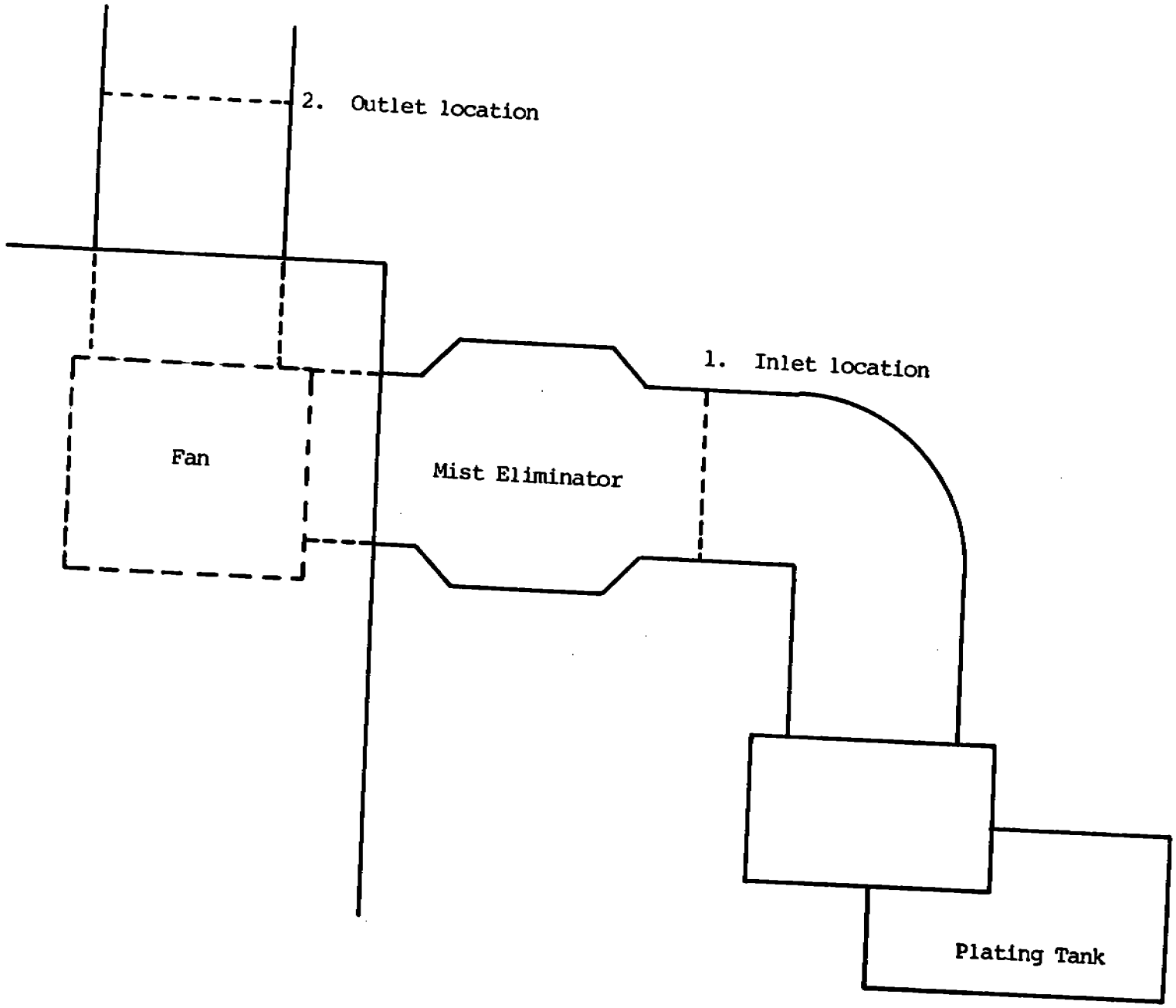


Figure 1.1. Location of sample points.

SECTION 2.0
PROCESS OPERATION

2.1 PROCESS DESCRIPTION

Precision Machine and Hydraulics, Inc. is a small job shop specializing in precision finishing of hydraulic cylinders. The plant currently operates one hard chromium plating tank. The tank is used to plate hydraulic cylinders which range in size from 5.1 to 28 cm (2.0 to 11.0 in) in diameter and 0.6 to 2.4 m (2.0 to 8.0 ft) in length. The plating tank operates approximately 8 hours/day, 5 days/week. Typical plating times range from 1.5 to 15.0 hours. Cylinders plated for more than 8 hours are plated over a 2-day period.

The plating tank is 2.4 m (8.0 ft) long, 0.76 m (2.5 ft) wide, and 2.7 m (9.0 ft) deep, and holds approximately 4,810 ℓ (1,270 gal) of plating solution. The plating solution contains chromic acid in a concentration of about 210 g/ℓ (28 oz/gal) of water. Sulfuric acid is used as a catalyst at a bath concentration of 2.1 g/ℓ (0.28 oz/gal). The temperature of the plating solution is maintained at about 54°C (130°F). The tank is divided into two plating cells. Each plating cell is equipped with a rectifier. The typical current and voltage applied to each cell ranges from 2,500 to 3,000 amperes and from 4.5 to 6.0 volts, respectively.

2.2 AIR POLLUTION CONTROL

The capture and control system on the plating tank consists of a single-sided lateral hood ducted to a mesh-pad mist eliminator. Figure 2-1 presents a side view of the capture and control system on the

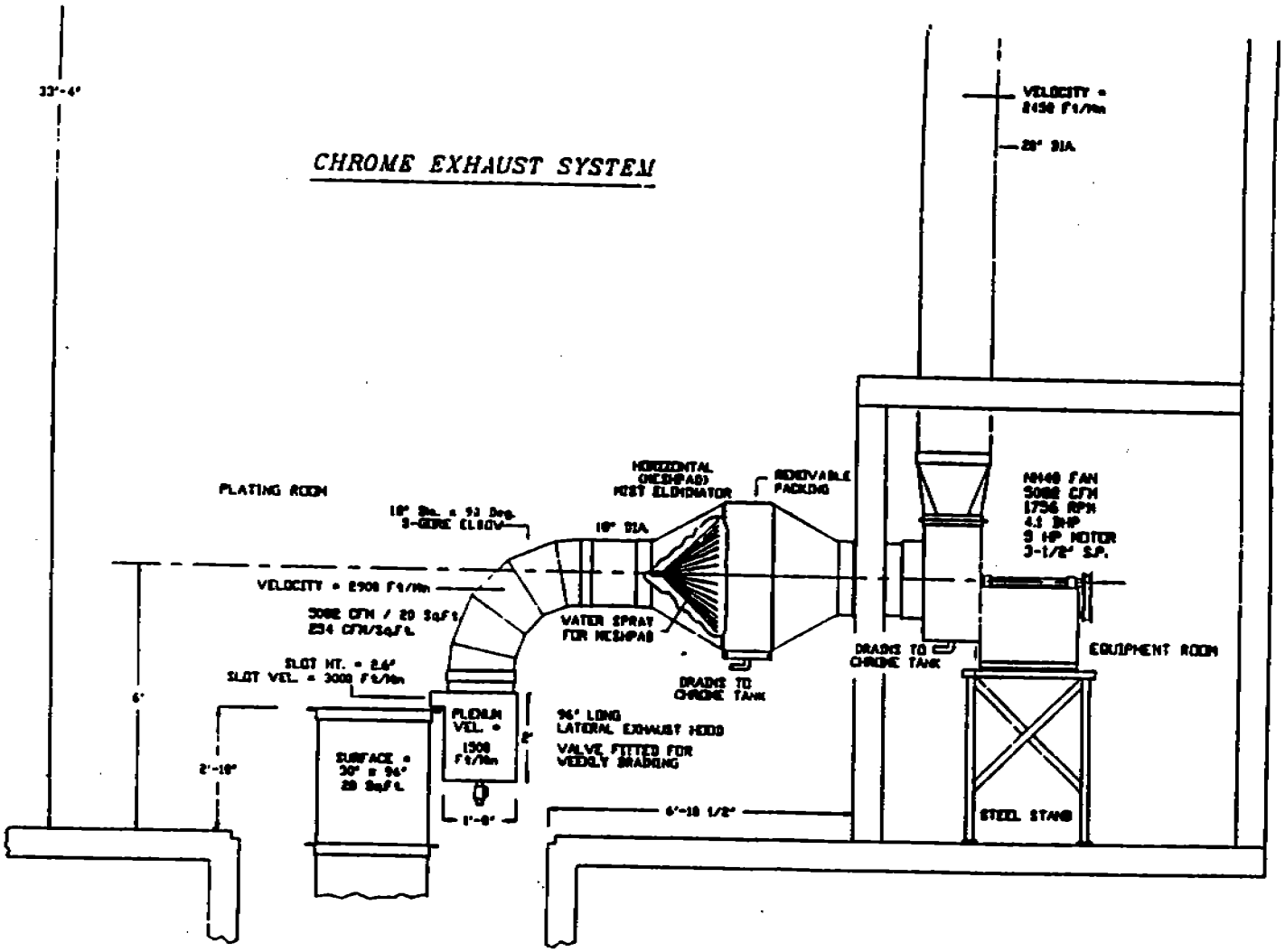


Figure 2-1. Side view of capture and control system at Precision Machine and Hydraulic, Inc., Worthington, West Virginia.

plating tank. The design airflow rate of the ventilation system is 140 cubic meters per minute (m^3/min) (5,100 cubic feet per minute [ft^3/min]). The actual measured flow rate is 125 m^3/min (4,430 ft^3/min).

The mesh-pad mist eliminator was fabricated and installed in May 1988 by ChromeTech, Inc., Bedford, Ohio. Figure 2-2 presents a detailed schematic of the mesh-pad mist eliminator. The unit has a design pressure drop of 0.62 kilopascal (kPa) (2.5 inches of water column [in w.c.]) at a velocity of 150 to 210 meters per minute (500 to 700 feet per minute).

Based on the static presure measured at the inlet and outlet of the mist eliminator, the pressure drop recorded during testing was 0.62 kPa (2.5 in. w.c.). The mist eliminator consists of two mesh pads spaced approximately 10 cm (4 in.) apart. Each mesh pad is 79 cm (31 in.) in diameter. The primary mesh pad at the inlet of the unit is 6.4 to 7.6 cm (2.5 to 3.0 in.) thick, and the secondary mesh pad at the outlet is 3.2 to 3.8 cm (1.25 to 1.5 in.) thick. Each mesh pad consists of layers of interlocked polypropylene threads. Each thread is 0.05 cm (0.0200 in.) in diameter. The thread count is 4.3 by 3.3 per square centimeter (28 by 21 per square inch) and the weave type is honeycomb.

The unit is equipped with two spray nozzles which are activated periodically to wash down the pads. One spray nozzle is located at the inlet of the unit prior to the primary mesh pad and the other spray nozzle is located at the outlet of the unit behind the secondary mesh pad. The first nozzle sprays into the primary mesh pad in the direction of airflow, and the second spray nozzle sprays into the secondary mesh pad counter to the airflow. The ventilation system is shut off and the spray nozzles are activated at the end of each day to wash down the mesh pads. During each washdown, the mesh pads are flooded with 38 ℓ (10 gal) of water at a pressure of 1.7 to 2.0 atmospheres (25 to 30 pounds per square inch). The washdown water drains from the bottom of the mesh-pad unit through a pipe directly to the plating tank. In addition, the unit has a removable cover that allows the mesh pads to be

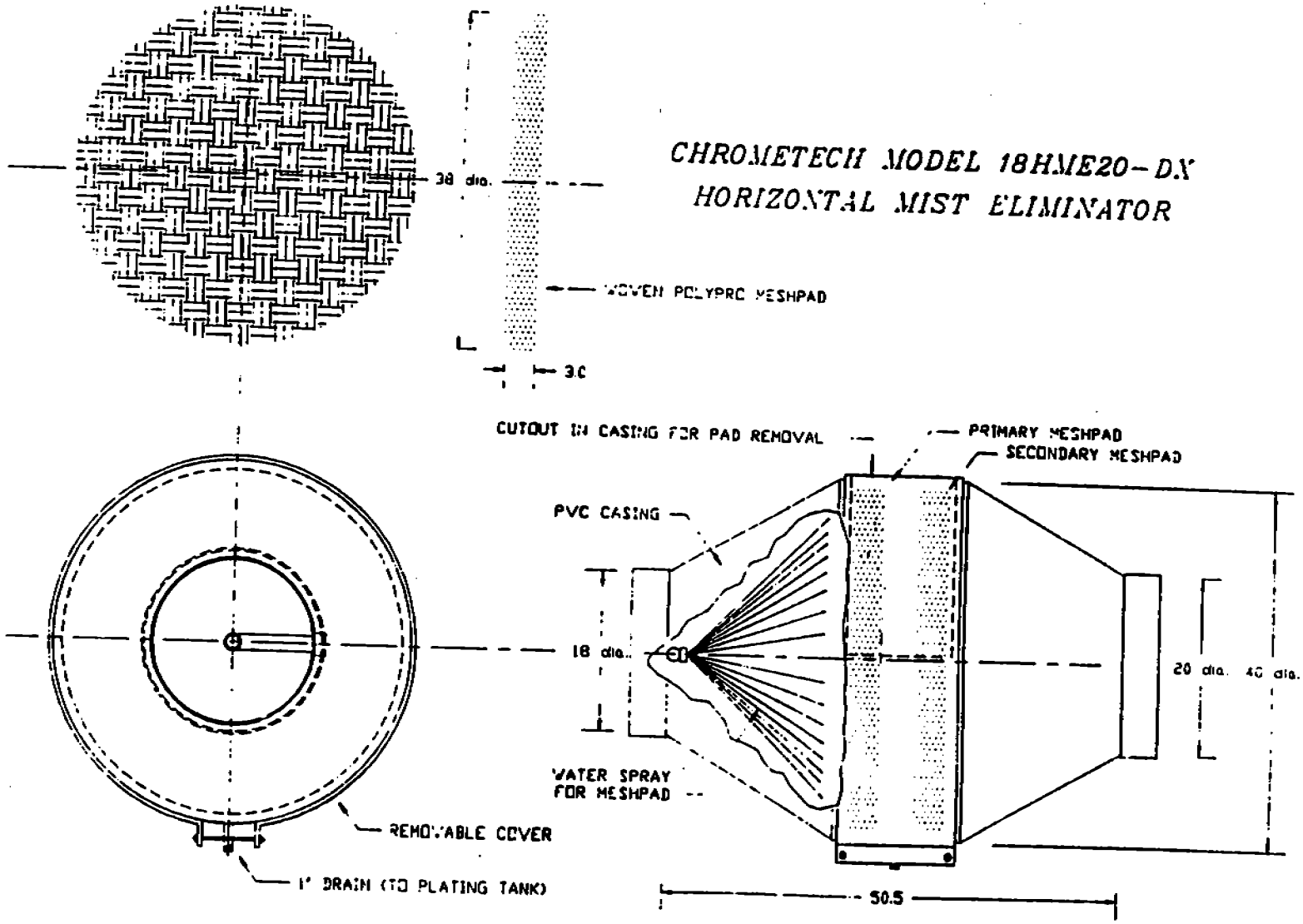


Figure 2-2. Cross-sectional view of mesh-pad mist eliminator at Precision Machine and Hydraulic, Inc., Worthington, West Virginia.

removed and cleaned by immersion in the rinse tank. Immersion cleaning is performed once a month.

2.3 PROCESS CONDITIONS DURING TESTING

Mass emission tests were conducted simultaneously at the inlet and outlet of the mist eliminator unit to characterize the performance of the control device in controlling chromic acid mist.

Process parameters recorded during each test run were plating solution temperature, operating voltage, and operating current. In addition, the number and surface area of parts plated during each test run was recorded. Process data sheets documenting the process parameters monitored during testing are presented in Appendix A. Average values for the operating parameters recorded for each test run are presented in Table 2-1. The process was operating normally during testing. The total current supplied to the tanks during each test run was calculated in terms of ampere-hours. A summary of the total current values is presented in Table 2-2.

Grab samples of the plating solution were taken during each test run to determine the Cr^{+6} concentration of the solution during emission testing. The Cr^{+6} concentrations of the grab samples are reported in Section 3 of this report.

The mesh pads were cleaned by immersion in the rinse tank prior to the first test run. The mist eliminator washdown system was activated at the end of test runs No. 1 and 5. The mesh pads were removed and cleaned using a water hose at the end of test run No. 3. No grab samples of the washdown water were obtained because the location of the drain pipe outlet was 25 cm (10 in.) below the surface of the plating solution.

Test run No. 1 was 3 hours in duration, and the four subsequent runs were each 2 hours in duration. Each test run was interrupted 20 to 30 minutes to change test ports.

TABLE 2-1. AVERAGE OPERATING PARAMETERS DURING MASS EMISSION TESTS

Run No.	Rectifier No.	Operating volatge, volts	Operating current, amperes	Operating temperature, °C (°F)	Surface area plated m^2 (ft^2)
1	1	4.6	2,800	56 (133)	1.4 (15.2)
	2	5.4	3,700		
2	1	4.7	2,000	56 (133)	1.3 (13.9)
	2	4.9	3,000		
3	1	4.7	1,500	56 (133)	1.3 (13.4)
	2	4.9	3,700		
4	1	4.7	1,200	55 (131)	1.1 (12.3)
	2	5.0	3,600		
5	1	4.9	1,300	56 (133)	1.1 (11.7)
	2	4.7	3,600		

TABLE 2-2. TOTAL CURRENT SUPPLIED TO PLATING TANK DURING MASS EMISSION TESTS

Run No.	Rectifier No.	Total current ampere-hours	
		Inlet	Outlet
1	1	9,236	9,236
	2	11,833	11,833
Total[a]		21,100	21,100
2	1	3,899	3,899
	2	6,101	6,101
Total[a]		10,000	10,000
3	1	3,003	3,003
	2	7,403	7,403
Total[a]		10,400	10,400
4	1	2,489	2,489
	2	7,130	7,130
Total[a]		9,600	9,600
5	1	2,601	2,601
	2	7,093	7,093
Total[a]		9,700	9,700

[a]Totals are rounded to nearest 100.

SECTION 3.0
SUMMARY OF RESULTS

INTRODUCTION

Five Modified Method 13B (MM13B) samples were collected at each sample location. All of the emission samples were analyzed on site for Cr^{+6} concentrations using the procedures outlined in the method entitled "Draft Method-Determination of Hexavalent Chromium in Dry Particulate Emissions from Stationary Sources". This analytical method is presented in Appendix D.

In addition to the emission samples, grab samples of the plating bath were composited during each MM13B run and analyzed using the same colorimetric procedures used for the emission samples. Table 3-1 presents a schedule of the activities during the test program. The results from the sampling program are presented in the remainder of this section.

HEXAVALENT CHROMIUM EMISSION RESULTS

Emission samples were collected isokinetically using a Method 13B sample train that had been modified by removing the glass fiber filter and placing 100 mℓ of 0.1N NaOH in each of the first two impingers. The impinger solutions were recovered into tared polyethylene sample bottles and the total volume of the recovered samples was determined gravimetrically. Following recovery of the samples, an aliquot of the solution was analyzed for Cr^{+6}. The following subsections present the flue gas data and analytical results for each sample location.

TABLE 3-1. SCHEDULE OF ACTIVITIES

Date (1988)	Sample Type	Run No.	Test Time (Minutes)	Parameter Measured
9/20	MM13B	I-1, O-1	192	Cr^{+6}
9/20	SM	O1 series		Cr^{+6}
9/20	SM	I1 series		Cr^{+6}
9/20	plating sol.	1		Cr^{+6}
9/21	MM13B	I-2, O-2	120	Cr^{+6}
9/21	SM	I2 series		Cr^{+6}
9/21	SM	O2 series		Cr^{+6}
9/21	plating sol.	2		Cr^{+6}
9/21	MM13B	I-3, O-3	120	Cr^{+6}
9/21	SM	I3 series		Cr^{+6}
9/21	SM	O3 series		Cr^{+6}
9/21	plating sol.	3		Cr^{+6}
9/22	MM13B	I-4, O-4	120	Cr^{+6}
9/22	SM	I4 series		Cr^{+6}
9/22	SM	O4 series		Cr^{+6}
9/22	plating sol.	4		Cr^{+6}
9/22	MM13B	I-5, O-5	120	Cr^{+6}
9/22	SM	I5 series		Cr^{+6}
9/22	SM	O5 series		Cr^{+6}
9/22	plating sol.	5		Cr^{+6}

Inlet to the Mesh-Pad Mist Eliminator

Modified Method 13B--

A summary of the flue gas conditions at this location are presented in Table 3-2. The volumetric flowrates were consistent and averaged 121 dry standard cubic meters per minute (dscmm), (4,273 dry standard cubic feet per minute, (dscfm)). The flue gas temperature averaged 24°C (76°F) and the moisture content averaged 1.64 percent. The flue gas was essentially ambient air and was assigned a dry molecular weight of 28.95 lb/lb mole. The isokinetic sampling rates were within the allowable limitations for these sample runs.

Prior to sampling, it was decided that the first MM13B run should be run at 8 minutes per point for a total sample time of 192 minutes. This sample time ensured the collection of a detectable concentration of Cr^{+6}. Following the analysis of the sample, it was determined that the sample time per point could be reduced to 5 minutes, for a total sample time of 120 minutes. The uncontrolled emissions as measured in each MM13B run were consistent and averaged 11.4 mg/dscm (0.005 gr/dscf). A summary of the MM13B sample volumes, analytical results and emission rates for this location is presented in Table 3-3.

Outlet from the Mist Eliminator

Modified Method 13B--

A summary of the flue gas conditions at this location are also presented in Table 3-2. The volumetric flowrates were consistent and averaged 118 dry standard cubic meters per minute (dscmm), (4,173 dry standard cubic feet per minute, (dscfm)). The flue gas temperature averaged 26°C (79°F) and the moisture content averaged 1.71 percent. The flue gas was essentially ambient air and was assigned a dry molecular weight of 28.95 lb/lb mole. The isokinetic sampling rates were within the allowable limitations for these sample runs.

TABLE 3-2. SUMMARY OF FLUE GAS CONDITIONS

Run No.	Date	Volumetric Flowrate dscm/min	dscf/min	Temperature °C	°F	% Moisture	% Isokinetic
I-1	9/20/88	118	4,157	27	82	1.54	98.5
O-1	9/20/88	117	4,144	29	85	1.59	97.6
I-2	9/21/88	125	4,429	22	72	1.59	98.9
O-2	9/21/88	118	4,177	24	75	1.67	99.6
I-3	9/21/88	119	4,194	24	75	1.24	99.2
O-3	9/21/88	118	4,152	26	78	1.70	99.8
I-4	9/22/88	123	4,343	22	71	1.69	99.9
O-4	9/22/88	120	4,224	23	74	1.75	100.1
I-5	9/22/88	120	4,235	27	80	1.92	100.1
O-5	9/22/88	118	4,167	28	83	1.85	100.6

TABLE 3-3. SUMMARY OF SAMPLE VOLUMES, ANALYTICAL RESULTS AND EMISSION RATES FOR THE MESH-PAD MIST ELIMINATOR INLET

Run No.	Stack dscfm	Volume Metered dscf	Total Mass Cr+6, mg	Concentration mg/dscm	Concentration gr/dscf	Emission Rates kg/hr	Emission Rates lb/hr
I-1	4157	165.672	34.012	7.2499	0.00317	0.0512	0.113
I-2	4429	110.820	32.794	10.4502	0.00457	0.0786	0.173
I-3	4194	105.286	35.798	12.0070	0.00525	0.0856	0.189
I-4	4393	109.801	43.325	13.9341	0.00609	0.1028	0.227
I-5	4235	107.227	40.564	13.3593	0.00584	0.0961	0.212

As was done for the inlet testing, it was decided that the first MM13B run should be conducted at 8 minutes per point for a total sample time of 192 minutes. This increased sample time ensured the collection of a detectable concentration of Cr^{+6}. Following the analysis of the sample, it was determined that the sample time per point could be reduced to 5 minutes for a total sample time of 120 minutes. The controlled emissions measured in each MM13B were consistent and averaged 0.03 mg/dscm (0.00001 gr/dscf). A summary of the MM13B sample volumes, analytical results and emission rates for this location are presented in Table 3-4.

The Cr^{+6} removal efficiencies for the system were consistent and averaged 99.7%. A summary of removal efficiencies for the system is presented in Table 3-5.

PLATING TANK SOLUTIONS

During each MM13B run, grab samples of the plating bath solution were collected and composited. The samples were analyzed for Cr^{+6} concentration. The results from these analyses are presented in Table 3-6.

SCREENING METHOD RESULTS

Screening method samples were taken at the inlet and outlet of the control device at the same time the Modified Method 13-B samples were taken. The screening method apparatus was the same as used at Roll Technology in August 1988. A piece of 1/8" I.D. Teflon tubing (24 inches long) followed by a 37 mm Millipore filter comprised the part of the train where the sample was collected. Approximately 10' of Tygon tubing connected the tubing-filter assembly to another Millipore filter followed by a hypodermic needle that was connected to a leakless vane pump by another short piece of Tygon tubing. This system was arranged in quadruplicate. This "Quad" probe assembly traversed the stack during the

TABLE 3-4. SUMMARY OF SAMPLE VOLUMES, ANALYTICAL RESULTS AND EMISSION RATES FOR THE MESH-PAD MIST ELIMINATOR OUTLET

Run No.	Stack dscfm	Volume Metered dscf	Total Mass Cr+6, mg	Concentration mg/dscm	Concentration gr/dscf	Emission Rates kg/hr	Emission Rates lb/hr
0-1	4144	174.537	0.2911	0.0589	0.00003	0.0004	0.0009
0-2	4177	112.193	0.1018	0.0320	0.00001	0.0002	0.0005
0-3	4152	111.821	0.1077	0.0340	0.00001	0.0002	0.0005
0-4	4224	114.023	0.0891	0.0276	0.00001	0.0002	0.0004
0-5	4167	113.046	0.0338	0.0106	0.000005	0.0001	0.0002

TABLE 3-5. SUMMARY OF Cr^{+6} REMOVAL EFFICIENCIES

Run No.	Cr^{+6} Emission Rate lb/hr	Cr^{+6} Removal Efficiency
I-1	0.113	
O-1	0.0009	99.2%
I-2	0.173	
O-2	0.0005	99.7%
I-3	0.189	
O-3	0.0005	99.7%
I-4	0.227	
O-4	0.0004	99.8%
I-5	0.212	
O-5	0.0002	99.9%
Average		99.7%

Run No.	Cr^{+6} Concentration (mg/m^3)	Cr^{+6} Removal Efficiency
I-1	7.2499	99.2%
O-1	.0589	
I-2	10.4502	99.7%
O-2	.0320	
I-3	12.0070	99.7%
O-3	.0340	
I-4	13.9508	99.8%
O-4	.0276	
I-5	13.3593	99.9%
O-5	.0106	
Average		99.7%

TABLE 3-6. SUMMARY OF PLATING SOLUTION ANALYTICAL RESULTS

Run No.	Cr^{+6} Concentration, μg/mℓ
Plating Solution	
I-1	97,128
I-2	101,724
I-3	102,279
I-4	104,818
I-5	102,001

regular test effort. Due to the size of the "Quad" probe assembly, it was not possible to sample all the points that the MM-13B trains sampled. Nine out of 12 points were sampled on each traverse. Total screening sample time was the same as the Modified Method 13B trains.

As has happened in the past, the outlet measurements were more reproducible than the inlet measurements. Inlet locations have usually been close to the plating tank and chromic acid globules may break loose from the duct walls and bias some of the samples high. Reproducility is much better at the outlet.

During this screening effort, it became apparent that if sampling is done at a constant rate for uniform time intervals, traversing the stack will always bias the results low, because the procedure does not correct sample volumes to account for velocity differences. Thus samples collected at low flow points will be sampled for too long while samples at high flow points will be too short.

Another problem that has become evident in the screening method is the determination of the volume of sample collected. A hypodermic needle in ambient air will give reproducible volumes. This principle is applied when hypodermic needles are used to check meter box specifications in the field. Whenever something (such as Tygon tubing) is placed in front of the needle, the volume changes. Furthermore, the ideal gas low cannot be used to determine volumes at other temperatures and pressures based on a set of conditions and data obtained in the lab. While it would be possible to develop the equations needed to theoretically determine sample volumes at a test site, this would be costly, time consuming , and complicated to use.

Clearly, a simple method of determining volumes is needed. Two techniques have been experimented with, and both use the empirical approach. The first method involves filling a container with water,

weighing it, and then submerging the container into a larger container of water. The sampling train is turned on; an outlet hose on the pump is placed into the smaller container; and the time for the displacement is recorded. The container is then weighed again and the loss of weight is the weight of water displaced. Using these data, a sample volume can be calculated.

The above method has some drawbacks. First, a scale that will weigh up to 8 pounds in accurate increments is necessary. Such scales are expensive. In addition, two people are required to insert the tube and operate the stopwatch. The outside of the container, when weighed, must always be dry.

The second method to determine volume also involves water displacement, but in this case the container is weighted. Using a weighted container, there is no need to hold the container under water with one hand while holding the outlet hose from the pump with the other. The person making the volume determination can insert the hose with one hand while operating the stopwatch with the other. When the container rises from the bottom of the larger container, the time is recorded and the volume determined.

Both methods have been tried in the laboratory. The lack of a good scale and the necessity of using two people for volume determinations makes the first approach unattractive. The second method (weighted container) has been tested in the lab and gives volumes within 2 percent of the true volume (true volume determined with a spirometer).

For the next screening method test effort, the first Millipore filter that follows the segment of Teflon tubing will be replaced with a set of midget impingers. The first two impingers will contain 15 ml. of 0.1 Normal NaOH. The third will be empty and the fourth will contain

silica gel. Sampling times per point will be adjusted for velocity traverse data. Sampling runs will be approximately the same length of time as the MM13B runs.

The results of the screening runs for the West Virginia Test are presented in tables 3-7 and 3-8.

TABLE 3-7. INLET SCREENING METHOD RESULTS

Screening Run No.	Volume Samples	Stack DSCFM	Screen mg/M³	MM13B Mg/M³	% of MM13B
I-1-A	28.2660	4157	14.923	7.2535	205.74
I-1-B	26.7795	4157	9.166	7.2535	126.37
I-1-C	27.9414	4157	3.320	7.2535	45.77
I-1-D	23.9651	4157	45.322	7.2535	624.83
	(Sample I-1-D spilled during recovery)				
I-2-A	16.9238	4429	7.2953	10.4498	69.81
I-2-B	16.0337	4429	4.9549	10.4498	47.42
I-2-C	16.7294	4429	6.3637	10.4498	60.90
I-2-D	14.3486	4429	9.3789	10.4498	89.75
I-3-A	17.157	4194	12.5391	12.0070	104.43
I-3-B	16.2547	4194	11.8034	12.0070	98.30
I-3-C	16.9600	4194	3.0442	12.0070	25.35
I-3-D	14.5464	4194	4.5228	12.0070	37.67
I-4-A	16.8368	4343	11.1961	13.9341	80.35
I-3-B	15.9514	4343	11.4168	13.9341	81.93
I-4-C	16.6435	4343	10.9081	13.9341	78.28
I-4-D	14.2750	4343	11.9288	13.9341	85.61
I-5-A	17.4167	4235	12.2588	13.3593	91.76
I-5-B	16.5008	4235	11.2357	13.3593	84.10
I-5-C	17.2167	4235	4.3587	13.3593	32.63
I-5-D	14.7666	4235	13.2344	13.3593	99.07

TABLE 3-8. OUTLET SCREENING METHOD RESULTS

Screening Run No.	Volume Samples	Stack DSCFM	Screen mg/M³	MM13B Mg/M³	% of MM13B
0-1-E	31.9449	4144	.0358	.0597	59.97
0-1-F	45.7199	4144	.0244	.0597	40.87
0-1-G	45.4538	4144	.0253	.0597	42.38
0-1-H	47.0541	4244	.0362	.0597	60.64
0-2-E	19.1329	4177	.0161	.0320	50.31
0-2-F	27.3833	4177	.0133	.0320	41.56
0-2-G	27.2239	4177	.0071	.0320	22.19
0-2-H	28.1823	4177	.0069	.0320	21.56
0-3-E	19.3226	4152	.0046	.0340	13.53
0-3-F	27.6547	4152	.0195	.0340	57.35
0-3-G	27.4937	4152	.0197	.0340	57.94
0-3-H	28.4617	4152	.0200	.0340	58.82
0-4-E	19.0395	4224	.0169	.0254	66.53
0-4-F	24.2496	4224	.0106	.0254	41.73
0-4-G	27.0910	4224	.0123	.0254	48.43
0-4-H	28.0448	4224	.0137	.0254	53.94
0-5-E	19.7133	4167	.0084	.0106	79.25
0-5-F	28.2140	4167	.0081	.0106	76.42
0-5-G	28.0497	4167	.0087	.0106	82.08
0-5-H	29.0373	4167	.0084	.0106	79.25

SECTION 4.0
SAMPLING LOCATIONS AND TEST METHODS

EMISSION SAMPLES

Location of Measurement Sites

EPA Reference Method 1 "Sample and Velocity Traverse for Stationary Sources" was used to select representative measurement sites. The diameter of the duct at the inlet measured 17.6 inches. Two sample ports were cut in the duct at 90 degrees from each other. The straight run of duct was 1 foot in length. Therefore, the measurement site did not meet minimum sampling criteria.

The measurement site for the outlet of the mist eliminator was located in a 19.5 inch diameter vertical duct. This measurement site met minimum sampling requirements.

According to EPA Method 1 criteria, each site required 24 sample traverse points, 12 on each diameter. Table 4-1 shows the traverse points used.

Prior to sampling, verification of the absence of cyclonic flow at each sample traverse point was assessed based on procedures described in EPA Reference Method 1. In this method the face openings of the Type-S pitot tube are aligned perpendicular to the duct cross-sectional plane, designated "0-degree reference." Null (zero) pitot readings obtained at 0-degree reference indicate an acceptable flow condition at a given point. If the point reading was not zero at 0-degree reference, the pitot was rotated until a null reading was obtained. The value of the

TABLE 4-1. SAMPLE TRAVERSE POINT LOCATIONS FOR THE MESH-PAD MIST ELIMINATOR INLET AND OUTLET

Traverse Point No.	Location (inches) Mist Eliminator Inlet	Mist Eliminator Outlet
1	0.5	0.5
2	1.2	1.3
3	2.1	2.3
4	3.1	3.5
5	4.4	4.9
6	6.3	6.9
7	11.4	12.5
8	13.2	14.6
9	14.5	16.0
10	15.5	17.2
11	16.4	18.2
12	17.1	19.00

rotation angle (yaw) was recorded for each point and averaged across the duct. Method 1 criteria stipulate that average angular rotations greater than 20 degrees indicate cyclonic (nonaxial) flow conditions in the duct. Both of these sites indicated acceptable flow patterns so that extraction of representative samples from these sites was performed using appropriate sampling procedures.

Test Methods

Velocity and static pressures, moisture content, and temperature were measured prior to sampling, in order to define sampling rates and nozzle sizes as described in the EPA Reference Methods 1, 2 and 4.

An EPA MM13B sample train was used to collect the Cr^{+6} samples. The sample train consisted of a 316 stainless steel button-hook nozzle, an unheated Pyrex glass-lined probe, and a series of four impingers. The first, third and fourth impingers were Greenburg-Smith design, modified by replacing the tip with a 1/2-in. inside diameter glass tube extending to 1/2-in. from the bottom of the flask. The second impinger was a Greenburg-Smith impinger with the standard tip. The first and second impingers contained 100mℓ of 0.1N NaOH. The third impinger was empty and the fourth impinger contained approximately 200 grams of silica gel. The balance of the sampling system consisted of a vacuum pump, dry gas meter, calibrated orifice and related temperature and pressure indicating apparatus to determine dry gas sample volume, stack gas temperature, volumetric flow rate and isokinetic sampling rates. During sampling, stack gas temperature and the gas temperature exiting the last impinger were monitored with calibrated thermocouples.

The sampling time was decreased from 8 minutes per point (192 minute total sample time) to 5 minutes per point (120 minute total sample time) since the concentration of Cr^{+6} was such that good analytical results could be obtained using the shorter time.

The impingers were weighed before and after each test to determine the moisture content of the flue gas stream. All connecting glassware, the nozzle and probe were rinsed with 0.1N NaOH and combined with the impinger solution into a tared polyethylene sample bottle. The total volume of the sample was determined gravimetrically. The liquid level was marked on each sample bottle and each bottle was marked indicating the run number and bottle contents.

Following the recovery of the samples, all samples, including blanks, were analyzed for Cr^{+6} concentration using the analytical methodology developed by the EPA.

EMISSION SAMPLE ANALYSIS

The MM13B samples and the plating solution were analyzed for Cr^{+6} concentration. The analyses were conducted on site in the EPA mobile laboratory. Immediately following the sample recovery, the samples were submitted to the analyst and the analyses and calculations were performed the same day. The analytical results were calculated on the Hewlett Packard 41CV computer that was set up in the on-site computer center. The calculations were also performed by the EPA Task Manager.

The analytical method entitled "Draft Method - Determination of Hexavalent Chromium in Dry Particulate Emissions from Stationary Sources" was used as a "guideline" in conducting the analyses. This method is currently under development by the EPA and is presented in Appendix D.

There were several variations between the draft method and the analytical method that was performed in the field. They are described as follows:

1. The collected samples were not digested in an alkaline solution. Aliquots of the recovered samples were pipeted directly from the sample bottle and prepared as in paragraph 5.7.1 of the Draft Method.

2. The pH of the sample aliquot was monitored with a pH meter while adjusting the pH of the aliquot to 2 ± .5.

3. The spectrophotometer was calibrated with standards containing 2 mℓ, 5 mℓ, 7 mℓ, 10 mℓ, 15 mℓ and 20 mℓ of the 5 μg/mℓ working standard. The spectrophotometer calibration factor, K_c, was calculated as follows:

$$K_c = 10 \frac{A_1 + 2.5A_2 + 3.5A_3 + 5A_4 + 7.5A_5 + 10A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2}$$

4. The value of this calibration factor was calculated using a computer program that was developed by the EPA Task Manager for the HP41 calculator.

SECTION 5.0
QUALITY ASSURANCE

INTRODUCTION

The goal of the quality assurance activities for this project is to ensure, to the highest degree possible, the accuracy of data collected. The procedures contained in the "Quality Assurance Handbook for Air Pollution Measurement Systems," Volume III, "Stationary Source Specific Methods," EPA-600/4-77-027B served as the basis for performance of all testing and related work activities that were undertaken in this testing program. In addition to the quality assurance measure guidelines presented above, specific quality assurance activities were conducted for several of the individual testing activities, as performed; these are presented in the paragraphs that follow.

FIELD QUALITY ASSURANCE PROCEDURES

In order to assure a high level of quality control while sampling to allow the comparison of data from these two methods, a field quality assurance program was followed during the test program. Methods used to obtain the required level of quality assurance are itemized below.

Sample Blanks

Reagent Blanks--

The 0.1N NaOH absorbing solution was transported to the field in its "as-purchased" container. When in the field, the 0.1N NaOH was transferred to a polyethylene wash bottle. From the wash bottle, the NaOH solution was used for sample train preparation and recovery.

A blank sample was collected from the solution in the wash bottle. This sample was given to the on-site laboratory personnel with the emission samples, and analyzed in the same manner. Results of the blank analyses are presented in Table 5-1.

H_2O Blanks--

A distilled water blank was obtained from the wash bottles and analyzed in the same manner as the emission samples.

Duplicate Samples

One sample for every 10 samples analyzed was a duplicate, e.g., if 24 samples were analyzed, 3 duplicate samples would be analyzed. The analytical results for the duplicated samples are presented in Table 5-1.

Standards

Daily, throughout the analysis of the samples, standards were set up as a spot check of the spectrophotometer calibration. The results of these checks are presented in Table 5-1.

Chain of Custody

In an effort to maintain the integrity of all samples taken at the test facility, a chain of custody procedure was followed. Once the samples were placed in custody of the analytical group, that group provided for safe storage and maintenance of records sufficient to maintain sample integrity. The "Chain of Custody" data sheets are presented in Appendix E.

Sample Transfer

All MM13B samples collected during testing remained in the custody of EPA personnel and were secured in the mobile laboratory while in the field.

TABLE 5-1. SUMMARY OF ANALYTICAL RESULTS FOR QA/QC SAMPLES AND BLANKS

Sample No.	Date (1988)	Type of Sample: Duplicate	Type of Sample: Standard	Total µg Cr^{+6}
0-1	9/20	X		288
50 µg/100 mℓ	9/20		X	53.0
75 µg/100 mℓ	9/21		X	76.8
0-A-2	9/21	X		101.8
0-3	9/22	X		110.6
10 µg/100 mℓ	9/22		X	9.9
I-3-B	9/22	X		5,484
10 µg/100 mℓ	9/22		X	10.2
75 µg/100 mℓ	9/22		X	73.2
50 µg/100 mℓ	9/29		X	51.84
Plating Sol. Run 2	9/29	X		101,172 µg/mℓ
Blanks				
0.1N NaOH	9/20			0.44
0.1N NaOH	9/21			0.00
0.1N NaOH	9/22			0.00
H_2O	9/29			0.00

SAMPLING TRAIN COMPONENTS

The equipment used in this test program, including nozzles, pitot tubes, dry gas meters, orifices, and thermocouples were uniquely identified and were calibrated in accordance with calibration procedures specified in the applicable EPA Reference Method prior to, and at the completion of the testing program. The calibration sheets are presented in Appendix F.

VERIFICATION OF CALCULATIONS

Emission Calculations

Dry gas volumes, percent moisture of the stack gas, gas flow rates, and Cr^{+6} emission rates were calculated using a Hewlett Packard 41CV programmable calculator. The programs used can be found in the document: "Source Test Calculation and Check Programs for Hewlett Packard 41 Calculators" (EPA-340/1-85-018). The results were checked and verified by the contractor task manager.

Chromium Concentration Calculations

All absorbance data for blanks, standards, samples and QA/QC samples were documented in a notebook. The Cr^{+6} content and total mass of Cr^{+6} collected were calculated using a program developed by the EPA Task Manager for the HP41CV programmable calculator.

APPENDIX A
PROCESS DATA – MRI

AMPERE-HOUR CALCULATIONS

Test run No.: 1
Tank No.: 1
Cell No.: 1

Start time: 15:20
Stop time: 19:32

Time, 24-h clock		Time interval, min		Operating current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
15:20	15:20					
15:30	15:30	10	10	1,600	267	267
15:40	15:40	10	10	1,600	267	267
15:50	15:50	10	10	1,600	267	267
16:00	16:00	10	10	1,600	267	267
16:10	16:10	10	10	1,550	258	258
16:20	16:20	10	10	3,600	600	600
16:30	16:30	10	10	3,500	583	583
16:40	16:40	10	10	3,250	542	542
16:50	16:50	10	10	3,300	600	600
16:56	16:56	6	6	3,300	330	330
Subtotal		96	96		3,981	3981
17:56	17:56					
18:05	18:05	9	9	3,300	495	495
18:15	18:15	10	10	3,300	550	550
18:25	18:25	10	10	3,300	550	550
18:35	18:35	10	10	3,300	550	550
18:55	18:55	20	20	3,250	1,083	1,083
19:05	19:05	10	10	3,300	550	550
19:15	19:15	10	10	3,250	542	542
19:25	19:25	10	10	3,300	550	550
19:32	19:32	7	7	3,300	385	385
Subtotal		96	96		5,255	5,255
TOTAL		192	192		9,236	9,236

AMPERE-HOUR CALCULATIONS

Test run No.: 1
Tank No.: 1
Cell No.: 2

Start time: 15:20
Stop time: 19:32

Time, 24-h clock		Time interval, min		Operating current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
15:20	15:20					
15:30	15:30	10	10	3,700	617	617
15:40	15:40	10	10	3,700	617	617
15:50	15:50	10	10	3,700	617	617
16:00	16:00	10	10	3,700	617	617
16:10	16:10	10	10	3,700	617	617
16:20	16:20	10	10	3,700	617	617
16:30	16:30	10	10	3,700	617	617
16:40	16:40	10	10	3,700	617	617
16:50	16:50	10	10	3,700	617	617
16:56	16:56	6	6	3,700	370	370
Subtotal		96	96		5,923	5,923
17:56	17:56					
18:05	18:05	9	9	3,700	555	555
18:15	18:15	10	10	3,700	617	617
18:25	18:25	10	10	3,700	617	617
18:35	18:35	10	10	3,700	617	617
18:55	18:55	20	20	3,700	1,234	1,234
19:05	19:05	10	10	3,700	617	617
19:15	19:15	10	10	3,675	613	613
19:25	19:25	10	10	3,650	608	608
19:32	19:32	7	7	3,650	432	432
Subtotal		96	96		5,910	5,910
TOTAL		192	192		11,833	11,833

AMPERE-HOUR CALCULATIONS

Test run No.: 2
Tank No.: 1
Cell No.: 1

Start time: 09:27
Stop time: 12:01

Time, 24-h clock		Time interval, min		Operating current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
09:27	09:27					
09:30	09:30	3	3	1,700	85	85
09:40	09:40	10	10	1,700	283	283
09:50	09:50	10	10	1,700	283	283
10:00	10:00	10	10	1,700	283	283
10:10	10:10	10	10	1,700	283	283
10:20	10:20	10	10	1,700	283	283
10:27	10:27	7	7	1,700	198	198
Subtotal		60	60		1,698	1,698
11:01	11:01					
11:10	11:10	9	9	2,200	330	330
11:20	11:20	10	10	2,200	367	367
11:30	11:30	10	10	2,200	367	367
11:40	11:40	10	10	2,200	367	367
11:50	11:50	10	10	2,200	367	367
12:01	12:01	11	11	2,200	403	403
Subtotal		60	60		2,201	2,201
TOTAL		120	120		3,899	3,899

AMPERE-HOUR CALCULATIONS

Test run No.: 2
Tank No.: 1
Cell No.: 2

Start time: 09:27
Stop time: 12:01

Time, 24-h clock		Time interval, min		Operating current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
09:27	09:27					
09:30	09:30	3	3	3,300	165	165
09:40	09:40	10	10	3,300	550	550
09:50	09:50	10	10	3,300	550	550
10:00	10:00	10	10	3,300	550	550
10:10	10:10	10	10	3,300	550	550
10:20	10:20	10	10	3,300	550	550
10:27	10:27	7	7	3,300	385	395
Subtotal		60	60		3,300	3,300
11:01	11:01					
11:10	11:10	9	9	2,800	420	420
11:20	11:20	10	10	2,800	467	467
11:30	11:30	10	10	2,800	467	467
11:40	11:40	10	10	2,800	467	467
11:50	11:50	10	10	2,800	467	467
12:01	12:01	11	11	2,800	513	513
Subtotal		60	60		2,801	2,801
TOTAL		120	120		6,101	6,101

AMPERE-HOUR CALCULATIONS

Test run No.: 3
Tank No.: 1
Cell No.: 1

Start time: 14:07
Stop time: 16:31

Time, 24-h clock		Time interval, min		Operating current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
14:07	14:07					
14:10	14:10	3	3	1,550	78	78
14:20	14:20	10	10	1,500	250	250
14:30	14:30	10	10	1,500	250	250
14:40	14:40	10	10	1,500	250	250
14:50	14:50	10	10	1,500	250	250
15:00	15:00	10	10	1,500	250	250
15:07	15:07	7	7	1,500	175	175
Subtotal		60	60		1,503	1,503
15:31	15:31					
15:40	15:40	9	9	1,500	225	225
15:50	15:50	10	10	1,500	250	250
16:00	16:00	10	10	1,500	250	250
16:10	16:10	10	10	1,500	250	250
16:20	16:30	10	10	1,500	250	250
16:31	16:31	11	11	1,500	275	275
Subtotal		60	60		1,500	1,500
TOTAL		120	120		3,003	3,003

AMPERE-HOUR CALCULATIONS

Test run No.: 3
Tank No.: 1
Cell No.: 2

Start time: 14:07
Stop time: 16:31

Time, 24-h clock		Time interval, min		Operating current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
14:07	14:07					
14:10	14:10	3	3	3,700	185	185
14:20	14:20	10	10	3,700	617	617
14:30	14:30	10	10	3,700	617	617
14:40	14:40	10	10	3,700	617	617
14:50	14:50	10	10	3,700	617	617
15:00	15:00	10	10	3,700	617	617
15:07	15:07	7	7	3,700	432	432
Subtotal		60	60		3,702	3,702
15:31	15:31					
15:40	15:40	9	9	3,700	555	555
15:50	15:50	10	10	3,700	617	617
16:00	16:00	10	10	3,700	617	617
16:10	16:10	10	10	3,700	617	617
16:20	16:20	10	10	3,700	617	617
16:31	16:31	11	11	3,700	678	678
Subtotal		60	60		3,701	3,701
TOTAL		120	120		7,403	7,403

AMPERE-HOUR CALCULATIONS

Test run No.: 4
Tank No.: 1
Cell No.: 1

Start time: 08:55
Stop time: 11:41

Time, 24-h clock		Time interval, min		Operating current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
08:55	08:55					
09:05	09:05	10	10	1,400	233	233
09:15	09:15	10	10	1,400	233	233
09:25	09:25	10	10	1,400	233	233
09:35	09:35	10	10	1,400	233	233
09:45	09:45	10	10	1,400	233	233
09:55	09:55	10	10	1,400	233	233
Subtotal		60	60		1,400	1,400
10:41	10:41					
10:50	10:50	9	9	800	120	120
11:00	11:00	10	10	800	133	133
11:10	11:10	10	10	800	133	133
11:20	11:20	10	10	800	133	133
11:30	11:30	10	10	1,600	267	267
11:41	11:41	11	11	1,650	303	303
Subtotal		60	60		1,089	1,089
TOTAL		120	120		2,489	2,489

AMPERE-HOUR CALCULATIONS

Test run No.: 4
Tank No.: 1
Cell No.: 2

Start time: 08:55
Stop time: 11:41

Time, 24-h clock		Time interval, min		Operating current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
08:55	08:55					
09:05	09:05	10	10	3,600	600	600
09:15	09:15	10	10	3,600	600	600
09:25	09:25	10	10	3,600	600	600
09:35	09:35	10	10	3,600	600	600
09:45	09:45	10	10	3,600	600	600
09:55	09:55	10	10	3,600	600	600
Subtotal		60	60		3,600	3,600
10:41	10:41					
10:50	10:50	9	9	3,600	540	540
11:00	11:00	10	10	3,600	600	600
11:10	11:10	10	10	3,600	600	600
11:20	11:20	10	10	3,600	600	600
11:30	11:30	10	10	3,400	567	567
11:41	11:41	11	11	3,400	623	623
Subtotal		60	60		3,530	3,530
TOTAL		120	120		7,130	7,130

AMPERE-HOUR CALCULATIONS

Test run No.: 5
Tank No.: 1
Cell No.: 1

Start time: 13:47
Stop time: 16:07

Time, 24-h clock		Time interval, min		Operating current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
13:47	13:47					
13:50	13:50	3	3	1,400	70	70
14:00	14:00	10	10	1,500	250	250
14:10	14:10	10	10	1,500	250	250
14:20	14:20	10	10	1,500	250	250
14:30	14:30	10	10	1,500	250	250
14:40	14:40	10	10	1,500	250	250
14:47	14:47	7	7	1,500	175	175
Subtotal		60	60		1,495	1,495
15:07	15:07					
15:10	15:10	3	3	1,000	50	50
15:20	15:20	10	10	1,000	167	167
15:30	15:30	10	10	1,000	167	167
15:40	15:40	10	10	1,900	317	317
15:50	15:50	10	10	900	150	150
16:00	16:00	10	10	900	150	150
16:07	16:07	7	7	900	105	105
Subtotal		60	60		1,106	1,106
TOTAL		120	120		2,601	2,601

AMPERE-HOUR CALCULATIONS

Test run No.: 5
Tank No.: 1
Cell No.: 2

Start time: 13:47
Stop time: 16:07

Time, 24-h clock		Time interval, min		Operating current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
13:47	13:47					
13:50	13:50	3	3	3,600	180	180
14:00	14:00	10	10	3,500	583	583
14:10	14:10	10	10	3,500	583	583
14:20	14:20	10	10	3,500	583	583
14:30	14:30	10	10	3,500	583	583
14:40	14:40	10	10	3,500	583	583
14:47	14:47	7	7	3,500	408	408
Subtotal		60	60		3,503	3,503
15:07	15:07					
15:10	15:10	3	3	3,500	175	175
15:20	15:20	10	10	3,500	583	583
15:30	15:30	10	10	3,500	583	583
15:40	15:40	10	10	3,500	583	583
15:50	15:50	10	10	3,700	617	617
16:00	16:00	10	10	3,700	617	617
16:07	16:07	7	7	3,700	432	432
Subtotal		60	60		3,590	3,590
TOTAL		120	120		7,093	7,093

SOURCE SAMPLING DATA SHEET

Location: Precision Machine and Hydraulic, Inc., Worthington, West Virginia

Date: September 20, 1988

Tank No: 1 Test start time: 15:20

Test run No.: 1 Test stop time: 19:32

Time, 24-h clock clock	Cell No.	Operating voltage, volts	Operating current, amperes	Operating temp., °F	Notes
15:20	1 2	4.4 5.6	1,600 3,700	133	Started testing at 15:20
15:30	1 2	4.4 5.6	1,600 3,700	133	
15:40	1 2	4.4 5.6	1,600 3,700	135	Number of parts in tank = 3 Surface area of parts: 509 in.^{2}, 905 in.^{2}, and 314 in.^{2}
15:50	1 2	4.4 5.6	1,600 3,700	133	
16:00	1 2	4.4 5.6	1,600 3,700	133	
16:10	1 2	4.4 5.6	1,550 3,700	133	
16:20	1 2	6.4 5.6	3,600 3,700	133	Additional part added at 16:17. Surface area of part = 678 in.^{2}
16:30	1 2	4.7 5.6	3,500 3,700	133	
16:40	1 2	4.7 5.6	3,250 3,700	133	
16:50	1 2	4.6 5.6	3,300 3,700	133	Stopped testing at 16:56
17:55	1 2	4.6 5.4	3,300 3,700	133	Started testing at 17:56
18:05	1 2	4.6 5.4	3,300 3,700	133	
18:15	1 2	4.6 5.4	3,300 3,700	133	
18:25	1 2	4.6 5.2	3,300 3,700	134	
18:35	1 2	4.7 5.2	3,300 3,700	133	
18:55	1 2	4.6 5.2	3,250 3,700	133	
19:05	1 2	4.7 5.2	3,300 3,700	133	
19:15	1 2	4.6 5.2	3,250 3,675	133	
19:25	1 2	4.6 5.0	3,300 3,650	133	
19:35	1 2	4.6 5.0	3,300 3,700	133	Stopped testing at 19:32

SOURCE SAMPLING DATA SHEET

Location: Precision Machine and Hydraulic, Inc., Worthington, West Virginia

Date: September 21, 1988

Tank No: 1 Test start time: 09:27

Test run No.: 2 Test stop time: 12:01

Time, 24-h clock clock	Cell No.	Operating voltage, volts	Operating current, amperes	Operating temp., °F	Notes
09:30	1 2	4.8 5.2	1,700 3,300	132	Started testing at 09:27
09:40	1 2	4.8 5.2	1,700 3,300	133	Number of parts in plating tank = 3. Surface area of each part: 905 $in.^2$, 314 $in.^2$, and 679 $in.^2$
09:50	1 2	4.8 5.2	1,700 3,300	133	
10:00	1 2	4.8 5.2	1,700 3,300	133	
10:10	1 2	4.8 5.2	1,700 3,300	133	
10:20	1 2	4.8 5.2	1,700 3,300	132	Additional part added to tank at 10:30. Surface area of part = 210 $in.^2$ Stopped testing at 10:27.
11:00	1 2	4.8 4.6	2,200 2,800	133	Started testing at 11:01
11:10	1 2	4.6 4.6	2,200 2,800	133	
11:20	1 2	4.6 4.6	2,200 2,800	132	
11:30	1 2	4.6 4.6	2,200 2,800	132	
11:40	1 2	4.6 4.6	2,200 2,800	132	
11:50	1 2	4.6 4.6	2,200 2,800	132	
12:00	1 2	4.6 4.6	2,200 2,800	133	Stopped testing at 14:07

SOURCE SAMPLING DATA SHEET

Location: Precision Machine and Hydraulic, Inc., Worthington, West Virginia

Date: September 21, 1988

Tank No: 1 Test start time: 14:07

Test run No.: 3 Test stop time: 16:31

Time, 24-h clock clock	Cell No.	Operating voltage, volts	Operating current, amperes	Operating temp., °F	Notes
14:10	1	4.8	1,550	132	Started testing at 14:07
	2	5.2	3,700		
14:20	1	4.8	1,500	132	Number of parts in tank = 4
	2	5.2	3,700		Surface area of parts: 905 in^2, 314 $in.^2$, 509 $in.^2$, and 210 in^2
14:30	1	4.8	1,500	133	
	2	5.2	3,700		
14:40	1	4.8	1,500	133	
	2	5.2	3,700		
14:50	1	4.8	1,500	133	
	2	5.0	3,700		
15:00	1	4.8	1,500	132	Stopped testing at 15:07
	2	5.0	3,700		
15:10	1	4.8	1,500	132	
	2	5.0	3,700		
15:30	1	4.8	1,500	133	Started testing at 15:31
	2	4.8	3,700		
15:40	1	4.8	1,500	133	
	2	4.8	3,700		
15:50	1	4.6	1,500	132	
	2	4.8	3,700		
16:00	1	4.6	1,500	132	
	2	4.8	3,700		
16:10	1	4.6	1,500	132	
	2	4.6	3,700		
16:20	1	4.6	1,500	133	
	2	4.6	3,700		
16:30	1	4.6	1,500	133	Stopped testing at 16:31
	2	4.6	3,700		

SOURCE SAMPLING DATA SHEET

Location: Precision Machine and Hydraulic, Inc., Worthington, West Virginia

Date: September 22, 1988

Tank No: 1 Test start time: 08:55

Test run No.: 4 Test stop time: 11:41

Time, 24-h clock clock	Cell No.	Operating voltage, volts	Operating current, amperes	Operating temp., °F	Notes
08:55	1 2	4.6 5.2	1,400 3,600	128	Started testing at 08:55
09:05	1 2	4.8 5.2	1,400 3,600	129	Number of parts in tank = 5 Surface area of parts: 208 in.^{2}, 31 in.^{2}, 305 in.^{2}, 905 in.^{2}, and 314 in.^{2}
09:15	1 2	4.8 5.2	1,400 3,600	129	Part removed at 09:00 with surface area of 31 in.^{2}
09:25	1 2	4.8 5.2	1,400 3,600	129	
09:35	1 2	4.8 5.2	1,400 3,600	130	
09:45	1 2	4.8 5.2	1,400 3,600	130	
09:55	1 2	4.8 5.2	1,400 3,600	132	Stopped testing at 09:55
10:40	1 2	4.6 5.0	800 3,600	132	Started testing at 10:41
10:50	1 2	4.6 5.0	800 3,600	132	
11:00	1 2	4.6 5.0	800 3,600	132	
11:10	1 2	4.6 5.0	800 3,600	133	
11:20	1 2	4.6 4.8	800 3,600	133	Additional part added at 11:25. Surface area of 352 in.^{2}
11:30	1 2	4.6 4.6	1,600 3,400	133	
11:40	1 2	4.6 4.6	1,650 3,400	133	Stopped testing at 11:41

SOURCE SAMPLING DATA SHEET

Location: Precision Machine and Hydraulic, Inc., Worthington, West Virginia

Date: September 22, 1988

Tank No: 1 Test start time: 13:47

Test run No.: 5 Test stop time: 16:07

Time, 24-h clock clock	Cell No.	Operating voltage, volts	Operating current, amperes	Operating temp., °F	Notes
13:50	1 2	4.6 5.0	1,400 3,600	132	Started testing at 13:47. Number of parts in tank = 4. Surface area of parts: 905 in.^{2}, 314 in.^{2}, 208 in.^{2}, and 345 in.^{2} Additional part added to tank at 13:55 with surface area of 31 in.^{2}
14:00	1 2	4.6 4.8	1,500 3,500	133	
14:10	1 2	4.6 4.8	1,500 3,500	133	
14:20	1 2	4.6 5.0	1,500 3,500	133	
14:30	1 2	4.6 4.8	1,500 3,500	132	
14:40	1 2	4.6 4.8	1,500 3,500	132	Stopped testing at 14:47
14:50	1 2	4.6 4.8	1,500 3,500	132	
15:10	1 2	4.8 4.8	1,000 3,500	133	Started testing at 15:07
15:20	1 2	5.0 4.6	1,000 3,500	133	Part with surface area of 208 in.^{2} removed at 15:05. Part with surface area of 31 in.^{2} removed at 15:15. Part with surface area of 345 in.^{2} removed at 15:42. Additional part added at 15:40 with surface area of 296 in.^{2}
15:30	1 2	5.2 4.6	1,000 3,500	132	
15:40	1 2	7.1 4.6	1,900 3,500	133	
15:50	1 2	4.8 4.6	900 3,700	133	
16:00	1 2	4.8 4.6	900 3,700	133	
16:10	1 2	4.8 4.6	900 3,700	133	Stopped testing at 16:07

APPENDIX B
FIELD DATA SHEETS

PRELIMINARY VELOCITY TRAVERSE

PLANT
DATE 9/20/88
LOCATION inlet
STACK I.D. 175/A + M1/2
BAROMETRIC PRESSURE, in. Hg 29.16
STACK GAUGE PRESSURE, in. H_2O -2.2
OPERATORS Lori

moisture 2.8%

horiz

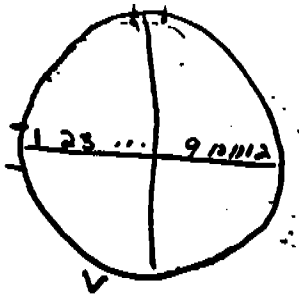
TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.495	78
2	.5	
3	.47	
4	.43	
5	.45	
6	.48	
7	.56	
8	.55	
9	.53	
10	.54	
11	.56	
12	.55	
AVERAGE		

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.21	78
2	.26	
3	.32	
4	.35	
5	.37	
6	.42	
7	.64	
8	.86	
9	.985	
10	1.1	
11	1.15	
12	1.15	
AVERAGE		

EPA (Dur) 233
4/72

PLANT Precision Machine & Hydraulics
DATE 2 Sept 1988
LOCATION Tyler
STACK I.D. ~~18"~~ 17.62 ⌀
BAROMETRIC PRESSURE, in. Hg 29.29
STACK GAUGE PRESSURE, in. H_2O − 2.15
OPERATORS F. Clay & A. Rappole



SCHEMATIC OF TRAVERSE POINT LAYOUT

<	TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
5°	1	0.75	68
8°	2	0.55	
15°	3	0.52	
10°	4	0.49	
0°	5	0.55	
0°	6	0.56	
0°	7	0.52	
0°	8	0.49	
7°	9	0.61	
15°	10	0.51	
10°	11	0.50	
[illegible]	12	0.70	69
AVERAGE			

<	TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
CC 8°	1	1.20	69
CC 3°	2	1.10	
CC 3°	3	1.10	
CC 3°	4	1.00	
C 3°	5	0.99	
0°	6	0.82	
C 4°	7	0.45	
C 4°	8	0.40	
C 2°	9	0.37	
C 5°	10	0.35	
C 2°	11	0.24	
C 2°	12	0.25	69
AVERAGE			

EPA (Dur) 233
4/72

Act Dia .2338
use 0.25

PRELIMINARY VELOCITY TRAVERSE

PLANT Precision Platers (W.V)
DATE 9/20/88
LOCATION Outlet
STACK I.D. 21 7/16 + 2 1/4 - 19 3/16 (L)
BAROMETRIC PRESSURE, in. Hg 29.16
STACK GAUGE PRESSURE, in. H_2O + .29
OPERATORS Sorrell
moisture 2.8%

19.75 (R) avg for velocity (19.47)
make probe for smaller dia.

SCHEMATIC OF TRAVERSE POINT LAYOUT

(L)

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.37	~~69~~ 78
2	.415	
3	.425	
4	.415	
5	.38	
6	.34	
7	.375	
8	.405	
9	.410	
10	.43	
11	.495	
12	.505	
AVERAGE		

(R)

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.14	78
2	.275	
3	.32	
4	.335	
5	.34	
6	.335	
7	.33	
8	.365	
9	.425	
10	.490	
11	.53	
12	.55	
AVERAGE		

NJ AK

EPA (Dur) 233
4/72

PRELIMINARY VELOCITY TRAVERSE

PLANT Precision Machine & Hydraulics
DATE 7 Sept 88
LOCATION Oxford
STACK I.D. ~~20"~~ 19.876
BAROMETRIC PRESSURE, in. Hg 29.29
STACK GAUGE PRESSURE, in. H_2O + 0.2
OPERATORS

19" ID
~~8~~76

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	0.25	69
2	0.28	
3	0.30	
4	0.33	
5	0.34	
6	0.34	
7	0.32	
8	0.33	
9	.42	
10	.50	
11	.55	
12	.50	69
AVERAGE		

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	0.38	69
2	0.42	
3	0.41	
4	0.40	
5	0.36	
6	0.34	
7	0.36	
8	0.38	
9	0.41	
10	0.46	
11	0.45	
12	0.45	69
AVERAGE		

EPA (Dur) 233
4/72

Act Dia = .2614
use 5/16 (.3175)

FIELD DATA

PLANT Precision Machine + Hydraulics
DATE 9/20/88
SAMPLING LOCATION Inlet
SAMPLE TYPE
RUN NUMBER 1
OPERATOR Lou
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.13
STATIC PRESSURE, (P_s) -2.2
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .256
ASSUMED MOISTURE, % 2.8
SAMPLE BOX NUMBER
METER BOX NUMBER RAC-7
METER $\Delta H_@$ 1.9918
C FACTOR
PROBE HEATER SETTING —
HEATER BOX SETTING —
REFERENCE Δp
Y = .9968

start 3:20

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 8 MINUTES

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	END °F	IMPINGER TEMPERATURE, °F
	0	879.003											
1	8	885.80	.55	2.64	2.64	4	79	80	83				
2	16	892.85	.55	2.67	2.67	4	93	82	84				
3	24	900.02	.56	2.76	2.76	4	105	86	84				
4	32	907.00	.51	2.55	2.55	3.9	113	92	84				
5	40	914.02	.50	2.51	2.51	3.9	116	96	84				
6	48	921.10	.52	2.62	2.62	3.9	118	98	84				
7	56	928.6	.55	2.82	2.82	4.0	120	114	84				
8	64	935.8	.53	2.70	2.70	4.0	122	106	84				
9	72	943.15	.53	2.71	2.71	4.0	123	107	84				
10	80	951.00	.60	3.13	3.13	4.5	124	108	82				
11	88	958.80	.60	3.09	3.09	4	126	109	82				
12	96	964.943	.16	0.82	0.82	4	126	110	82				
13	(8) 104	971.05	.36	1.77	1.77	2	89	92	82				
14	(16) 112	976.8	.36	1.78	1.78	2.3	100	92	82				
15	(24) 120	982.8	.36	1.80	1.80	2.3	108	95	81				
16	(32) 128	988.8	.375	1.89	1.89	2.3	112	97	81				
17	(40) 136	995.05	.4	2.03	2.03	2.3	115	100	80.5				
18	(48) 144	1001.85	.47	2.39	2.39	3.0	117	102	80				
19	(56) 152	1009.40	.565	2.89	2.89	3.0	119	104	80				
20	(64) 160	1018.90	.94	4.83	4.83	5.1	122	105	79				
21	(72) 168	1028.90	1.05	5.43	5.43	6.1	127	107	79				
22	(80) 176	1039.00	1.15	5.95	5.95	7.0	124	108	78				
23	(88) 184	1050.45	1.25	6.51	6.51	8.0	127	108	75.5				
24	(96) 192	1061.334	1.15	6.02	6.02	8.0	129	109	74				

COMMENTS:

EPA (Out) 235
4/72

METERED VOL. = 182.219

3.0963

AVERAGE T_m = 108

T_s AVERAGE = 81 ~~82~~

17.7055

B-6

ANALYTICAL DATA

PLANT Pac. Mach & Vyd.

DATE 9-20-88

SAMPLING LOCATION INLET

SAMPLE TYPE M 13 B

RUN NUMBER ~~MM2B1~~ I-1

SAMPLE BOX NUMBER inlet

CLEAN-UP ~~MAN~~ person Ms Owens, Mr Brown

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

FILTER NUMBER _____ _____ — CONTAINER _____ _____ mg

_____ _____

_____ _____

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

	#1	#2	#3
IMPINGERS			
FINAL VOLUME	560.4 ~~ml~~ gr	584.4 gr	463.8 gr
INITIAL VOLUME	547.3 ~~ml~~ gr	572.7 gr	459.5 gr
NET VOLUME	13.1 ~~ml~~ gr	11.7 gr	4.3 gr
SILICA GEL			
FINAL WEIGHT	691.5 g	g	g
INITIAL WEIGHT	665.5 g	g	g
NET WEIGHT	26.0 g	g	g

TOTAL MOISTURE 55.1 g

EPA (Dur) 231
4/77

```
                XROM "PRESS"
NO. OF POINTS ?
                24.0000     RUN
DELTA P ?
                .5500       RUN
STACK TEMP ?
                83.0000     RUN
DELTA P ?
                .5500       RUN
STACK TEMP ?
                84.0000     RUN
DELTA P ?
                .5600       RUN
STACK TEMP ?
                84.0000     RUN
DELTA P ?
                .5100       RUN
STACK TEMP ?
                84.0000     RUN
DELTA P ?
                .5000       RUN
STACK TEMP ?
                84.0000     RUN
DELTA P ?
                .5200       RUN
STACK TEMP ?
                84.0000     RUN
DELTA P ?
                .5500       RUN
STACK TEMP ?
                84.0000     RUN
DELTA P ?
                .5300       RUN
STACK TEMP ?
                84.0000     RUN
DELTA P ?
                .5300       RUN
STACK TEMP ?
                84.0000     RUN
DELTA P ?
                .6100       RUN
STACK TEMP ?
                82.0000     RUN
DELTA P ?
                .6000       RUN
STACK TEMP ?
                82.0000     RUN
DELTA P ?
                .1600       RUN
STACK TEMP ?
                82.0000     RUN
DELTA P ?
                .3600       RUN
STACK TEMP ?
                82.0000     RUN
DELTA P ?
                .3600       RUN
STACK TEMP ?
                82.0000     RUN
DELTA P ?
                .3600       RUN
STACK TEMP ?
                81.0000     RUN
DELTA P ?
                .3750       RUN
STACK TEMP ?
                81.0000     RUN
DELTA P ?
                .4000       RUN
STACK TEMP ?
                80.5000     RUN
DELTA P ?
                .4700       RUN
STACK TEMP ?
                80.0000     RUN
DELTA P ?
                .5650       RUN
STACK TEMP ?
                80.0000     RUN
DELTA P ?
                .9400       RUN
STACK TEMP ?
                79.0000     RUN
DELTA P ?
                1.0500      RUN
STACK TEMP ?
                79.0000     RUN
DELTA P ?
                1.1500      RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                1.2500      RUN
STACK TEMP ?
                75.5000     RUN
DELTA P ?
                1.1500      RUN
STACK TEMP ?
                74.0000     RUN

SQRT PSTS = 17.7021
AVE STK TEMP = 81.3750
```

```
                XROM "METH 5"
RUN NUMBER
INLET 1
                            RUN
METER BOX Y?
                .9968       RUN
DELTA H?
                3.1000      RUN
BAR PRESS ?
                29.1300     RUN
METER VOL ?
                182.2190    RUN
MTR TEMP F?
                108.0000    RUN
STATIC HOH IN ?
                -2.2000     RUN
STACK TEMP
                81.0000     RUN
ML. WATER ?
                55.1000     RUN

SAT % = 3.7

IMP. % HOH = 1.5
% HOH=1.5

% CO2?
                .7000       RUN
% OXYGEN?
                21.0000     RUN
% CO ?
                0.0000      RUN

MWd =28.95
MW WET=28.78

SQRT PSTS ?
                17.7021     RUN
TIME MIN ?
                192.0000    RUN
NOZZLE DIA ?
                .2560       RUN
STK DIA INCH ?
                17.6250     RUN

* VOL MTR STD = 165.672
  STK PRES ABS = 28.97
  VOL HOH GAS = 2.59
  % MOISTURE = 1.54
  MOL DRY GAS = 0.985
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.78
  VELOCITY FPS = 44.02
  STACK AREA = 1.69
  STACK ACFM = 4,475.
* STACK DSCFM = 4,164.
  % ISOKINETIC = 98.29
```

```
                XROM "MASSFLO"
RUN NUMBER
                            COS
I-1
                            RUN

VOL MTR STD ?
                165.672     RUN
STACK DSCFM ?
                4,164.00    RUN
FRONT 1/2 MG ?
                34.012      RUN
BACK 1/2 MG ?
                            RUN

F  GR/DSCF = 3.17E-3
F  MG/MMM = 7.25
F  LB/HR = 0.11
F  KG/HR = 0.05

                            FIX 5
                            RUN
B  GR/DSCF = 0.00000
B  MG/MMM = 0.00000
B  LB/HR = 0.00000
B  KG/HR = 0.00000

I  GR/DSCF = 0.00317
I  MG/MMM = 7.24987
I  LB/HR = 0.11308
I  KG/HR = 0.05129
```

FIELD DATA

PLANT Precision Machine + Hydraulics
DATE 9/21/88
SAMPLING LOCATION inlet
SAMPLE TYPE
RUN NUMBER 2
OPERATOR LOBI
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.27
STATIC PRESSURE, (P_s) -2.2
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .256
ASSUMED MOISTURE, % 1.0
SAMPLE BOX NUMBER
METER BOX NUMBER RAC-7
METER $\Delta H_@$ 1.9918
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp
y = .9968

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	PROBE TEMPERATURE END °F	IMPINGER TEMPERATURE, °F
		61.530											
1	5	65.75	.55	2.73	2.73	3.2	66	69	68				
2	10	70.20	.55	2.75	2.75	↓	74	68	68				
3	15	74.70	.56	2.83	2.83	↓	84	70	69				
4	20	79.15	.51	2.61	2.61	↓	93	74	69				
5	25	83.55	.52	2.68	2.68	↓	98	77	69				
6	30	88.15	.56	2.90	2.90	3.7	103	81	70				
7	35	92.80	.565	2.94	2.94	↓	106	84	70.5				
8	40	97.35	.51	2.67	2.67	3.2	108	87	71				
9	45	101.80	.495	2.59	2.59	↓	110	89	72				
10	50	106.33	.535	2.81	2.81	3.6	112	92	72				
11	55	111.20	.62	3.27	3.27	4.0	113	94	72				
12	60	116.379	.715	3.79	3.27	5.0	116	95	71				
1	65	120.80	.36	1.84	1.84	2.4	87	89	73				
2	70	124.58	.37	1.90	1.90	2.5	94	88	73				
3	75	128.50	.40	2.07	2.07	2.8	100	89	73.5				
4	80	132.59	.435	2.26	2.26	3.0	104	90	73				
5	85	136.95	.49	2.56	2.56	3.0	107	102	73				
6	90	141.40	.50	2.62	2.62	3.1	110	94	73				
7	95	147.10	1.0	5.27	5.27	6.5	113	95	73				
8	100	153.45	1.05	5.56	5.56	7.0	118	97	73				
9	105	160.00	1.10	5.86	5.86	7.5	121	98	72.5				
10	110	166.166	1.15	6.13	6.13	8.0	122	100	73				
11	115	173.65	1.25	6.68	6.68	8.9	123	101	72.5				
12	120	180.699	1.25	6.70	6.70	8.9	124	102	72				

COMMENTS:

EPA (Dur) 235
4 72

METER VOL. = 118.635
tot vol
.0 in 350

AVE. ΔH = 3.48

Tm AVE. = 96°F Ts AVE = 72°F

B-9

.913

ANALYTICAL DATA

PLANT Precision Mach + Hydraulic

DATE 9/21/88

SAMPLING LOCATION inlet

SAMPLE TYPE MM13B

RUN NUMBER I-2

SAMPLE BOX NUMBER inlet

CLEAN-UP MAN Ms. Owens, Ms. Brown

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

FILTER NUMBER _____ _____ — CONTAINER _____ _____ mg

_____ _____

_____ _____

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

	#1	#2	#3
IMPINGERS			
FINAL VOLUME	556.4 mlgr	574.4	462.6
INITIAL VOLUME	547.8 mlgr	571.8	460.2
NET VOLUME	8.6 mlgr	2.6	2.4
SILICA GEL			
FINAL WEIGHT	94779.8 g	_____ g	_____ g
INITIAL WEIGHT	755.3 g	_____ g	_____ g
NET WEIGHT	24.5 g	_____ g	_____ g

TOTAL MOISTURE 38.1 g

EPA (Dur) 231
4/72

```
                    XROM "PRESS"
NO. OF POINTS ?
                24.0000      RUN
DELTA P ?
                .5500        RUN
STACK TEMP ?
                68.0000      RUN
DELTA P ?
                .5500        RUN
STACK TEMP ?
                68.0000      RUN
DELTA P ?
                .5600        RUN
STACK TEMP ?
                69.0000      RUN
DELTA P ?
                .5100        RUN
STACK TEMP ?
                69.0000      RUN
DELTA P ?
                .5200        RUN
STACK TEMP ?
                69.0000      RUN
DELTA P ?
                .5600        RUN
STACK TEMP ?
                70.0000      RUN
DELTA P ?
                .5650        RUN
STACK TEMP ?
                70.5000      RUN
DELTA P ?
                .5100        RUN
STACK TEMP ?
                71.0000      RUN
DELTA P ?
                .4950        RUN
STACK TEMP ?
                72.0000      RUN
DELTA P ?
                .5350        RUN
STACK TEMP ?
                72.0000      RUN
DELTA P ?
                .6200        RUN
STACK TEMP ?
                72.0000      RUN
DELTA P ?
                .7150        RUN
STACK TEMP ?
                71.0000      RUN
DELTA P ?
                .3600        RUN
STACK TEMP ?
                73.0000      RUN
DELTA P ?
                .3700        RUN
STACK TEMP ?
                73.0000      RUN
DELTA P ?
                .4000        RUN
STACK TEMP ?
                73.5000      RUN
DELTA P ?
                .4350        RUN
STACK TEMP ?
                73.0000      RUN
DELTA P ?
                .4900        RUN
STACK TEMP ?
                73.0000      RUN
DELTA P ?
                .5000        RUN
STACK TEMP ?
                73.0000      RUN
DELTA P ?
                1.0000       RUN
STACK TEMP ?
                73.0000      RUN
DELTA P ?
                1.0500       RUN
STACK TEMP ?
                73.0000      RUN
DELTA P ?
                1.1000       RUN
STACK TEMP ?
                72.5000      RUN
DELTA P ?
                1.1500       RUN
STACK TEMP ?
                73.0000      RUN
DELTA P ?
                1.2500       RUN
STACK TEMP ?
                72.5000      RUN
DELTA P ?
                1.2500       RUN
STACK TEMP ?
                72.0000      RUN

SQRT PSTS = 18.4814
AVE STK TEMP = 71.5000
```

```
                    XROM "METH 5"
RUN NUMBER
INLET 2
                             RUN
METER BOX Y?
                .9968        RUN
DELTA H?
                3.4800       RUN
BAR PRESS ?
                29.2700      RUN
METER VOL ?
                118.6350     RUN
MTR TEMP F?
                96.0000      RUN
STATIC HOH IN ?
                -2.2000      RUN
STACK TEMP ?
                72.0000      RUN
ML. WATER ?
                38.1000      RUN

SAT % = 2.7

IMP. % HOH = 1.6
% HOH=1.6

% CO2?
                .7000        RUN
% OXYGEN?
                21.0000      RUN
% CO ?
                0.0000       RUN

MWd =28.95
MW WET=28.78

SQRT PSTS ?
                18.4814      RUN
TIME MIN ?
                120.0000     RUN
NOZZLE DIA ?
                .2560        RUN
STK DIA INCH ?
                17.6250      RUN

* VOL MTR STD = 110.820
  STK PRES ABS = 29.11
  VOL HOH GAS = 1.79
  % MOISTURE = 1.59
  MOL DRY GAS = 0.984
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.78
  VELOCITY FPS = 45.86
  STACK AREA = 1.69
  STACK ACFM = 4,662
* STACK DSCFM = 4,429
  % ISOKINETIC = 98.89

END OF FIELD DATA
```

```
                    XROM "MASSFLO"
RUN NUMBER
U-2                          RUN
VOL MTR STD ?
                110.82000    RUN
STACK DSCFM ?
                4,429.00000  RUN
FRONT 1/2 MG ?
                32.79400     RUN
BACK 1/2 MG ?
                             RUN

F  GR/DSCF = 0.00457
F  MG/MMM = 10.45017
F  LB/HR = 0.17336
F  KG/HR = 0.07864

                             RUN
B  GR/DSCF = 0.00000
B  MG/MMM = 0.00000
B  LB/HR = 0.00000
B  KG/HR = 0.00000

T  GR/DSCF = 0.00457
T  MG/MMM = 10.45017
T  LB/HR = 0.17336
T  KG/HR = 0.07864
                             RUN
```

FIELD DATA

PLANT Precision Machine Hydraulics
DATE 9/21/88
SAMPLING LOCATION inlet
SAMPLE TYPE
RUN NUMBER 3
OPERATOR Lael
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE ~~29.27~~ 29.30
STATIC PRESSURE, (P_s) -2.2
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .256
ASSUMED MOISTURE, % 0.75
SAMPLE BOX NUMBER
METER BOX NUMBER RAC-7
METER $\Delta H_@$ 1.9918
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

Y = .9968

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\ out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	PROBE TEMPERATURE END °F	IMPINGER TEMPERATURE, °F
		180.926											
1	5	185.75	.58	2.91	2.91	4.2	76	78	~~74~~				
2	10	190.10	.55	2.78	2.78	4.0	85	78	~~75~~ 74.5				
3	15	194.52	.545	2.79	2.79	4.0	95	80	75				
4	20	199.98	.515	2.66	2.66	3.8	100	83	74				
5	25	203.47	.52	2.70	2.70	4.1	105	86	75				
6	30	208.15	.57	2.97	2.97	5.2	108	88	75				
7	35	212.9	.575	3.01	3.01		111	91	75				
8	40	217.5	.53	2.79	2.79	5.0	113	93	75				
9	45	222.1	.52	2.74	2.74	↓	114	95	74.5				
10	50	226.75	.545	2.88	2.88		115	96	74.5				
11	55	231.5	~~.55~~	~~2.23~~	2.91		115	98	74.5				
12	60	236.254	.56	2.98	2.98		116	99	73				
1	65	239.90	.31	1.60	1.60	3.0	92	92	74				
2	70	243.50	.345	1.78	1.78		95	92	75				
3	75	247.0	.36	1.87	1.87	3.4	102	92	75				
4	80	251.1	.395	2.06	2.06	3.8	106	93	75				
5	85	255.15	.42	2.20	2.20	4.0	110	94	75				
6	90	259.55	.49	2.58	2.58	4.8	112	96	75				
7	95	264.80	.86	4.53	4.53	8.3	113	96	75				
8	100	271.20	1.10	5.83	5.83	11	117	98	75				
9	105	277.90	1.15	6.12	6.12	12	122	100	76				
10	110	284.7	1.20	6.47	6.47	13	123	112	75				
11	115	290.6	.785	4.22	4.22	7.5	125	103	74				
12	120	294.730	.34	1.83	1.83	3	123	104	73				

COMMENTS:

METER VOL. = 113.707 AVE. ΔH = 3.13 AVE. T_m = 101 T_s AVE. = 75

EPA (Dwi) 235
4 72

ANALYTICAL DATA

PLANT Precisim Machine Hyd.

DATE 9/21/88

SAMPLING LOCATION inlet

SAMPLE TYPE MM13B

RUN NUMBER I-3

SAMPLE BOX NUMBER inlet

CLEAN-UP MAN Ms Owens, Mr. Brown, Ms. Beaky

COMMENTS:

FRONT HALF

LABORATORY RESU

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER _____ _____

FILTER NUMBER _____ _____ — CONTAINER _____ _____

_____ _____

_____ _____

FRONT HALF SUBTOTAL _____

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____

ETHER-CHLOROFORM EXTRACTION _____

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____

BACK HALF SUBTOTAL _____

TOTAL WEIGHT _____

MOISTURE

IMPINGERS	#1	#2	#3
FINAL VOLUME	542.2 ml	559.1	480.0
INITIAL VOLUME	532.2 ml	557.8	477.6
NET VOLUME	10.0 ml	1.3	2.4

SILICA GEL			
FINAL WEIGHT	792.8 g	_____ g	_____ g
INITIAL WEIGHT	778.4 g	_____ g	_____ g
NET WEIGHT	14.4 g	_____ g	_____ g

TOTAL MOISTURE 28.1

EPA (Dur) 231
4/72

```
                          RUN
NO. OF POINTS ?
          24.0000         RUN
DELTA P ?
           .5800          RUN
STACK TEMP ?
          74.0000         RUN
DELTA P ?
           7.0000         CLX
           .5500          RUN
STACK TEMP ?
          74.0000         RUN
DELTA P ?
           .5450          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .5150          RUN
STACK TEMP ?
          74.0000         RUN
DELTA P ?
           .5200          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .5700          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .5750          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .5300          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .5200          RUN
STACK TEMP ?
          74.5000         RUN
DELTA P ?
           .5450          RUN
STACK TEMP ?
          74.5000         RUN
DELTA P ?
           2.0000         CLX
           .5500          RUN
STACK TEMP ?
          74.5000         RUN
DELTA P ?
           .5600          RUN
STACK TEMP ?
          73.0000         RUN
DELTA P ?
           .3100          RUN
STACK TEMP ?
          74.0000         RUN
DELTA P ?
           .3450          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .3600          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .3950          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .4200          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .4900          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .8600          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
          1.1000          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
          1.1500          RUN
STACK TEMP ?
          76.0000         RUN
```

```
DELTA P ?
          1.2000          RUN
STACK TEMP ?
          75.0000         RUN
DELTA P ?
           .7850          RUN
STACK TEMP ?
          74.0000         RUN
DELTA P ?
           .3400          RUN
STACK TEMP ?
          73.0000         RUN

SQRT PSTS = 17.5390
AVE STK TEMP = 74.6042


                 XROM "METH 5"
RUN NUMBER
INLET 3                   RUN
METER BOX Y?
           .9968          RUN
DELTA H?
          3.1300          RUN
BAR PRESS ?
         29.3000          RUN
METER VOL ?
        113.7070          RUN
MTR TEMP F?
        101.0000          RUN
STATIC HOH IN ?
         -2.2000          RUN
STACK TEMP ?
         75.0000          RUN
ML. WATER ?
         28.1000          RUN

SAT % = 3.0

IMP. % HOH = 1.2

% HOH=1.2

% CO2?
           .7000          RUN
% OXYGEN?
         21.0000          RUN
% CO ?
          0.0000          RUN

MWd =28.95
MW WET=28.82

SQRT PSTS ?
         17.5390          RUN
TIME MIN ?
        120.0000          RUN
NOZZLE DIA ?
           .2560          RUN
STK DIA INCH ?
         17.6250          RUN

* VOL MTR STD = 105.286
  STK PRES ABS = 29.14
  VOL HOH GAS = 1.32
  % MOISTURE = 1.24
  MOL DRY GAS = 0.988
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.82
  VELOCITY FPS = 43.47
  STACK AREA = 1.69
  STACK ACFM = 4,419.
* STACK DSCFM = 4,194.
  % ISOKINETIC = 99.21

END OF FIELD DATA
```

```
                          RUN
RUN NUMBER
I-3                       RUN
VOL MTR STD ?
        105.28600         RUN
STACK DSCFM ?
       4,194.00000        RUN
FRONT 1/2 MG ?
         35.79800         RUN
BACK 1/2 MG ?
                          RUN

F  GR/DSCF = 0.00525
F  MG/MMM = 12.00701
F  LB/HR = 0.18862
F  KG/HR = 0.08556
                          RUN
B  GR/DSCF = 0.00000
B  MG/MMM = 0.00000
B  LB/HR = 0.00000
B  KG/HR = 0.00000

T  GR/DSCF = 0.00525
T  MG/MMM = 12.00701
T  LB/HR = 0.18862
T  KG/HR = 0.08556
                          RUN
```

FIELD DATA

PLANT Precision Machine & Hydraulics
DATE 9/22/88
SAMPLING LOCATION inlet
SAMPLE TYPE
RUN NUMBER 4
OPERATOR Lori
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE ~~29.31~~ 29.28
STATIC PRESSURE, (P_s) -2.2
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .256
ASSUMED MOISTURE, % 0.5
SAMPLE BOX NUMBER RAC-7
METER BOX NUMBER 1.9918
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

$Y = .9968$

READ AND RECORD ALL DATA EVERY 5 MINUTES

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\ out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	PROBE TEMPERATURE END °F	IMPINGER TEMPERATURE, °F
		294.893											
1	5	299.55	.58	2.91	2.91	3.9	66	68	67				
2	10	304.15	.565	2.86	2.86		76	69	68.5				
3	15	308.6	.53	2.71	2.71		87	71	68				
4	20	313.1	.53	2.73	2.73		94	74	69				
5	25	317.6	.53	2.76	2.76	3.2	99	78	69				
6	30	322.3	.57	2.99	2.99		102	81	68				
7	35	327.0	.58	3.05	3.05		105	84	69				
8	40	331.7	.54	2.85	2.85		108	87	70				
9	45	336.3	.53	2.82	2.82		110	89	68.5				
10	50	341.1	.58	3.08	3.08	3.9	110	91	70				
11	55	345.35	.41	2.19	2.19		112	93	68				
12	60	349.594	.45	2.41	2.41		111	94	68				
1	65	353.29	.34	1.74	1.74	2.2	80	83	72				
2	70	356.9	.335	1.72	1.72		86	83	73				
3	75	360.7	.37	1.91	1.91		94	84	73				
4	80	364.55	.38	1.97	1.97		100	85	74				
5	85	368.6	.42	2.19	2.19	2.9	103	87	74				
6	90	372.95	.515	2.70	2.70		105	89	74				
7	95	378.4	.89	4.68	4.68		108	92	74				
8	100	384.7	1.05	5.56	5.56	7.0	114	94	74				
9	105	390.5	1.1	5.87	5.87		119	96	74				
10	110	397.9	1.15	6.15	6.15		121	98	74	*			
11	115	405.1	1.3	7.00	7.00	9.0	122	99	72				
12	120	412.101	1.25	6.74	6.74		123	101	72				
		117.1050		ΔH AVE = 3.40			T_m AVE. = 94		T_s AVE. = 71				

COMMENTS:

EPA (Dur) 235
4-72

B-15

ANALYTICAL DATA

PLANT Precision Machine + Hydraulic

DATE 9/21/88

SAMPLING LOCATION inlet

SAMPLE TYPE MM13B

RUN NUMBER ~~[illegible]~~ I-4

SAMPLE BOX NUMBER inlet

CLEAN-UP MAN Ms. Backer, Ms. Owens, Mr. Brown

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

FILTER NUMBER _____ _____ — CONTAINER _____ _____ mg

_____ _____

_____ _____

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

IMPINGERS	#1		#2	#3
FINAL VOLUME	560.3	ml/gr	574.6	462.5
INITIAL VOLUME	548.9	ml/gr	572.9	460.5
NET VOLUME	11.4	ml/gr	1.7	2.0

SILICA GEL			
FINAL WEIGHT	785.3 g	_____ g	_____ g
INITIAL WEIGHT	760.2 g	_____ g	_____ g
NET WEIGHT	25.1 g	_____ g	_____ g

TOTAL MOISTURE 40.42 g

EPA (Dur) 231

```
                    XROM "PRESS"
NO. OF POINTS ?
                .0000      CLX
DELTA P ?     24.0000      RUN
STACK TEMP ?   .5800       RUN
DELTA P ?     67.0000      RUN
STACK TEMP ?   .5650       RUN
DELTA P ?     68.5000      RUN
STACK TEMP ?   .5300       RUN
DELTA P ?     68.0000      RUN
STACK TEMP ?   .5300       RUN
                3.0000     CLX
DELTA P ?     69.0000      RUN
STACK TEMP ?   .5300       RUN
DELTA P ?     69.0000      RUN
STACK TEMP ?   .5700       RUN
DELTA P ?     68.0000      RUN
STACK TEMP ?   .5800       RUN
DELTA P ?     69.0000      RUN
STACK TEMP ?   .5400       RUN
DELTA P ?     70.0000      RUN
STACK TEMP ?   .5300       RUN
DELTA P ?     68.5000      RUN
STACK TEMP ?   .5800       RUN
DELTA P ?     70.0000      RUN
STACK TEMP ?   .4100       RUN
DELTA P ?     68.0000      RUN
STACK TEMP ?   .4500       RUN
DELTA P ?     68.0000      RUN
STACK TEMP ?   .3400       RUN
DELTA P ?     72.0000      RUN
STACK TEMP ?   .3350       RUN
DELTA P ?     73.0000      RUN
STACK TEMP ?   .3700       RUN
DELTA P ?     73.0000      RUN
STACK TEMP ?   .3800       RUN
DELTA P ?     74.0000      RUN
STACK TEMP ?   .4200       RUN
DELTA P ?     74.0000      RUN
STACK TEMP ?   .5150       RUN
DELTA P ?     74.0000      RUN
STACK TEMP ?   .8900       RUN
DELTA P ?     74.0000      RUN
STACK TEMP ?  1.0500       RUN
                2.0000     CLX
DELTA P ?     74.0000      RUN
STACK TEMP ?  1.1000       RUN
              74.0000      RUN
DELTA P ?
STACK TEMP ?  1.1500       RUN
              74.0000      RUN
DELTA P ?
STACK TEMP ?  1.3000       RUN
              72.0000      RUN
DELTA P ?
STACK TEMP ?  1.2500       RUN
              72.0000      RUN

SQRT PSTS = 18.1000
AVE STK TEMP = 70.9583
```

```
K                   XROM "METH 5"
RUN NUMBER
INLET 4
                                 RUN
METER BOX Y?
DELTA H?        .9968            RUN
BAR PRESS ?    3.4000            RUN
METER VOL ?   29.2800            RUN
MTR TEMP F?  117.1050            RUN
STATIC HOH IN ?  94.0000         RUN
STACK TEMP ?  -2.2000            RUN
ML. WATER ?   71.0000            RUN
              40.2000            RUN

SAT % = 2.6

IMP. % HOH = 1.7

% HOH=1.7

% CO2?
% OXYGEN?        .7000            RUN
% CO ?         21.0000            RUN
                0.0000            RUN

MWd =28.95
MW WET=28.77

SQRT PSTS ?
TIME MIN ?     18.1000            RUN
NOZZLE DIA ?  120.0000            RUN
STK DIA INCH ?  .2560             RUN
               17.6250            RUN

* VOL MTR STD = 109.801
  STK PRES ABS = 29.12
  VOL HOH GAS = 1.89
  % MOISTURE = 1.69
  MOL DRY GAS = 0.983
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.77
  VELOCITY FPS = 44.91
  STACK AREA = 1.69
  STACK ACFM = 4,565.
* STACK DSCFM = 4,343.
  % ISOKINETIC = 99.92

END OF FIELD DATA
```

```
                    XROM "MASSFLO"
RUN NUMBER
I-4                              RUN

VOL MTR STD ?
          109.801000             RUN
STACK DSCFM ?
        4,343.000000             RUN
FRONT 1/2 MG ?
           43.325000             RUN
BACK 1/2 MG ?
                                 RUN

F  GR/DSCF = 0.006089
F  MG/MMM = 13.934109
F  LB/HR = 0.226673
F  KG/HR = 0.102819
```

FIELD DATA

PLANT Precision Machine + Hydraulics
DATE 9/22/88
SAMPLING LOCATION inlet
SAMPLE TYPE
RUN NUMBER 5
OPERATOR Lori
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE ~~29.23~~ 29.21
STATIC PRESSURE, (P_s) -2.2
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .254
ASSUMED MOISTURE, % 0.25
SAMPLE BOX NUMBER
METER BOX NUMBER RAC-7
METER $\Delta H_@$ 1.9918
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

Y = 0.9968

READ AND RECORD ALL DATA EVERY 5 MINUTES

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	PROBE TEMPERATURE END °F	IMPINGER TEMPERATURE, °F
		412.414											
1	5	417.0	.565	2.85	2.85		77	80	78				
2	10	421.6	.56	2.85	2.85		86	80	78				
3	15	426.1	.53	2.72	2.72	5.2	96	82	78				
4	20	430.6	.52	2.70	2.70		103	84	78				
5	25	435.1	.52	2.72	2.72		108	88	78				
6	30	439.7	.535	2.80	2.80		110	91	79				
7	35	444.45	.60	3.16	3.16		113	94	79				
8	40	449.05	.52	2.75	2.75	5.1	116	96	79				
9	45	453.8	.51	2.71	2.71		117	98	79				
10	50	458.25	.53	2.82	2.82		118	100	79				
11	55	462.99	.54	2.87	2.87		118	101	79				
12	60	467.135	.41	2.19	2.19		120	102	78				
		467.210											
1	65	470.85	.33	1.71	1.71		96	97	80.5				
2	70	474.5	.33	1.72	1.72		100	97	81				
3	75	478.3	.38	1.99	1.99	3.9	106	97	81				
4	80	482.4	.41	2.15	2.15		110	98	81				
5	85	486.75	.49	2.58	2.58		112	99	81				
6	90	491.2	.49	2.59	2.59		116	100	81				
7	95	496.45	.765	4.06	4.06		119	102	82				
8	100	502.5	.95	5.06	5.06	9.8	122	103	82				
9	105	508.85	1.05	5.62	5.62		124	105	81				
10	110	515.9	1.2	6.43	6.43		127	106	82				
11	115	522.75	1.25	6.74	6.74		130	108	81				
12	120	529.212	.975	5.28	5.28		132	109	80				

COMMENTS:

EPA (Rev. 4-85) 4/72

Vol = 116.7230

ΔH AVE. = 3.29 T_m AVE. = 104 T_s AVE = 80

ANALYTICAL DATA

PLANT Precision Machine & Hydraulics COMMENTS:

DATE 9-22-88

SAMPLING LOCATION Inlet

SAMPLE TYPE M 13B

RUN NUMBER I - 5

SAMPLE BOX NUMBER

CLEAN-UP MAN Ms. Owens, Mr. Brown

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

FILTER NUMBER _____ _____ — CONTAINER _____ _____ mg

_____ _____

_____ _____

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

IMPINGERS	566.6 #1	#2	#3	480.8
FINAL VOLUME	~~574.9~~ ml	~~578.9~~ 563.4	~~486.3~~	
INITIAL VOLUME	556.4 ml	560.9	478.0	
NET VOLUME	10.2 ml	2.5	2.8	

SILICA GEL	777.7		
FINAL WEIGHT	~~803.8~~ g	_____ g	_____ g
INITIAL WEIGHT	748.7 g	_____ g	_____ g
NET WEIGHT	29.0 g	_____ g	_____ g

TOTAL MOISTURE 44.5 g

EPA (Dur) 231
4/72

```
                8.0000     CLX
              XROM "PRESS"
NO. OF POINTS ?
              24.0000     RUN
DELTA P ?
               .5650      RUN
STACK TEMP ?
              78.0000     RUN
DELTA P ?
               .5600      RUN
STACK TEMP ?
              78.0000     RUN
DELTA P ?
               .5300      RUN
STACK TEMP ?
              78.0000     RUN
DELTA P ?
               .5200      RUN
STACK TEMP ?
              78.0000     RUN
DELTA P ?
               .5200      RUN
STACK TEMP ?
              78.0000     RUN
DELTA P ?
               .5350      RUN
STACK TEMP ?
              79.0000     RUN
DELTA P ?
               .6000      RUN
STACK TEMP ?
              79.0000     RUN
DELTA P ?
               .5200      RUN
STACK TEMP ?
              79.0000     RUN
DELTA P ?
               .5100      RUN
STACK TEMP ?
              79.0000     RUN
DELTA P ?
               .5300      RUN
STACK TEMP ?
              79.0000     RUN
DELTA P ?
               .5400      RUN
STACK TEMP ?
              79.0000     RUN
DELTA P ?
               .4100      RUN
STACK TEMP ?
              78.0000     RUN
DELTA P ?
               .3300      RUN
STACK TEMP ?
              80.5000     RUN
DELTA P ?
               .3300      RUN
STACK TEMP ?
              81.0000     RUN
DELTA P ?
               .3800      RUN
STACK TEMP ?
              81.0000     RUN
DELTA P ?
               .4100      RUN
STACK TEMP ?
              81.0000     RUN
DELTA P ?
               .4900      RUN
STACK TEMP ?
              81.0000     RUN
DELTA P ?
               .4900      RUN
STACK TEMP ?
              81.0000     RUN
DELTA P ?
               .7650      RUN
STACK TEMP ?
               5.0000     CLX
              82.0000     RUN
DELTA P ?
               .9500      RUN
STACK TEMP ?
              82.0000     RUN
DELTA P ?
              1.0500      RUN
STACK TEMP ?
              81.0000     RUN
```

```
DELTA P ?
              1.2000      RUN
STACK TEMP ?
              82.0000     RUN
DELTA P ?
              1.2500      RUN
STACK TEMP ?
              81.0000     RUN
DELTA P ?
               .9750      RUN
STACK TEMP ?
              80.0000     RUN

SQRT PSTS = 18.0035
AVE STK TEMP = 79.8125
                          CL Σ
                          XLA
```

```
                XROM "METH 5"
RUN NUMBER
INLET 5
                          RUN
METER BOX Y?
               .9968      RUN
DELTA H?
              3.2900      RUN
BAR PRESS ?
             29.2100      RUN
METER VOL ?
            116.7230      RUN
MTR TEMP F?
            104.0000      RUN
STATIC HOH IN ?
             -2.2000      RUN
STACK TEMP
             80.0000      RUN
ML. WATER ?
             44.5000      RUN

SAT % = 3.6

IMP. % HOH = 1.9
% HOH=1.9

% CO2?
% OXYGEN?      .7000      RUN
             21.0000      RUN
% CO ?
              0.0000      RUN

MWd =28.95
MW WET=28.74

SQRT PSTS ?
             18.0035      RUN
TIME MIN ?
            120.0000      RUN
NOZZLE DIA ?
               .2560      RUN
STK DIA INCH ?
             17.6250      RUN

* VOL MTR STD = 107.219
  STK PRES ABS = 29.05
  VOL HOH GAS = 2.09
  % MOISTURE = 1.92
  MOL DRY GAS = 0.981
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.74
  VELOCITY FPS = 44.74
  STACK AREA = 1.69
  STACK ACFM = 4,549.
* STACK DSCFM = 4,235.
  % ISOKINETIC = 100.06

END OF FIELD DATA
```

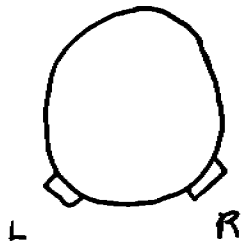
```
RUN NUMBER
I-5                       RUN
VOL MTR STD ?
            107.21900     RUN
STACK DSCFM ?
          4,235.00000     RUN
FRONT 1/2 MG ?
             40.56400     RUN
BACK 1/2 MG ?
                          RUN

F  GR/DSCF = 0.00584
F  MG/MMM = 13.36029
F  LB/HR = 0.21193
F  KG/HR = 0.09613

B  GR/DSCF = 0.00000      RUN
B  MG/MMM = 0.00000
B  LB/HR = 0.00000
B  KG/HR = 0.00000

T  GR/DSCF = 0.00584
T  MG/MMM = 13.36029
T  LB/HR = 0.21193
T  KG/HR = 0.09613
                          RUN
```

FIELD DATA

PLANT Precision Machine
DATE 9/20/88
SAMPLING LOCATION Outlet
SAMPLE TYPE M5
RUN NUMBER 1 Outlet
OPERATOR Sorrell
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.13
STATIC PRESSURE, (P_s) -.29
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .292
ASSUMED MOISTURE, % 28
SAMPLE BOX NUMBER
METER BOX NUMBER RAC-8
METER $\Delta H_@$ 2.0003
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp
Y = .9932

SCHEMATIC OF TRAVERSE POINT LAYOUT



READ AND RECORD ALL DATA EVERY 8 MINUTES

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	PROBE TEMPERATURE END °F	IMPINGER TEMPERATURE, °F
	0 / 3120	437.856											
L 1	8	444.5	.33	2.80	2.80	3.0	102	99	~~88~~ 85				64
2	16	452.7	.41	3.53	3.53	5.0	116	101	86				70
3	24	461.3	.45	3.91	3.91	5.2	124	105	86				58
4	32 (4)	469.8	.41	3.57	2.57	5.0	126	107	87				64
5	40 (10)	478.0	.385	3.36	3.36	4.6	127	109	87				60
6	48 (18)	485.9	.36	3.15	3.15	4.2	127	110	87				60
7	56 (26)	494.0	.38	3.32	3.32	4.5	127	111	87				60
8	64 (34)	502.3	.395	3.45	3.45	4.7	127	111	87				58
9	72 (42)	511.1	.435	3.81	3.81	5.0	127	112	87				58
10	80 (50)	520	.430	3.77	3.77	5.0	129	112	87				58
11	88 (58)	528.4	.450	3.95	3.95	5.2	129	112	87				55
12	96 (66)	537.171	.44	3.86	3.86	5.1	129	113	87				55
13	104 (74)												
14	112 (82)	99.315											
15	120 (90)												
16	128 (98)												
17	136 (106)												
18	144 (114)												
19	152 (122)												
20	160 (130)												
21	168 (138)												
22	176 (146)												
23	184 (154)												
24	192 (162)												

COMMENTS:

EPA (Dur) 235
4-72

FIELD DATA

PLANT Precision Machine
DATE 9/20/88
SAMPLING LOCATION Outlet
SAMPLE TYPE ~~196~~ 13B
RUN NUMBER 1 (Cont)
OPERATOR SDuvell
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.13
STATIC PRESSURE, (P_s) .29
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .292
ASSUMED MOISTURE, % 2.8
SAMPLE BOX NUMBER
METER BOX NUMBER RAC-8
METER $\Delta H_@$ 2.0003
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 8 MINUTES

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F	OUTLET ($T_{m\ out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	END °F	IMPINGER TEMPERATURE, °F
			537.368											
Rside 1	104	4	542.4	.12	1.03	1.03	1.8	111	109	87				
2	112	8	548.9	.25	2.18	2.18	3.0	123	110	85				56
3	120	12	556.3	.32	2.80	2.80	4.0	125	111	85				56
4	128	16	564.0	.34	2.99	2.99	4.0	127	111	84				55
5	136	20	572.0	.36	3.17	3.17	4.2	128	112	84				56
6	144	24	580.0	.36	3.19	3.19	4.2	130	113	83				56
7	152	28	587.7	.32	2.83	2.83	3.9	130	113	83				55
8	160	4	595.8	.38	3.36	3.36	4.5	129	113	83				58
9	168	12	604.5	.44	3.90	3.90	5.1	129	113	82				58
10	176	20	613.9	.51	4.54	4.54	6.1	131	114	81				55
11	184	28	623.8	.57	5.08	5.08	7.0	133	114	81				55
12	192	6	633.938	.58	5.19	5.19	7.2	134	115	80				55
			95.57											
			96.57											
	Tot Vol		194.885											
	METER Vol. = 195.885				ΔH AVE = 3.45		T_m AVE = 118			T_s AVE = 85				

COMMENTS:

PSTS = 14.5026

EPA (Dur) 235
4 72

ANALYTICAL DATA

PLANT Precision Machine + Hydraulics COMMENTS:

DATE 9/20/88

SAMPLING LOCATION Outlet

SAMPLE TYPE MM13B

RUN NUMBER ~~I-1~~ O-1

SAMPLE BOX NUMBER Outlet

CLEAN-UP MAN Ms. Owens, Mr. Brown

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

FILTER NUMBER _____ _____ — CONTAINER _____ _____ mg

_____ _____

_____ _____

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

IMPINGERS	#1	#2	#3
FINAL VOLUME	573.0 mlgr	605.5	453.8
INITIAL VOLUME	566.4 mlgr	585.6	449.1
NET VOLUME	6.6 mlgr	19.9	4.7

SILICA GEL			
FINAL WEIGHT	703.6 g	_____ g	_____ g
INITIAL WEIGHT	675.0 g	_____ g	_____ g
NET WEIGHT	28.6 g	_____ g	_____ g

TOTAL MOISTURE 59.8 g

EPA (Dur) 231
4/72

```
                    XROM "PRESS"  NORM
NO. OF POINTS ?
                          24.0000    RUN
DELTA P ?
                           .3300     RUN
STACK TEMP ?
                          85.0000    RUN
DELTA P ?
                           .4100     RUN
STACK TEMP ?
                          86.0000    RUN
DELTA P ?
                           .4500     RUN
STACK TEMP ?
                          86.0000    RUN
DELTA P ?
                           .4100     RUN
STACK TEMP ?
                          87.0000    RUN
DELTA P ?
                           .3850     RUN
STACK TEMP ?
                          87.9000    RUN
DELTA P ?
                           .3600     RUN
STACK TEMP ?
                          87.0000    RUN
DELTA P ?
                           .3800     RUN
STACK TEMP ?
                          87.0000    RUN
DELTA P ?
                           .3950     RUN
STACK TEMP ?
                          87.0000    RUN
DELTA P ?
                           .4350     RUN
STACK TEMP ?
                          87.0000    RUN
DELTA P ?
                           .4300     RUN
STACK TEMP ?
                          87.0000    RUN
DELTA P ?
                           .4500     RUN
STACK TEMP ?
                          87.0000    RUN
DELTA P ?
                           .4400     RUN
STACK TEMP ?
                          87.0000    RUN
DELTA P ?
                           .1200     RUN
STACK TEMP ?
                          87.0000    RUN
DELTA P ?
                           .2500     RUN
STACK TEMP ?
                          85.0000    RUN
DELTA P ?
                           .3200     RUN
STACK TEMP ?
                          85.0000    RUN
DELTA P ?
                           .3400     RUN
STACK TEMP ?
                          84.0000    RUN
DELTA P ?
                           .3600     RUN
STACK TEMP ?
                          84.0000    RUN
DELTA P ?
                           .3600     RUN
STACK TEMP ?
                          83.0000    RUN
DELTA P ?
                           .3200     RUN
STACK TEMP ?
                          83.0000    RUN
DELTA P ?
                           .3800     RUN
STACK TEMP ?
                          83.0000    RUN
DELTA P ?
                           .4400     RUN
STACK TEMP ?
                          82.0000    RUN
DELTA P ?
                           .5100     RUN
STACK TEMP ?
                          81.0000    RUN
DELTA P ?
                           .5700     RUN
STACK TEMP ?
                          81.0000    RUN
DELTA P ?
                           .5800     RUN
STACK TEMP ?
                          80.0000    RUN
SQRT PSTS = 14.5026
AVE STK TEMP = 84.9167
```

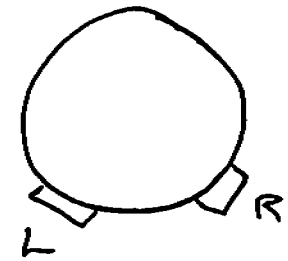
```
                    XROM "METH 5"
RUN NUMBER
                                     CHS
0-1
                                     RUN
METER BOX Y?
                           .9932     RUN
DELTA H?
                          3.4500     RUN
BAR PRESS ?
                         29.1300     RUN
METER VOL ?
                        195.8850     RUN
MTR TEMP F?
                        118.0000     RUN
STATIC HOA IN ?
                           .2900     RUN
STACK TEMP
                         85.0000     RUN
ML. WATER ?
                         59.8000     RUN

SAT % = 4.2

IMP. % HOH = 1.6
% HOH=1.6

% CO2?
                           .7000     RUN
% OXYGEN?
                         21.0000     RUN
% CO ?
                         78.3000     RUN

MWd =28.95
MW WET=28.78

SQRT PSTS ?
                         14.5026     RUN
TIME MIN ?
                        192.0000     RUN
NOZZLE DIA ?
                           .2920     RUN
STK DIA INCH ?
                         19.4700     RUN

* VOL MTR STD = 174.537
  STK PRES ABS = 29.15
  VOL H2O GAS = 2.81
  % MOISTURE = 1.59
  MOL DRY GAS = 0.984
  % NITROGEN = -1.00E-4
  MOL WT DRY = 28.95
  MOL WT WET = 28.78
  VELOCITY FPS = 35.96
  STACK AREA = 2.07
  STACK ACFM = 4,461.
* STACK DSCFM = 4,144.
  % ISOKINETIC = 97.60

END OF FIELD DATA
```

```
RUN NUMBER .
0-1
                                     RUN
VOL MTR STD ?
                        174.53700    RUN
STACK DSCFM ?
                        4,144.00000  RUN
FRONT 1/2 MG ?
                           .29110    RUN
BACK 1/2 MG ?
                                     RUN

F  GR/DSCF = 0.00003
F  MG/MMM = 0.05890
F  LB/HR = 0.00091
F  KG/HR = 0.00041

                                     RUN
B  GR/DSCF = 0.00000
B  MG/MMM = 0.00000
B  LB/HR = 0.00000
B  KG/HR = 0.00000

T  GR/DSCF = 0.00003
T  MG/MMM = 0.05890
T  LB/HR = 0.00091
T  KG/HR = 0.00041
                                     RUN
```

FIELD DATA

PLANT Precision Machine
DATE 9/21/88
SAMPLING LOCATION Outlet
SAMPLE TYPE ~~MM5~~ ISB
RUN NUMBER 2
OPERATOR Sorrell
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.27
STATIC PRESSURE, (P_s) .29
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .293
ASSUMED MOISTURE, % 1.0
SAMPLE BOX NUMBER
METER BOX NUMBER RAC-8
METER $\Delta H_@$ 2.0003
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp



SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

Y = .9932

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	PROBE TEMPERATURE END °F	IMPINGER TEMPERATURE, °F
	0	9130	634.689											
Pside 1	5		638.3	.18	1.60	1.60	2.0	95	93	71				
2	10		642.6	.275	2.48	2.48	3.1	109	94	71				60
3	15		647.2	.305	2.76	2.76	3.3	114	96	72				58
4	20		652.0	.345	3.13	3.13	4.0	116	97	72				52
5	25		657.0	.37	3.35	3.35	4.0	117	96	73				55
6	30		662.2	.38	3.45	3.45	4.2	118	100	73				56
7	35		667.0	.315	2.87	2.87	3.5	119	100	73				59
8	40		672.1	.38	3.45	3.45	4.2	119	101	74				64
9	45		677.4	.44	3.99	3.99	5.0	120	101	75				64
10	50		683.3	.51	4.64	4.64	5.9	121	102	75				65
11	55		689.4	.55	5.01	5.01	6.2	123	103	75				70
12	60		695.777	.57	5.20	5.20	6.7	123	103	75				70
			695.779											68
side 1	65		699.0	.135	1.20	1.00	1.0	100	99	75				
2	70		704.0	.44	3.94	3.94	5.0	108	99	76				52
3	75		709.5	.43	3.87	3.87	4.8	114	100	76				52
4	80		715.0	.445	4.01	4.01	5.0	116	100	76				53
5	85		720.4	.43	3.89	3.89	4.8	117	101	76				53
6	90		725.8	.41	3.71	3.71	4.5	118	102	76				54
7	95		730.9	.38	3.44	3.44	4.2	118	102	76				55
8	100		735.9	.255	3.21	3.21	4.0	117	102	76				55
9	105		741.1	.390	3.53	3.53	4.2	117	102	76				55
10	110		746.4	.410	3.71	3.71	4.5	117	102	76				56
11	115		752.0	.460	4.16	4.16	5.0	117	102	76				56
12	120		757.813	.490	4.44	4.44	5.2	119	103	76				56
			123.123	ΔH Ave. = 3.54				T_m Ave. = 108		T_s Ave. = 75				

COMMENTS:

Final leakage rate .019 cfm

EPA (Dur) 235
4-72

ANALYTICAL DATA

PLANT Precision Mach + Hyd

DATE 9/21/88

SAMPLING LOCATION Outlet

SAMPLE TYPE MM13B

RUN NUMBER 0-2

SAMPLE BOX NUMBER OUTLET

CLEAN-UP MAN Ms. Owens, Ms. Brown

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

FILTER NUMBER _____ _____ — CONTAINER _____ _____ mg

_____ _____

_____ _____

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

	#1	#2	#3	#4
IMPINGERS				
FINAL VOLUME	579.2 mlgr	591.2	452.4	
INITIAL VOLUME	568.2 mlgr	588.1	449.6	
NET VOLUME	11.0 mlgr	3.1	2.8	
SILICA GEL				
FINAL WEIGHT	785.5 g	g	g	
INITIAL WEIGHT	761.9 g	g	g	
NET WEIGHT	23.6 g	g	g	

TOTAL MOISTURE _____ g

EPA (Dur) 231
4/72

0-2 271-4-3

```
NO. OF POINTS ?          RUN
DELTA P ?  24.0000       RUN
STACK TEMP ?  .1800      RUN
DELTA P ?  71.0000       RUN
STACK TEMP ?  .2750      RUN
DELTA P ?  71.0000       RUN
STACK TEMP ?  .3050      RUN
DELTA P ?  72.0000       RUN
STACK TEMP ?  .3450      RUN
DELTA P ?  72.0000       RUN
STACK TEMP ?  .3700      RUN
DELTA P ?  73.0000       RUN
STACK TEMP ?  .3800      RUN
DELTA P ?  73.0000       RUN
STACK TEMP ?  .3150      RUN
DELTA P ?  73.0000       RUN
STACK TEMP ?  .3800      RUN
DELTA P ?  74.0000       RUN
STACK TEMP ?  .4400      RUN
DELTA P ?  75.0000       RUN
STACK TEMP ?  .5100      RUN
DELTA P ?  75.0000       RUN
STACK TEMP ?  .5500      RUN
DELTA P ?  75.0000       RUN
STACK TEMP ?  .5700      RUN
DELTA P ?  75.0000       RUN
STACK TEMP ?  .1350      RUN
DELTA P ?  75.0000       RUN
STACK TEMP ?  .4400      RUN
DELTA P ?  76.0000       RUN
STACK TEMP ?  .4300      RUN
DELTA P ?  76.0000       RUN
STACK TEMP ?  .4450      RUN
DELTA P ?  76.0000       RUN
STACK TEMP ?  .4300      RUN
DELTA P ?  76.0000       RUN
STACK TEMP ?  .4100      RUN
DELTA P ?  76.0000       RUN
STACK TEMP ?  .3800      RUN
DELTA P ?  76.0000       RUN
STACK TEMP ?  .3550      RUN
DELTA P ?  76.0000       RUN
STACK TEMP ?  .3900      RUN
           76.0000       RUN
```

```
DELTA P ?
STACK TEMP ?  .4100      RUN
DELTA P ?  76.0000       RUN
STACK TEMP ?  .4600      RUN
DELTA P ?  76.0000       RUN
STACK TEMP ?  .4900      RUN
           76.0000       RUN
SQRT PSTS = 14.3269
AVE STK TEMP = 74.5833
```

```
RUN NUMBER  XROM "METH 5"
0-2

METER BOX Y?             RUN
DELTA H?      .9932      RUN
BAR PRESS ?  3.5400      RUN
METER VOL ?  29.2700     RUN
MTR TEMP F?  123.1230    RUN
STATIC HOH IN ?  108.0000  RUN
STACK        .2900       RUN
ML. WATER ?  75.0000     RUN
             40.5000     RUN

SAT % = 3.0

IMP. % HOH = 1.7
% HOH=1.7

% CO2?
% OXYGEN?      .7000      RUN
% CO ?       21.0000      RUN
                           RUN
MWd =28.95
MW WET=28.77

SQRT PSTS ?
TIME MIN ?  14.3269      RUN
NOZZLE DIA ?  120.0000   RUN
STK DIA INCH ?  .2920    RUN
             19.4700     RUN
* VOL MTR STD = 112.193
  STK PRES ABS = 29.29
  VOL HOH GAS = 1.91
  % MOISTURE = 1.67
  MOL DRY GAS = 0.983
  % NITROGEN = 78.30
  MOL WT DRY = 28.88
  MOL WT WET = 28.95
  MOL WT WET = 28.77
  VELOCITY FPS = 35.44
  STACK AREA = 2.07
  STACK ACFM = 4,397
* STACK DSCFM = 4,177
  % ISOKINETIC = 99.57
```

```
RUN NUMBER
0-2
                         RUN
VOL MTR STD ?  112.19300 RUN
STACK DSCFM ?  4,177.00000 RUN
FRONT 1/2 MG ?  .10180   RUN
BACK 1/2 MG ?            RUN

F  GR/DSCF = 0.00001
F  MG/MMM = 0.03204
F  LB/HR = 0.00050
F  KG/HR = 0.00023

B  GR/DSCF = 0.00000     RUN
B  MG/MMM = 0.00000
B  LB/HR = 0.00000
B  KG/HR = 0.00000

T  GR/DSCF = 0.00001
T  MG/MMM = 0.03204
T  LB/HR = 0.00050
T  KG/HR = 0.00023
```

END OF FIELD DATA

FIELD DATA

PLANT Precision Machine
DATE 7/21/88
SAMPLING LOCATION Outlet
SAMPLE TYPE ~~MM5~~ 13B
RUN NUMBER 3
OPERATOR Sorrell
AMBIENT TEMPERATURE 75°F
BAROMETRIC PRESSURE 29.30
STATIC PRESSURE, (P_s) -.29
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .1292
ASSUMED MOISTURE, % .75
SAMPLE BOX NUMBER
METER BOX NUMBER RAC-8
METER $\Delta H_@$ 2.0003
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY ____ MINUTES

Y = .9932

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\ out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	PROBE TEMPERATURE END °F	IMPINGER TEMPERATURE, °F
	0 / 7:08	758.008											
side 1	5	762.9	.37	3.30	3.30	5.0	101	99	77				
2	10	768.3	.435	3.92	3.92	6.0	114	100	78				54
3	15	773.8	.44	3.98	3.98	6.1	119	101	78				54
4	20	779.2	.41	3.73	3.73	5.5	121	103	78				58
5	25	784.4	.395	3.50	3.50	5.1	121	103	78				65
6	30	789.4	.355	3.23	3.23	4.9	121	104	78				67
7	35	794.5	.375	3.41	3.41	5.0	121	105	78				68
8	40	799.7	.38	3.46	3.46	5.1	121	105	78				64
9	45	804.8	.37	3.37	3.37	5.0	121	105	78				62
10	50	810.1	.40	3.64	3.64	5.4	120	105	78				60
11	55	815.7	.45	4.09	4.09	6.2	120	105	78				60
12	60	821.257	.475	4.32	4.32	6.5	121	105	78				60
		821.338											60
1	65	825.0	.19	1.70	1.70	2.5	104	102	78				
2	70	829.3	.26	2.35	2.35	3.3	115	103	78				
3	75	833.8	.30	2.72	2.72	4.0	118	104	78				
4	80	838.6	.33	3.00	3.00	4.2	120	105	78				55
5	85	843.5	.345	3.14	3.14	4.6	121	105	78				57
6	90	848.6	.36	3.28	3.28	4.9	121	105	78				58
7	95	853.7	.32	2.91	2.91	4.3	121	105	78				59
8	100	858.3	.34	3.09	3.09	4.5	120	105	78				60
9	105	863.4	.38	3.46	3.46	5.2	120	106	78				60
10	110	869.2	.475	4.33	4.33	6.3	121	106	78				
11	115	875.1	.54	4.93	4.93	7.5	123	106	78				
12	120	881.339	.565	5.17	5.17	7.9	125	106	78				62
		123.25	Ave ΔH: 3.50				Tm Ave = 111		Ts Ave = 77				

COMMENTS:

EPA (Dur) 235
4/72

ANALYTICAL DATA

PLANT Precision Machine & Hydraulic

DATE 9-21-88

SAMPLING LOCATION Outlet

SAMPLE TYPE M 13 B

RUN NUMBER 0-3

SAMPLE BOX NUMBER

CLEAN-UP MAN Mr Barker, Mr. Brown

COMMENTS:

FRONT HALF

		LABORATORY RESULTS
ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER _____	_____ mg
FILTER NUMBER _____ _____	CONTAINER _____	_____ mg
_____ _____		
_____ _____		

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER	CONTAINER _____	_____ mg
	ETHER-CHLOROFORM EXTRACTION	_____ mg
ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER	CONTAINER _____	_____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

IMPINGERS	#1	#2	#3
FINAL VOLUME	582.8 ~~mg~~	592.5	452.1
INITIAL VOLUME	571.2 ~~mg~~	589.4	450.3
NET VOLUME	11.6 ~~mg~~	3.1	1.8

SILICA GEL			
FINAL WEIGHT	782.2 g	_____ g	_____ g
INITIAL WEIGHT	757.7 g	_____ g	_____ g
NET WEIGHT	24.5 g	_____ g	_____ g

TOTAL MOISTURE 41.0 g

EPA (Dur) 231
4/72

```
                XROM "PRESS"
NO. OF POINTS ?
                24.0000     RUN
DELTA P ?
                .3700       RUN
STACK TEMP ?
                77.0000     RUN
DELTA P ?
                .4350       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .4400       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .4100       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3850       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3550       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3750       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3800       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3700       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .4000       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .4500       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .4750       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .1900       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .2600       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3000       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3300       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3450       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3600       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3200       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3400       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .3800       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .4750       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .5400       RUN
STACK TEMP ?
                78.0000     RUN
DELTA P ?
                .5650       RUN
STACK TEMP ?
                78.0000     RUN

SQRT PSTS = 14.3161
AVE STK TEMP = 77.9583
```

```
                XROM "METH 5"
RUN NUMBER
0-3                         RUN
METER BOX Y?
                .9932       RUN
DELTA H?
                3.5000      RUN
BAR PRESS ?
                29.3000     RUN
METER VOL ?
                123.2500    RUN
MTR TEMP F?
                111.0000    RUN
STATIC HOA IN ?
                .2900       RUN
STACK TEMP
                78.0000     RUN
ML. WATER ?
                41.0000     RUN

SAT % = 3.3

IMP. % HOH = 1.7
% HOH=1.7

% CO2?
                .7000       RUN
% OXYGEN?
                21.0000     RUN
% CO ?
                78.3000     RUN

MWd =28.95
 WET=28.77

SQRT PSTS
                14.3161     RUN
TIME MIN ?
                120.0000    RUN
NOZZLE DIA ?
                .2920       RUN
STK DIA INCH ?
                19.4700     RUN

* VOL MTR STD = 111.821
  STK PRES ABS = 29.32
  VOL HOH GAS = 1.93
  % MOISTURE = 1.70
  MOL DRY GAS = 0.983
  % NITROGEN = -1.00E-4
  MOL WT DRY = 28.95
  MOL WT WET = 28.77
  VELOCITY FPS = 35.40
  STACK AREA = 2.07
  STACK ACFM = 4,391.
* STACK DSCFM = 4,152.
  % ISOKINETIC = 99.84

END OF FIELD DATA
```

```
RUN NUMBER
0-3                         RUN
VOL MTR STD ?
                111.82100   RUN
STACK DSCFM ?
                4,152.00000 RUN
FRONT 1/2 MG ?
                0.10770     RUN
BACK 1/2 MG ?               RUN

F  GR/DSCF = 0.00001
F  MG/MMM = 0.03401
F  LB/HR = 0.00053
F  KG/HR = 0.00024
                            RUN
B  GR/DSCF = 0.00000
B  MG/MMM = 0.00000
B  LB/HR = 0.00000
B  KG/HR = 0.00000

T  GR/DSCF = 0.00001
T  MG/MMM = 0.03401
T  LB/HR = 0.00053
T  KG/HR = 0.00024
                            RUN
```

FIELD DATA

PLANT Precision Machine
DATE 9/27/88
SAMPLING LOCATION Outlet
SAMPLE TYPE 13B
RUN NUMBER 4
OPERATOR Sorrell
AMBIENT TEMPERATURE 68
BAROMETRIC PRESSURE 29.28
STATIC PRESSURE, (P_s) -.29
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .242
ASSUMED MOISTURE, % 0.5
SAMPLE BOX NUMBER
METER BOX NUMBER RAC-8
METER $\Delta H_@$ 2.0003
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY _____ MINUTES

Y = .9932

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	PROBE TEMPERATURE END °F	IMPINGER TEMPERATURE, °F
side	0 / 855	881.646											
1	5	885.8	.27	2.38	2.38	3.2	85	83	70				
2	10	890.1	.275	2.43	2.43	3.3	92	83	71				46
3	15	894.5	.31	2.76	2.76	3.8	98	84	72				48
4	20	899.3	.335	3.00	3.00	4.2	103	86	72				51
5	25	904.1	.35	3.14	3.14	4.2	105	88	72				52
6	30	909.1	.365	3.29	3.29	4.6	107	90	71				53
7	35	913.7	.31	2.80	2.80	4.0	109	91	72				53
8	40		.35	3.16	3.16	4.3	110	93	73				
9	45	924.0	.43	3.90	3.90	5.3	111	94	72				53
10	50		.51	4.63	4.63	6.1	113	95	73				54
11	55		.56	5.10	5.10	7.3	116	96	73				55
12	60	942.163	.555	~~5.12~~ 3.99	~~5.12~~ 5.12	7.2	119	~~108~~ 98	74				
side .284 1	65	947.4	.39	3.50	3.50	5.0	99	97	74				
2	70	952.9	.45	4.09	4.09	5.8	113	99	75				49
3	75	958.5	.44	4.01	4.01	5.7	119	100	76				
4	80	963.8	.41	3.75	3.75	5.2	121	101	76				56
5	85	969.0	.38	3.47	3.47	5.0	121	102	77				
6	90	974.2	.37	3.38	3.38	4.8	120	103	77				57
7	95	979.3	.375	3.42	3.42	4.9	119	103	77				57
8	100	984.4	.37	3.38	3.38	4.9	119	103	77				58
9	105	989.5	.37	3.38	3.38	4.9	119	103	78				
10	110	994.8	.40	3.65	3.65	5.1	119	103	77				59
11	115	000.2	.44	4.02	4.02	5.7	120	103	77				
12	120	005.462	.47	4.30	4.30		121	104	77				60

COMMENTS:

ΔH AVE.=3.58 T_m AVE.=104 T_s AVE.=74

EPA (Dwr) 235
4 72

ANALYTICAL DATA

PLANT Precision Machine & Hydraulics

DATE 9-22-88

SAMPLING LOCATION Outlet

SAMPLE TYPE M 13B

RUN NUMBER 0-4

SAMPLE BOX NUMBER

CLEAN-UP MAN

COMMENTS:

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

FILTER NUMBER _____ _____ — CONTAINER _____ _____ mg

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

IMPINGERS	#1		#2	#3
FINAL VOLUME	580.2	mgl	591.7	451.8
INITIAL VOLUME	566.9	mgl	588.1	450.1
NET VOLUME	13.3	mgl	3.6	1.7

SILICA GEL			
FINAL WEIGHT	776.6 g	_____ g	_____ g
INITIAL WEIGHT	752.0 g	_____ g	_____ g
NET WEIGHT	24.6 g	_____ g	_____ g

TOTAL MOISTURE 43.2 g

EPA (Dur) 231
4/72

OUTLET RUN 4
279-4-3

```
                    CLX
NO. OF POINTS ?     RUN
24.0000             RUN
DELTA P ?
.2700               RUN
STACK TEMP ?
70.0000             RUN
DELTA P ?
.2750               RUN
STACK TEMP ?
71.0000             RUN
DELTA P ?
.3100               RUN
STACK TEMP ?
71.0000             RUN
DELTA P ?
.3350               RUN
STACK TEMP ?
72.0000             RUN
DELTA P ?
.3500               RUN
STACK TEMP ?
72.0000             RUN
DELTA P ?
.3650               RUN
STACK TEMP ?
71.0000             RUN
DELTA P ?
.3100               RUN
STACK TEMP ?
72.0000             RUN
DELTA P ?
.3500               RUN
STACK TEMP ?
73.0000             RUN
DELTA P ?
.4300               RUN
STACK TEMP ?
72.0000             RUN
DELTA P ?
.5100               RUN
STACK TEMP ?
73.0000             RUN
DELTA P ?
.5600               RUN
STACK TEMP ?
73.0000             RUN
DELTA P ?
.5550               RUN
STACK TEMP ?
74.0000             RUN
DELTA P ?
.3900               RUN
STACK TEMP ?
74.0000             RUN
DELTA P ?
.4500               RUN
STACK TEMP ?
75.0000             RUN
DELTA P ?
.4400               RUN
STACK TEMP ?
76.0000             RUN
DELTA P ?
.4100               RUN
STACK TEMP ?
76.0000             RUN
DELTA P ?
.3800               RUN
STACK TEMP ?
77.0000             RUN
DELTA P ?
.3700               RUN
STACK TEMP ?
77.0000             RUN
DELTA P ?
.3750               RUN
STACK TEMP ?
77.0000             RUN
DELTA P ?
.3700               RUN
STACK TEMP ?
77.0000             RUN
DELTA P ?
.3700               RUN
STACK TEMP ?
77.0000             RUN
DELTA P ?
.4000               RUN
STACK TEMP ?
77.0000             RUN
DELTA P ?
.4400               RUN
STACK TEMP ?
77.0000             RUN
DELTA P ?
.4700               RUN
STACK TEMP ?
77.0000             RUN

SQRT PSTS = 14.4668
AVE STK TEMP = 74.2083
```

```
                    XROM "METH 5"
RUN NUMBER          RUN
0-4
METER BOX Y?        RUN
.9932               RUN
DELTA H?
3.5800              RUN
BAR PRESS ?
29.2800             RUN
METER VOL ?
124.1950            RUN
MTR TEMP F?
104.0000            RUN
STATIC HOH IN ?
.2900               RUN
STACK TEMP.
74.0000             RUN
ML. WATER ?
43.2000             RUN

SAT % = 2.9

IMP. % HOH = 1.8
% HOH=1.8

% CO2?
.7000               RUN
% OXYGEN?
21.0000             RUN
% CO ?
                    RUN

MWd =28.55
MW WET=28.76

SQRT PSTS ?
14.4668             RUN
TIME MIN ?
120.0000            RUN
NOZZLE DIA ?
.2920               RUN
STK DIA INCH ?
19.4700             RUN

* VOL MTR STD = 114.023
  STK PRES ABS = 29.30
  VOL HOH GAS = 2.03
  % MOISTURE = 1.75
  MOL DRY GAS = 0.982
  % NITROGEN = 78.30
  MOL WT DRY = 28.55
  MOL WT WET = 28.76
  VELOCITY FPS = 35.79
  STACK AREA = 2.07
  STACK ACFM = 4,440.
* STACK DSCFM = 4,224.
  % ISOKINETIC = 100.08

END OF FIELD DATA
```

```
RUN NUMBER
0-4
                    RUN
VOL MTR STD ?
114.02200           RUN
STACK DSCFM ?
4,224.00000         RUN
FRONT 1/2 MG ?
.08910              RUN
BACK 1/2 MG ?
                    RUN

F  GR/DSCF = 0.00001
F  MG/MMM = 0.02760
F  LB/HR = 0.00044
F  KG/HR = 0.00020
                    RUN
B  GR/DSCF = 0.00000
B  MG/MMM = 0.00000
B  LB/HR = 0.00000
B  KG/HR = 0.00000

T  GR/DSCF = 0.00001
T  MG/MMM = 0.02760
T  LB/HR = 0.00044
T  KG/HR = 0.00020
                    RUN
```

FIELD DATA

PLANT Precision Machine
DATE 9/22/88
SAMPLING LOCATION Outlet
SAMPLE TYPE 13B
RUN NUMBER 5
OPERATOR Sorrell
AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE 29.23
STATIC PRESSURE, (P_s) .29
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D. .292
ASSUMED MOISTURE, % .25
SAMPLE BOX NUMBER
METER BOX NUMBER RAC-8
METER $\Delta H_@$ 2.0003
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

Y = .9932

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	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	PUMP VACUUM, in. Hg	DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\ out}$), °F	STACK TEMPERATURE (T_s), °F	FILTER TEMPERATURE °F	PROBE TEMPERATURE CENTER °F	PROBE TEMPERATURE END °F	IMPINGER TEMPERATURE, °F
	0	6.282											
1	5	11.5	.395	3.58	3.58	6.1	105	103	77				
2	10	16.9	.44	4.02	4.02	7.0	122	104	81				
3	15	22.8	.44	4.03	4.03	7.0	127	106	82				50
4	20	28.1	.41	3.77	3.77	6.5	128	107	81				
5	25	33.4	.40	3.67	3.67	6.4	127	108	82				
6	30	38.3	.345	3.16	3.16	5.5	126	108	82				55
7	35	43.4	.355	3.25	3.25	5.8	125	108	82				57
8	40		.365	3.35	3.35	6.0	124	109	82				57
9	45	53.7	.375	3.44	3.44	6.0	124	109	82				58
10	50	59.0	.400	3.66	3.66	6.2	124	108	83				58
11	55	64.5	.44	4.03	4.02	7.0	125	109	83				
12	60	70.298	.47	4.30	4.30	7.7	125	109	83				59
1	65	74.25	.21	1.89	1.89	3.3	108	106	82				60
2	70	78.7	.295	2.68	2.68	4.8	119	102	83				
3	75	88	.32	2.92	2.92	5.0	123	108	84				50
4	80	88.5	.34	3.10	3.10	5.2	125	108	84				52
5	85	93.5	.35	3.20	3.2	5.5	126	109	84				52
6	90	98.7	.39	3.57	3.57	6.0	127	110	84				53
7	95	103.5	.32	2.93	2.93	5.0	128	110	85				53
8	100	108.6	.36	3.29	3.29	5.7	127	110	85				54
9	105		.435	3.99	3.99	7.0	127	111	84				55
10	110	120.2	.495	4.54	4.54	8.0	129	111	85				55
11	115	126.2	.54	4.96	4.96	9.0	130	111	85				55
12	120	132.425	.545	5.02	5.02	9.0	132	112	85				55

COMMENTS:

126.044 ΔH AVE = 3.6 AVE T_m = 116 T_s AVE. = 83

EPA (Dur) 235
4-72

ANALYTICAL DATA

PLANT Precision Machine & Hydraulics

COMMENTS:

DATE 9-22-88

SAMPLING LOCATION Outlet

SAMPLE TYPE M 13 B

RUN NUMBER 0 - 5

SAMPLE BOX NUMBER

CLEAN-UP MAN

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

FILTER NUMBER _____ _____ — CONTAINER _____ _____ mg

_____ _____

_____ _____

FRONT HALF SUBTOTAL _____ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

ETHER-CHLOROFORM EXTRACTION _____ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER _____ _____ mg

BACK HALF SUBTOTAL _____ mg

TOTAL WEIGHT _____ mg

MOISTURE

IMPINGERS	#1	#2	#3
FINAL VOLUME	571.7 ml	578.9	440.3
INITIAL VOLUME	553.8 ml	574.0	438.2
NET VOLUME	17.9 ml	4.9	2.1

SILICA GEL			
FINAL WEIGHT	803.8 g	g	g
INITIAL WEIGHT	783.5 g	g	g
NET WEIGHT	20.3 g	g	g

TOTAL MOISTURE 45.2 g

EPA (Dur) 231
4/72

OUTLET RUN 5 279-4-3

```
NO. OF POINTS ?
DELTA P ? 24.0000 RUN
STACK TEMP ? .3950 RUN
DELTA P ? 77.0000 RUN
STACK TEMP ? .4400 RUN
DELTA P ? 81.0000 RUN
STACK TEMP ? .4400 RUN
DELTA P ? 82.0000 RUN
STACK TEMP ? .4100 RUN
DELTA P ? 81.0000 RUN
STACK TEMP ? .4000 RUN
DELTA P ? 82.0000 RUN
STACK TEMP ? .3450 RUN
DELTA P ? 82.0000 RUN
STACK TEMP ? .3550 RUN
DELTA P ? 82.0000 RUN
STACK TEMP ? .3650 RUN
DELTA P ? 82.0000 RUN
STACK TEMP ? .3750 RUN
DELTA P ? 82.0000 RUN
STACK TEMP ? .4000 RUN
DELTA P ? 83.0000 RUN
STACK TEMP ? .4400 RUN
DELTA P ? 83.0000 RUN
STACK TEMP ? .4700 RUN
DELTA P ? 83.0000 RUN
STACK TEMP ? .2100 RUN
DELTA P ? 82.0000 RUN
STACK TEMP ? .2950 RUN
DELTA P ? 83.0000 RUN
STACK TEMP ? .3200 RUN
DELTA P ? 84.0000 RUN
STACK TEMP ? .3400 RUN
DELTA P ? 84.0000 RUN
STACK TEMP ? .3500 RUN
DELTA P ? 84.0000 RUN
STACK TEMP ? .3900 RUN
DELTA P ? 84.0000 RUN
STACK TEMP ? .3200 RUN
DELTA P ? 85.0000 RUN
STACK TEMP ? .3600 RUN
DELTA P ? 85.0000 RUN
STACK TEMP ? .4350 RUN
84.0000 RUN
```

```
DELTA P ?
STACK TEMP ? .4950 RUN
DELTA P ? 85.0000 RUN
STACK TEMP ? .5400 RUN
DELTA P ? 85.0000 RUN
STACK TEMP ? .5450 RUN
85.0000 RUN
SQRT PSTS = 14.5410
AVE STK TEMP = 82.9167
```

```
RUN NUMBER XROM "METH 5"
0-5 CHS
METER BOX Y? RUN
DELTA H? .9932 RUN
BAR PRESS ? 3.6000 RUN
METER VOL ? 29.2100 RUN
MTR TEMP F? 126.0440 RUN
STATIC HOA IN ? 16.0000 RUN
STACK TEMP .2900 RUN
ML. WATER ? 83.0000 RUN
45.2000 RUN

SAT % = 3.9

IMP. % HOH = 1.8
% HOH=1.8

% CO2?
% OXYGEN? .7000 RUN
% CO ? 21.0000 RUN
RUN

MWd =28.95
MW WET=28.75

SQRT PSTS ?
TIME MIN ? 14.5410 RUN
NOZZLE DIA ? 20.0000 RUN
STK DIA INCH ? .2920 RUN
19.4700 RUN

* VOL MTR STD = 113.046
  STK PRES ABS = 29.23
  VOL HOA GAS = 2.13
  % MOISTURE = 1.85
  MOL DRY GAS = 0.982
  % NITROGEN = 78.30
  MOL WT DRY = 28.82
  MOL WT WET = 28.75
  VELOCITY FPS = 36.02
  STACK AREA = 2.07
  STACK ACFM = 4,468.
* STACK DSCFM = 4,167.
  % ISOKINETIC = 100.58
```

```
RUN NUMBER
0-5 RUN
VOL MTR STD ?
113.04600 RUN
STACK DSCFM ?
4,167.00000 RUN
FRONT 1/2 MG ?
.03380 RUN
BACK 1/2 MG ?
RUN

F GR/DSCF = 4.61409E-6
F MG/MMM = 0.01056
F LB/HR = 0.00016
F KG/HR = 0.00007

B GR/DSCF = 0.00000 RUN
B MG/MMM = 0.00000
B LB/HR = 0.00000
B KG/HR = 0.00000

T GR/DSCF = 4.61409E-6
T MG/MMM = 0.01056
T LB/HR = 0.00016
T KG/HR = 0.00007
CLX
```

END OF FIELD DATA

APPENDIX C
CALCULATION CHECKS

SAMPLING MARY SHEET

PLANT PRECISION MACHINE AND HYDRAULICS

LOCATION Worthington, West Virginia

SAMPLED SOURCE Meshpad Outlet

Run	Date	N_p	3 Y_m	4 ΔH	5 P Bar.	6 V_m	7 T_m	8 V_m Std.	9 %	10 P_{st}	17 P_s	18 T_s	19 VP	20 V_w	21 $V_{w_{gas}}$	22 %M	23 M_d
1	21SEP88	24	.9932	3.45	29.13	195.885	118	174.537		.29	29.15	85		59.8	2.81	1.59	.984
2	21Sep88	24	.9932	3.54	29.27	123.123	108	112.193		.29	29.29	75		40.5	1.91	1.67	.983
3	22Sep88	24	.9932	3.50	29.30	123.250	111	111.821		.29	29.32	78		41.0	1.93	1.70	.983
4	22SEP88	24	.9932	3.58	29.28	124.195	104	114.023		.29	29.30	74		43.2	2.03	1.75	.982
5	22SEP88	24	.9932	3.60	29.21	126.044	116	113.046		.29	29.23	83		45.2	2.13	1.85	.982

Run	24 CO_2	25 O_2	26 N_2	27 CO	28 —	29 MW_d	30 MW	31 $C_p\sqrt{\Delta P_s(T_s + 460)}$	32	33 T_t	34 D_n	35 V_s	36 D_s	37 Area	38 ACFM	39 DSCFM	40 %I
1	0.7	21.0	78.3			28.95	28.78	.84	14.5026	122	.292	36.0	19.47	2.07	4461	4144	97.6
2	0.7	21.0	78.3			28.95	28.77	.84	14.3269	120	.292	35.4	19.47	2.07	4397	4177	99.6
3	0.7	21.0	78.3			28.95	28.77	.84	14.3161	120	.292	35.4	19.47	2.07	4391	4152	99.8
4	0.7	21.0	78.3			28.95	28.77	.84	14.4668	120	.292	35.8	19.47	2.07	4440	4224	100.1
5	0.7	21.0	78.3			28.95	28.75	.84	14.5410	120	.292	36.0	19.47	2.07	4468	4167	100.6

$$V_m \text{ Std.} = Y_m \frac{17.64 \times V_m \left(P \text{ Bar.} + \frac{\Delta H}{13.6}\right)}{(T_m + 460)}$$

$$V_{w_{gas}} = 0.0471\ V_w$$

$$M_d = \%CO_2 \times .44 + (\%O_2 \times .32) + (\%CO + \%N_2) \times .28 + \left(\%Other \times \frac{Mol.\ wt.}{100}\right)$$

$$MW = MW_d \times M_d + 18(1 - M_d)$$

$$V_s = 85.49 \times C_p\sqrt{\Delta P_s\ (T_s + 460)}\left[\frac{1}{P_s \times MW}\right]^{1/2}$$

$$I = \frac{0.09450 \times (T_s + 460) \times V_m \text{ Std.}}{V_s \times T_t \times P_s \times M_d \times A_n}$$

$$\%M = \frac{100 \times V_{w_{gas}}}{V_m \text{ Std.} + V_{w_{gas}}}$$

$$M_d = \frac{100 - \%M}{100}$$

$$P_s = P \text{ Bar.} \pm \frac{P_{st}}{13.6}$$

N_p = Total No. of Sampling points

Y_m = Meter Box Correction Factor

ΔH = Average Orfice Pressure Drop, inches H_2O

P Bar. = Barometric Pressure, Inches Hg. Absolute

V_m = Volume of Dry Gas at Meter Conditions, DCF

T_m = Average Meter Temperature, °F.

V_m Std. = Volume of Dry Gas at STP. DSCF[a]

% = Per Cent other gas removed before Dry Gas Meter

P_{st} = Static Pressure of Stack Gas, inches H_2O

P_s = Stack Gas Pressure, inches Hg.

T_s = Average Stack Temperature, °F

VP = Vapor Pressure of H_2O At Stack Temperature

V_w = Total H_2O Collected in Impingers and Silica Gel

$V_{w_{gas}}$ = Volume of water vapor collected at STP, SCF[b]

%M = Per Cent Moisture by volume

M_d = Mole Fraction of Dry Gas

$\%CO_2$ = Volume % Dry

$\%O_2$ = Volume % Dry

$\%N_2$ = Volume % Dry

%CO = Volume % Dry

MW_d = Molecular Weight of Stack Gas Dry Basis

MW = Molecular Weight of Stack Gas, Wet Basis

C_p = Pitot Tube Coefficient

$\sqrt{\Delta P\ (T_s + 460)}$ Is determined by averaging the square root of the product of the velocity head (P) and the absolute stack temperature from each sampling point.

T_t = Net time of test in minutes

D_n = Sampling Nozzle Diameter, inches

A_n = Area of Nozzle opening, ft^2.

V_s = Stack Gas Velocity at Stack Conditions, Feet per second.

D_s = Diameter of Stack, inches

Area = Area of duct in ft^2

ACFM = Actual Cubic Feet per minute

DSCFM = Dry Standard Cubic Feet per minute

%I = Per Cent Isokinetic

[a] Dry Standard Cubic Feet @ 68°F, 29.92 in. Hg.

[b] Standard Conditions @ 68°F, 29.92 in. Hg.

PLANT PRECISION MACHINE AND HYDRAULICS

SUMMARY OF EMISSIONS

SAMPLED SOURCE Meshpad outlet

LOCATION Worthington, West Virginia

RUN	DATE	1 V_m Std.	2 DSCFM
1	20Sep88	174.537	4144
2	21Sep88	112.193	4177
3	21Sep88	111.821	4152
4	22Sep88	114.023	4224
5	22Sep88	113.046	4167

FRONT HALF MILLIGRAMS

PROBE	CYCLONE	FILTER	3 TOTAL
			.295
			.1018
			.1077
			.0891
			.0338

4 BACK HALF	5 FRONT + BACK TOTAL

CONCENTRATIONS

FRONT HALF

RUN	Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
1	.000026	.0597	.00093	.00042
2	.000014	.0320	.00050	.00023
3	.000015	.0340	.00053	.00024
4	.000011	.0254	.00040	.00018
5	.000046	.0106	.00016	.000075
	6	7	8	9

BACK HALF

Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
10	17	18	19

TOTAL

Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
20	21	22	23

Remarks:

[redacted] SAMPLING [redacted] RY SHEET [redacted]

PLANT PRECISION MACHINE AND HYDRAULICS

LOCATION Worthington, West Virginia

SAMPLED SOURCE Meshpad Inlet

Run	Date	N_p	3 Y_m	4 ΔH	5 P Bar.	6 V_m	7 T_m	8 V_m Std.	9 %	10 P_{st}	17 P_s	18 T_s	19 VP	20 V_w	21 $V_{w_{gas}}$	22 %M	23 M_d
1	21Sep 88	24	.9968	3.10	29.13	182.219	108	165.672		-2.2	28.97	82		55.1	2.59	1.54	.985
2	21 22Sep 88	24	.9968	3.48	29.27	118.635	96	110.820		-2.2	29.11	72		38.1	1.79	1.59	.984
3	21 22Sep 88	24	.9968	3.13	29.30	113.707	101	105.286		-2.2	29.14	75		28.1	1.32	1.24	.988
4	22SEP88	24	.9968	3.40	29.28	117.105	94	109.801		-2.2	29.12	71		40.2	1.89	1.69	.983
5	22SEP88	24	.9968	3.32	29.21	116.723	104	107.227		-2.2	29.05	80		44.5	2.09	1.92	.981

Run	24 CO_2	25 O_2	26 N_2	27 CO	28 —	29 MW_d	30 MW	31 C_p	32 $\sqrt{\Delta P_s (T_s + 460)}$	33 T_t	34 D_n	35 V_s	36 D_s	37 Area	38 ACFM	39 DSCFM	40 %I
1	0.7	21	78.3			28.95	28.78	.84	17.7055	192	.256	44.0	17.625	1.69	4476	4157	98.5
2	0.7	21	78.3			28.95	28.78	.84	18.4814	120	.256	45.9	17.625	1.69	4662	4429	98.9
3	0.7	21	78.3			28.95	28.82	.84	17.5393	120	.256	43.5	17.625	1.69	4419	4194	99.2
4	0.7	21	78.3			28.95	28.82	.84	18.1000	120	.256	44.9	17.625	1.69	4565	4343	99.9
5	0.7	21	78.3			28.95	28.74	.84	18.0035	120	.256	44.7	17.625	1.69	4549	4235	100.07

Std. = $V_m = \dfrac{17.64 \times V_m (P\ Bar. + \frac{\Delta H}{13.6})}{(T_m + 460)}$

$= 0.0471\ V_w$

$\%M = \dfrac{100 \times V_{w_{gas}}}{V_m\ Std. + V_{w_{gas}}}$

$M_d = \dfrac{100 - \%M}{100}$

$= \%CO_2 \times .44 + (\%O_2 \times .32) + (\%CO + \%N_2) \times .28 + (\%Other \times \frac{Mol.\ wt.}{100})$

$MW_d = M_d + 18(1 - M_d)$

$P_s = P\ Bar. \pm \dfrac{P_{st}}{13.6}$

$85.49 = C_p \sqrt{\Delta P_s (T_s + 460)} \left[\dfrac{1}{P_s \times MW}\right]^{1/2}$

$\dfrac{0.09450 \times (T_s + 460) \times V_m\ Std.}{V_s \times T_t \times P_s \times M_d \times A_n}$

N_p = Total No. of Sampling points

Y_m = Meter Box Correction Factor

ΔH = Average Orifice Pressure Drop, inches H_2O

P Bar. = Barometric Pressure, inches Hg. Absolute

V_m = Volume of Dry Gas at Meter Conditions, DCF

T_m = Average Meter Temperature, °F.

V_m Std. = Volume of Dry Gas at STP. DSCF[a]

% = Per Cent other gas removed before Dry Gas Meter

P_{st} = Static Pressure of Stack Gas, inches H_2O

P_s = Stack Gas Pressure, inches Hg.

T_s = Average Stack Temperature, °F

VP = Vapor Pressure of H_2O At Stack Temperature

V_w = Total H_2O Collected in Impingers and Silica Gel

$V_{w_{gas}}$ = Volume of water vapor collected at STP, SCF[b]

%M = Per Cent Moisture by volume

M_d = Mole Fraction of Dry Gas

$\%CO_2$ = Volume % Dry

$\%O_2$ = Volume % Dry

$\%N_2$ = Volume % Dry

%CO = Volume % Dry

MW_d = Molecular Weight of Stack Gas Dry Basis

MW = Molecular Weight of Stack Gas, Wet Basis

C_p = Pitot Tube Coefficient

$\sqrt{\Delta P_s (T_s + 460)}$ is determined by averaging the square root of the product of the velocity head (P_s) and the absolute stack temperature from each sampling point.

T_t = Net time of test in minutes

D_n = Sampling Nozzle Diameter, inches

A_n = Area of Nozzle opening, ft^2.

V_s = Stack Gas Velocity at Stack Conditions, Feet per second.

D_s = Diameter of Stack, inches

Area = Area of duct in ft^2

ACFM = Actual Cubic Feet per minute

DSCFM = Dry Standard Cubic Feet per minute

%I = Per Cent Isokinetic

[a] Dry Standard Cubic Feet @ 68°F, 29.92 in. Hg.

[b] Standard Conditions @ 68°F. 29.92 in. Hg.

SUMMARY OF EMISSIONS

PLANT PRECISION MACHINE AND HYDRAULICS

LOCATION Worthington, West Virginia

SAMPLED SOURCE Meshpad Inlet

RUN	DATE	1 V_m Std.	2 DSCFM
1	20Sep88	165.672	4157
2	21Sep88	110.820	4429
3	21Sep88	105.286	4194
4	22SEP88	109.801	4343
5	22SEP88	107.227	4235

FRONT HALF MILLIGRAMS				4	5
PROBE	CYCLONE	FILTER	3 TOTAL	BACK HALF	FRONT + BACK TOTAL
			34.029		
			32.793		
			35.798		
			43.325		
			40.564		

CONCENTRATIONS

FRONT HALF				BACK HALF				TOTAL			
RUN	Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr	Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr	Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
1	.003170	7.2535	.1129	.0512								
2	.004567	10.4498	.1734	.0786								
3	.005247	12.0070	.1886	.0856								
4	.006089	13.9391	.2267	.1028								
5	.005838	13.3593	.2119	.0961								
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks:

APPENDIX D

Draft Method – Determination of Hexavalent Chromium in Dry Particulate Emissions from Stationary Sources

DRAFT METHOD - DETERMINATION OF HEXAVALENT CHROMIUM IN DRY PARTICULATE EMISSIONS FROM STATIONARY SOURCES

1.0 APPLICABILITY AND PRINCIPLE

1.1 Applicability

This method applies to the determination of hexavalent chromium (Cr^{+6}) in dry particulate emissions only from specified stationary sources whose emissions do not contain acids or organics.

1.2 Principle

Particulate emissions are collected from the source by use of Method 5. (Appendix A, 40 CFR Part 60). The collected samples are digested in an alkaline solution and analyzed for Cr^{+6} by the diphenylcarbazide colorimetric method.

2.0 RANGE, SENSITIVITY, PRECISION, AND INTERFERENCES

2.1 Range

A straight-line response curve can be obtained in the range 5 μg Cr^{+6}/100 mℓ to 100 μg Cr^{+6}/100 mℓ. For a minimum analytical accuracy of ±10 percent, the lower limit of the range is 10 μg/100 mℓ. The upper limit can be extended by appropriate dilution.

2.2 Sensitivity

A minimum detection limit of 1 μg Cr^{+6}/100 mℓ has been observed.

2.3 Precision

The overall precision for sample collection and analysis for Cr^{+6} in dry particulate emissions was determined at a ferrochrome smelter, a chemical plant, and a refractory brick plant. Replicate Method 5 filters

with both high and low particulate loadings were analyzed. The relative standard deviations were less than 10 percent in all cases.

2.4 Interference

Molybdenum, mercury and vanadium react with diphenylcarbazide to form a color; however, approximately 20 mg of these elements can be present in a sample without creating a problem. Iron produces a yellow color, but this effect is not measured photometrically at 540 nm. No interference was observed at the sources listed in Section 2.3.

3.0 APPARATUS

3.1 Sampling Train

Same as Method 5, Section 2.1.

3.2 Sample Recovery

Same as Method 5, Section 2.2.

3.3 Analysis

The following equipment is needed.

3.3.1 Beakers--

Borosilicate, 250-mℓ, with watchglass covers.

3.3.2 Filtration Apparatus--

Vacuum unit constructed of plastic or glass, to accommodate 47-mm diameter, 3.0-μg size Teflon filters (NOTE: Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency).

3.3.3 Volumetric Flasks--

100-mℓ and other appropriate volumes.

3.3.4 Hot Plate

3.3.5 Pipettes--

Assorted sizes, as needed.

3.3.6 Spectrophotometer--

To measure absorbance at 540 nm.

4.0 REAGENTS

Unless otherwise indicated, all reagents shall conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society. Where such specifications are not available, use the best available grade.

4.1 Sampling

Same as Method 5, Section 3.1.

4.2 Sample Recovery

Same as Method 5, Section 3.2.

4.3 Analysis

The following reagents are required.

4.3.1 Water--

Deionized distilled, meeting American Society for Testing and Materials (ASTM) specifications for type 2 reagent - ASTM Test Method D 1193-77 (incorporated by reference - see Section 61.18).

4.3.2 Digestion Solution--

Dissolve 20.0 g NaOH and 30.0 g anhydrous Na_2CO_3 in water in a 1-liter volumetric flask, and dilute to the mark. Store the solution in a tightly capped polyethylene bottle. Prepare fresh monthly.

4.3.3 Potassium Dichromate Stock Solution--

Dissolve 141.4 mg of analytical reagent grade $K_2Cr_2O_7$ in water, and dilute to 1 liter (1 mℓ = 50 μg Cr^{+6}).

4.3.4 Potassium Dichromate Standard Solution--

Dilute 10.00 mℓ $K_2Cr_2O_7$ stock solution to 100 mℓ (1 mℓ = 5 μg Cr^{+6}) with water.

4.3.5 Sulfuric Acid, 10 percent (v/v)--

Dilute 10 mℓ H_2SO_4 to 100 mℓ in water.

4.3.6 Acetone--

Same as Method 5, Section 3.2.

4.3.7 Diphenylcarbazide Solution--

Dissolve 250 mg of 1, 5-diphenylcarbazide in 50 mℓ acetone. Store in a brown bottle. Discard when the solution becomes discolored.

5.0 PROCEDURE

5.1 Sampling

Same as Method 5, Section 4.1.

5.2 Sample Recovery

Same as Method 5, Section 4.2.

5.3 Preservation

Tests with dry particulate source samples from the sources described in Section 2.3 demonstrated that the Cr^{+6} content of the samples was stable. Nevertheless, all samples should be protected from extreme heat, kept dry and should be analyzed within 1 month of collection.

5.4 Sample Digestion and Preparation

Place the contents of Container Number 2 (the acetone probe rinse) in a 250-mℓ beaker. Evaporate to dryness. Place the contents of Container Number 1 in the same beaker (cut the filter into small pieces). Add 40 mℓ of digestion solution (Section 4.3.2). Cover the beaker with the watchglass, and heat to near boiling on a hot plate with constant stirring for 30 minutes. Do not allow the solution to evaporate to dryness.

Cool the solution, and transfer it quantitatively to the filtration apparatus with water. Filter the solution through the 47-mm Teflon filter. Transfer the filtrate from the filter flask quantitatively to a 100 mℓ volumetric flask. Fill to the mark with water.

5.5 Reagent Blank Preparation

Take a representative amount of acetone and a blank Method 5 filter and proceed as in Section 5.4.

5.6 Silica Gel Weighing

Weigh the spent silica gel (Container Number 3) or silica gel plum impinger to the nearest 0.5 g using a balance. This step may be conducted in the field.

5.7 Analysis

5.7.1 Color Development and Measurement--

Transfer a 50-mℓ or smaller aliquot of the prepared sample to a 100 mℓ volumetric flask and add sufficient water to bring the volume to approximately 80 mℓ. Adjust the pH to 2 $\pm$ 0.5 with 10 percent H_2SO_4, add 2.0 mℓ of diphenylcarbazide solution, and dilute to volume with water. Allow the solution to stand about 10 minutes for color development. For each set of samples analyzed, treat an identical aliquot of reagent blank solution in the same way. Transfer a portion of the sample to a 1-cm absorption cell and measure the absorbance a the optimum wavelength (Section 6.2.1). Measure and subtract the reagent blank absorbance reading, if any, to obtain a net reading. If the absorbance of the sample exceeds the absorbance of the 100 µg Cr^{+6} standard as determined in Section 6.2.2, dilute the sample and the reagent blank with equal volumes of water.

5.7.2 Check for Matrix Effects on the Cr^{+6} Results--

Since the analysis for Cr^{+6} by colorimetry is sensitive to the chemical composition of the sample (matrix effects), the analyst shall check

at least one sample from each source using the method of additions as follows:

Obtain two equal volume aliquots of the same sample solution. The aliquots should contain between 30 and 50 µg of Cr^{+6} (less is acceptable if not possible). Spike one of the aliquots with an aliquot of standard solution that contains between 30 and 50 µg of Cr^{+6}. Now treat both the spiked and unspiked sample aliquots as described in Section 5.7.1.

Next, calculate the Cr^{+6} mass (C_s), in µg in the aliquot of the unspiked sample solution by using the following equation.

$$C_s = C_a \frac{A_s}{A_t - A_s} \qquad \text{Eq. 1-1}$$

Where:

C_a = Cr^{+6} in the standard solution, µg.
A_s = Absorbance of the unspiked sample solution.
A_t = Absorbance of the spiked sample solution.

Volume corrections will not be required since the solutions as analyzed have been made to the same final volume. If the results of the method of additions procedure used on the single source sample do not agree to within 10 percent of the value obtained by the routine spectrophotometric analysis, then reanalyze all samples from the source using this method of additions procedure.

6.0 CALIBRATION

6.1 Sampling Train

Perform all of the calibrations described in Method 5, Section 5.

6.2 Spectrophotometer Calibration

6.2.1 Optimum Wavelength Determination--

Calibrate the wavelength scale of the spectrophotometer every 6 months. The calibration may be accomplished by using an energy source with an intense line emission such as a mercury lamp, or by using a series of glass filters spanning the measuring range of the spectrophotometer. Calibration materials are available commercially and from the National Bureau of Standards. Specific details on the use of such materials are normally supplied by the vendor; general information about calibration techniques can be obtained from general reference books on analytical chemistry. The wavelength scale of the spectrophotometer shall read correctly within ±5 nm, at all calibration points; otherwise, repair and recalibrate the spectrophotometer. Once the wavelength scale of the spectrophotometer is in proper calibration, use 540 nm as the optimum wavelength for the measurement of the absorbance of the standards and samples.

Alternatively, a scanning procedure may be employed to determine the proper measuring wavelength. If the instrument is a double-beam spectrophotometer, scan the spectrum between 530 and 550 nm using the 50 μg Cr^{+6} standard solution (Section 4.3.4) in the sample cell and a blank solution in the reference cell. If a peak does not occur, the spectrophotometer is malfunctioning. When a peak is obtained within the 530 to 550 nm range, record and use the wavelength at which this peak occurs as the optimum wavelength for the measurement of absorbance of both the standards and the samples. For a single-beam spectrophotometer, follow the scanning procedure described above, except scan the blank and standard solutions separately. For this instrument, the optimum wavelength is the wavelength at which the maximum difference in absorbance between the standard and the blank occurs.

6.2.2 Spectrophotometer Calibration--

Alternative calibration procedures are allowed provided acceptable accuracy and precision can be demonstrated. Add 0.0 mℓ, 1 mℓ, 2 mℓ,

5 mℓ, 10 mℓ, 15 mℓ, and 20 mℓ of the working standard solution (1 mℓ = 5 μg Cr^{+6}) to a series of seven 100-ml volumetric flasks. Dilute each to mark with water. Analyze these calibration standards as in Section 5.7.1. This calibration procedure must be repeated on each day that samples are analyzed. Calculate the spectrophotometer calibration factor K_C as follows:

$$K_C = 5 \frac{A_1 + 2A_2 + 5A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2}$$

where:

K_C = Calibration factor.
A_1 = Absorbance of the 5 μg Cr^{+6}/100 mℓ standard.
A_2 = Absorbance of the 10 μg Cr^{+6}/100 mℓ standard.
A_3 = Absorbance of the 25 μg Cr^{+6}/100 mℓ standard.
A_4 = Absorbance of the 50 μg Cr^{+6}/100 mℓ standard.
A_5 = Absorbance of the 75 μg Cr^{+6}/100 mℓ standard.
A_6 = Absorbance of the 100 μg Cr^{+6}/100 mℓ standard.

6.2.2.1 Spectrophotometer Calibration Quality Control--Multiply the absorbance value obtained for each standard by the K_C factor (least squares slope) to determine the distance each calibration point lies from the theoretical calibration line. These calculated concentration values shall not differ from the actual concentrations (i.e., 5, 10, 25, 50, 75, and 100 μg Cr^{+6}/100 ℓ) by more than ___ percent (to be determined) for five of the six standards.

7.0 EMISSION CALCULATIONS

Carry out the calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculations.

7.1 Total Cr^{+6} in Sample.

Calculate m, the total μg Cr^{+6} in each sample, as follows:

$$m = \frac{100\ K_c\ AF}{v_a}$$

Where:

100 = Volume in mℓ of total sample.

A = Absorbance of sample.

F = Dilution factor (required only if sample dilution was needed to reduce the absorbance into the range of calibration).

v_a = Volume in mℓ of aliquot analyzed.

7.2 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop

Same as Method 5, Section 6.2.

7.3 Dry Gas Volume, Volume of Water Vapor, Moisture Content

Same as Method 5, Section 6.3, 6.4, and 6.5, respectively.

7.4 Cr^{+6} Emission Concentration

Calculate c_s (g/dscm), the Cr^{+6} concentration in the stack gas, dry basis, corrected to standard conditions, as follows:

$$c_s = 10^{-6} g/\mu g)(m/V_{m(std)})$$

7.5 Isokinetic Variation, Acceptable Results

Same as Method 5, Sections 6.11 and 6.12, respectively.

8.0 BIBLIOGRAPHY

1. Test Methods for Evaluating Solid Waste. U.S. Environmental Protection Agency. SW-846, 2nd Edition. July 1982.

2. Cox, X.B., R.W. Linton, and F.E. Butler. Determination of Chromium Speciation in Environmental Particles - A Multitechnique Study of Ferrochrome Smelter Dust. Accepted for publication in Environmental Science and Technology.

3. Same as in Bibliography of Method 5, Citations 2 to 5 and 7.

APPENDIX E
CHAIN OF CUSTODY

SAMPLE CHAIN OF CUSTODY

Plant: Precision Machine & Hydraulic Test Number: 3

Date Sampled: 9/21/88 Run Number: 2

SAMPLE RECOVERY

Container Code	Description
HM13B- O-2	probe, nozzle & impinger rinse
I-2	" " " "
Plating Sol. #1 & #2	plating tank solution

Person Engaged in Sample Recovery

Signature: Helen Owens

Title: Analyst

Location at which Recovery was Done: plant

Date and Time of Recovery: 9/21/88 5:00p

Sample(s) Recipient Upon Recovery if Not Recovery Person

Signature:

Title:

Date and Time of Receipt:

Sample Storage:

Laboratory Person Receiving Sample

Signature: Helen Owens

Title: Analyst

Date and Time of Receipt: 9/21/88 6:00p

Sample Storage:

ANALYSIS

Container Code	Method of Analysis	Date and Time of Analysis	Signature of Analyst
O-2	Cr^{+6}	9/21/88 6:00p	HO
I-2	"	" "	HO
Plating tank	Cr^{+6}	9/29/88 10:00A	HO

SAMPLE CHAIN OF CUSTODY

Plant: Precision Machine & Hydraulic Test Number: _____

Date Sampled: 9/20/88 Run Number: 1

SAMPLE RECOVERY

Container Code	Description
MM13B - O-1	probe, nozzle & impinger rinse
" - I-1	" " " "

Person Engaged in Sample Recovery

Signature: Hilly Owens

Title: Analyst

Location at which Recovery was Done: plant

Date and Time of Recovery: 9/20/88 8:00pm

Sample(s) Recipient Upon Recovery if Not Recovery Person

Signature: _____

Title: _____

Date and Time of Receipt: _____

Sample Storage: _____

Laboratory Person Receiving Sample

Signature: Hilly Owens

Title: _____

Date and Time of Receipt: _____

Sample Storage: _____

ANALYSIS

Container Code	Method of Analysis	Date and Time of Analysis	Signature of Analyst
O-1	Cr+6	9/20/88 8:30p	[illegible]
I-1	"	"	"

SAMPLE CHAIN OF CUSTODY

Plant: Precision Machine & Hydraulic Test Number:

Date Sampled: 9/22/88 Run Number: 3, 4 + 5

SAMPLE RECOVERY

Container Code	Description
HM13B - O-3, I-3	probe + nozzle rinse, impinger catch
O-4, I-4	" " " " "
O-5, I-5	" " " " "

Person Engaged in Sample Recovery

Signature: Holly Owens

Title: Analyst

Location at which Recovery was Done: plant

Date and Time of Recovery: 9/22/88 ~11:00pm, 3:00pm, 5:00pm

Sample(s) Recipient Upon Recovery if Not Recovery Person

Signature:

Title:

Date and Time of Receipt:

Sample Storage:

Laboratory Person Receiving Sample

Signature: Holly Owens

Title: Analyst

Date and Time of Receipt: 9/22/88, 11:30p, 3:30p, 5:30p

Sample Storage:

ANALYSIS

Container Code	Method of Analysis	Date and Time of Analysis	Signature of Analyst
I-3, O-3	Cr^{+6}	9/22/88 ~1:00p	HJO
I-4, O-4	Cr^{+6}	9/22/88 ~4:00	HJO
I-5, O-5	Cr^{+6}	9/22/88 - 6:00	HJO

APPENDIX F

Equipment Calibration Data

RAC-7
8-23-87

Orifice Setting	.5	.5	1	1	2	2	4	4	6	6	8	8
Lb. Ft. Wet	5.0	5.0	5.0	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
P BAR	29.72	—	—	—	—	—	—	—	—	—	—	→
Ave. t+460	540	542	553	557	560	564	569	570	572	573	574	574
Ft. Dry Finish	780.074	785.101	790.378	795.603	806.083	816.573	827.088	837.600	847.876	858.118	868.443	878.747
Ft. Dry Start	775.056	780.074	785.101	790.378	795.603	806.083	816.573	827.088	837.600	847.876	858.118	868.443
C	.0368	.0368	.0737	.0737	.147	.147	.294	.294	.431	.431	.588	.588
Ft. Difference	5.018	5.027	5.277	5.225	10.480	10.490	10.515	10.512	10.276	10.242	10.325	10.3[illegible]
BAR + C	29.568	29.568	29.7937	29.7937	29.867	29.867	30.014	30.014	30.151	30.151	30.308	30.30[illegible]
Wet t+460	540	540	540	540	540	540	540	540	540	540	540	540
Y	.9952	1.0034	.9679	.9846	.9847	1.0013	.9923	.9943	1.0161	1.0212	1.0095	1.011[illegible]
Inlet-T Dry	80	88	96	101	105	110	114	116	118	119	120	120
Outlet-T Dry	85	84	90	92	95	98	104	102	106	107	108	109
T Ave.	83	86	93	96	100	104	109	110	112	113	114	114
T wet	80	80	80	80	80	80	80	80	80	80	80	80
Twet+460	540	540	540	540	540	540	540	540	540	540	540	540
Time	12.6	12.6	9.3	9.2	13.4	13.4	9.7	9.7	7.9	7.8	6.9	6.9
Lb. Ft. Wet	5.0	5.0	5.0	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
X	.01585	.01585	.0317	.0317	.0634	.0634	.1268	.1268	.1902	.1902	.2536	.253[illegible]
P BAR	29.72	—	—	—	—	—	—	—	—	—	—	→
Tdry+460	540	544	550	552	555	558	564	564	566	567	568	568
ΔH ⑨	1.8288	1.8154	1.9564	1.9042	2.0125	2.0017	2.0755	2.0755	2.0577	2.0024	2.0856	2.085[illegible]
Ave. Y	.9986											
Ave. ΔH ⑨	1.9918											

$$Y = \frac{① \cdot ② \cdot ③}{④ \cdot ⑤ \cdot ⑥} \qquad \Delta H_{⑨} = \frac{⑩}{⑪ \cdot ⑫} \times \left(\frac{⑦ \cdot ⑧}{⑨}\right)^2$$

CFS-7

11-7-88

Orifice Setting	.5	.5	1	1	2	2	4	4	6	6	8	8
Cubic Ft. Wet	5.0	5.0	5.0	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
P BAR	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65
T ave. +460	545	552	559	561	565	568	570	562	567	568	571	571
C Ft. Dry Finish	536.109	541.239	546.409	551.592	562.164	572.613	583.201	593.672	604.144	614.645	625.133	635.65
C Ft. Dry Start	531.049	536.109	541.239	546.409	551.592	562.164	572.613	583.201	593.672	604.144	614.645	625.13
C	.0368	.0368	.0737	.0737	.147	.147	.294	.294	.431	.431	.588	.588
C Ft. Difference	5.060	5.130	5.170	5.183	10.572	10.449	10.588	10.471	10.472	10.501	10.488	10.52
P BAR + C	29.6868	29.6868	29.7237	29.7237	29.797	29.797	29.944	29.944	30.081	30.081	30.238	30.2
T wet +460	536	536	536	536	536	536	536	536	537	537	537	537
Y	1.0035	1.0025	1.0061	1.0072	0.9922	1.0092	0.9945	0.9915	0.9938	0.9928	0.9941	0.99
Inlet-T Dry	89	98	104	106	111	112	116	106	114	115	118	118
Outlet-T Dry	80	86	94	95	99	104	104	98	100	100	104	104
T Ave.	85	92	99	101	105	108	110	102	107	108	111	111
T wet	76	76	76	76	76	76	76	76	77	77	77	77
(7) T wet +460	536	536	536	536	536	536	536	536	537	537	537	537
(8) Time	12.6	12.7	9.2	9.2	13.3	13.3	9.7	9.6	7.9	7.9	6.9	6.9
(9) C Ft. Wet	5.0	5.0	5.0	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.
(10) X	.01585	.01585	.0317	.0317	.0634	.0634	.1268	.1268	.1902	.1902	.2536	.25
(11) P BAR	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.6
(12) Out Tdry +460	540	546	554	555	559	564	564	558	560	560	564	56
ΔH (a)	1.8061	1.8147	1.8771	1.8737	1.9440	1.9267	2.0497	2.0292	2.0616	2.0616	2.0821	2.08
Ave. Y	0.9982											
Ave. ΔH (a)	1.9674											

$$Y = \frac{(1)\cdot(2)\cdot(3)}{(4)\cdot(5)\cdot(6)} \qquad \Delta H_{@} = \frac{(10)}{(11)\cdot(12)} \times \left(\frac{(7)\cdot(8)}{(9)}\right)^2$$

RAC-8

1-29-87

Orifice Setting	.5	.5	1	1	2	2	4	4	6	6	8	8
Cubic Ft. Wet	5.0	5.0	5.0	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
P BAR	29.95	29.95	29.95	29.95	29.95	29.95	29.95	29.95	29.95	29.95	29.95	29.95
T Ave. +460	541	544	548	555	558	560	562	565	566	567	568	568
F Dry Finish	784.794	789.914	796.142	800.367	810.864	821.406	831.945	842.486	853.061	863.633	874.135	884.62
F Dry Start	779.632	784.794	789.914	796.142	800.367	810.864	821.406	831.945	842.486	853.061	863.633	874.13
C	.0368	.0368	.0737	.0737	.147	.147	.294	.294	.431	.431	.588	.588
F Difference	5.162	5.120	5.228	5.225	10.497	10.541	10.540	10.541	10.575	10.572	10.502	10.492
BAR + C	29.987	29.987	30.024	30.024	30.097	30.097	30.244	30.244	30.381	30.381	30.538	30.538
Twet+460	532	532	532	532	532	532	532	532	532	532	532	532
Y	.9838	.9974	.9827	.9958	.9943	.9937	.9925	.9977	.9918	.9938	.9971	.9980
Inlet-T Dry	83	88	93	100	103	105	108	111	112	113	115	115
Outlet-T Dry	78	80	83	90	93	95	96	99	100	101	101	101
T Ave.	81	84	88	95	98	100	102	105	106	107	108	108
Twet	72	72	72	72	72	72	72	72	72	72	72	72
Twet+460	532	532	532	532	532	532	532	532	532	532	532	532
Time	13.72	13.70	9.32	9.30	13.50	13.51	9.65	9.62	7.89	7.91	6.91	6.92
Cu. Ft. Wet	5.0	5.0	5.0	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
X	.01585	.01585	.0317	.0317	.0634	.0634	.1268	.1268	.1902	.1902	.2536	.2536
P BAR	29.95	29.95	29.95	29.95	29.95	29.95	29.95	29.95	29.95	29.95	29.95	29.95
T dry+460	538	543	543	550	553	555	556	559	560	561	561	561
ΔH ⑨	2.096	2.082	1.917	1.884	1.975	1.970	2.007	1.984	1.998	2.005	2.040	2.045
Ave. Y	.9932											
Ave. ΔH ⑨	2.0003											

$$Y = \frac{① \cdot ② \cdot ③}{④ \cdot ⑤ \cdot ⑥}$$

$$\Delta H_{⑨} = \frac{⑩}{⑪ \cdot ⑫} \times \left(\frac{⑦ \cdot ⑧}{⑨}\right)^2$$

RAC-8

11-10-88

Orifice Setting	.5	.5	1	1	2	2	4	4	6	6	8	8
Cubic Ft. Wet	5	5	5	5	10	10	10	10	10	10	10	10
P BAR	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63
T Ave. +460	544	552	558	562	567	569	572	572	574	574	576	576
Ft. Dry Finish	137.772	142.922	148.125	153.362	163.914	174.537	185.187	195.872	206.538	217.227	227.861	238.53
Ft. Dry Start	132.775	137.772	142.922	148.125	153.362	163.914	174.537	185.187	195.872	206.538	217.227	227.86
C	.0368	.0368	.0737	.0737	.147	.147	.294	.294	.431	.431	.588	.588
Ft. Difference	4.997	5.150	5.203	5.237	10.352	10.623	10.650	10.685	10.666	10.689	10.634	10.67
P BAR + C	29.6668	29.6668	29.7037	29.7037	29.777	29.777	29.924	29.924	30.061	30.061	30.218	30.217
T wet +460	535	535	535	535	535	535	535	535	535	535	535	535
Y	1.0162	1.0005	0.9998	1.0004	1.0187	0.9962	0.9940	0.9908	0.9922	0.9893	0.9927	0.984
Inlet-T Dry	89	100	106	110	114	116	119	120	123	123	124	124
Inlet-T Dry	79	84	90	94	100	102	104	106	106	106	107	108
T Ave.	84	92	98	102	107	109	112	113	114	114	116	116
T wet	75	75	75	75	75	75	75	75	75	75	75	75
T wet +460	535	535	535	535	535	535	535	535	535	535	535	535
Time	12.5	12.6	9.3	9.2	13.4	13.4	9.6	9.6	7.9	7.9	6.9	6.9
Cu. Ft. Wet	5	5	5	5	10	10	10	10	10	10	10	10
⑨ X	.01585	.01585	.0317	.0317	.0634	.0634	.1268	.1268	.1902	.1902	.2536	.253
⑩ P BAR	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.6
⑪ T dry +460	539	544	550	554	560	562	564	566	566	566	567	568
ΔH ⑫	1.7754	1.8039	1.9262	1.8774	1.9638	1.9568	2.0015	1.9944	2.0259	2.0259	2.0570	2.053
Ave. Y	0.9984											
Ave. ΔH ⑫	1.9546											

$$Y = \frac{① \cdot ② \cdot ③}{④ \cdot ⑤ \cdot ⑥}$$

$$\Delta H_{@} = \frac{⑩}{⑪ \cdot ⑫} \times \left(\frac{⑦ \cdot ⑧}{⑨}\right)^2$$

APPENDIX G

Project Participants and Activity Log

PROJECT PARTICIPANTS

Name	Title	Responsibility
Frank Clay	U.S. EPA Task Manager Computer Center Coordinator Test Observationist	Observed test activity and on-site data reduction and calculations, and assisted in MM13B sampling
John Brown	U.S. EPA, Technician	Sample recovery
Helen Owens	PEER Consultants, P.C. Contractor Task Mgr.	On-site analysis, report preparation
Robin Barker	MRI NSPS Contractor	Monitored process operation
Dan Bivens	U.S. EPA, Technician	Conducted MM13B
Lori Lay	U.S. EPA, Technician	Conducted MM13B
Condance Sorrell	U.S. EPA, Technician	Conducted MM13B

ACTIVITY LOG

9/19	Test crew travels to site
9/20	Site set-up, conduct 1 MM13B test, Screening Methods and analysis
9/21	Conduct 2 MM13B tests, 2 screening methods and analyses
9/22	Conduct 2 MM13B tests, 2 screening methods and analyses
9/23	Complete analysis, dismantle site and travel