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

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

Source category: Electroplating
Plant name: Roll Technology Corp.
Process: Hard Chrome

Filename: ELEC_R13.WQ1
Location: Greenville, SC
Test date: September 22-24, 1987

Date: 12/13/94
Ref. No.: 4-13
Process rate basis: production

Source	Type of control	Pollutant	Run No.	Test Method	Samp. time, min	Isokinetic, %	Gas volume, DSCF	Volum. flow rate, DSCFM	Mass, ug	Concen., gr/DSCF	Emission rate, lb/hr	Process rate, A-hr	Emission factor mg/A-hr	Emission factor gr/A-hr	Rat.
Hard chrome tank	none	total Cr	1	13B	120	99.3	91.32	11,268	7,500	0.0013	0.122	17,590	6.3	0.097	
		total Cr	2		120	98.1	94.29	11,779	7,500	0.0012	0.124	28,520	3.9	0.061	
		total Cr	3		120	100.6	90.566	11,027	13,600	0.0023	0.219	11,361	17	0.27	
		total Cr	4		120	101.6	91.045	11,034	5,000	0.00085	0.0802	21,652	3.4	0.052	
		total Cr	5		120	101.3	90.52	11,191	2,250	0.00038	0.0368	20,733	1.6	0.025	
		total Cr	6		120	102.7	86.844	10,361	4,750	0.00084	0.0750	20,373	3.3	0.052	
												Average	6.0	0.093	A
		Cr+6	1	13B	120	99.3	91.32	11,268	5,142	0.00087	0.084	17,590	4.3	0.067	
		Cr+6	2		120	98.1	94.29	11,779	6,262	0.00102	0.103	28,520	3.3	0.051	
		Cr+6	3		120	100.6	90.57	11,027	9,688	0.00165	0.156	11,361	12.5	0.192	
		Cr+6	4		120	101.6	91.05	11,034	4,483	0.00076	0.072	21,652	3.0	0.046	
		Cr+6	5		120	101.3	90.52	11,191	2,082	0.00035	0.034	20,733	1.5	0.023	
		Cr+6	6		120	102.7	86.84	10,361	3,968	0.00071	0.063	20,373	2.8	0.043	
												Average	4.6	0.070	A

Notes: Outlet data not useable because control devices not operating normally.

EMB Report No. 87-CEP-6

EMISSION TEST REPORT

ROLL TECHNOLOGY CORPORATION
GREENVILLE, SOUTH CAROLINA

EPA Contract No: 68-02-4346
Work Assignments 2 and 3

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September 1987

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B. Field Test Data Sheets
C. Labratory Data
D. Analytical Methods For Total Chromium and Hexavalent Chromium
E. Amphere-Hour Calculations
F. Project Participants

1.0 INTRODUCTION

Source testing was conducted at Roll Technology, Inc., Greenville, South Carolina, from September 22 through September 24, 1987. The primary purpose of this test was to evaluate an inexpensive screening method as an alternative to a Reference Method 13-B test for determining compliance. Reference Method 13-B tests also were conducted to evaluate the performance of the double-packed-bed scrubber and mist eliminator used to control emissions from four hard chromium plating tanks. The mass emission tests were performed by Peer Consultants, Inc., under the direction of Messrs. Frank Clay and John Brown of the U. S. Environmental Protection Agency (EPA), Emission Measurement Branch (EMB), and the screening method tests were performed by EMB personnel. Personnel from Entropy Environmentalists, Inc., Research Triangle Park, North Carolina, analyzed samples for hexavalent chromium at the plant site. Ms. Robin Barker of Midwest Research Institute monitored the process during the tests.

1.1 TEST PROTOCOL

1.1.1 Screening Method Tests

Teflon^R filters from personal samplers and pieces of Teflon^R tubing (8 inches in length) were used to collect the samples. Both the filters and the tubing were placed into the gas stream such that the tubing and filter openings faced directly into the gas stream flow. The sample locations were the inlet of the scrubber and outlet of the mist eliminator. Teflon^R filters and tubing were selected as the collection media because chromium has a high affinity to attach to the

Teflon^R surface, and Teflon^R is chemically inert with respect to chromic acid. Screening tests were conducted concurrently with the Reference Method 13-B tests at the inlet of the scrubber and the outlet of the mist eliminator. At the inlet, six 1-hour test runs were made. At the outlet, five 2-hour test runs were made. The purpose of the screening method is to develop an inexpensive test method for compliance testing.

1.1.2 Mass Emission Tests

Testing was conducted at the inlet and outlet of the scrubber and at the outlet of the mist eliminator. (The scrubber outlet also serves as the inlet of the mist eliminator). Six mass emission tests were conducted on the scrubber and mist eliminator. The inlet and outlet locations were tested simultaneously, and each test run lasted 2 hours. Emission testing was conducted with a modified Method 13-B sampling train. The sampling train was modified for chromium by eliminating the filter. One tenth normal sodium hydroxide is used in the impingers.

1.1.3 Process Operations During Testing

At the time of the test, the plant was plating industrial rolls and machine parts. Process operating parameters such as current, voltage, and bath temperature were recorded during each test run. Also recorded were descriptions (dimensions and surface area) and plating requirements (current and plating time) of each individual job or item being plated during each test run. The process was operating normally during testing.

1.2 SCRUBBER AND MIST ELIMINATOR TESTING

The double packed-bed scrubber was manufactured and installed by Napco, Inc. in 1978. Four plating tanks are vented to the scrubber, and whenever two of the tanks were

not charged, testing was stopped. The pressure drop across the scrubber was monitored during testing and averaged 0.31 kilopascal (kPa)(1.25 inches of water column [in. w.c.]). Personnel at Napco, Inc., were contacted to determine the design pressure drop of the unit. Napco, Inc., reported that the design pressure drop is 0.75 kPa (3.0 in. w.c.), which indicates the scrubber was operating well below optimum conditions during testing. The design gas flow rate of the scrubber was 9.4 standard cubic meters per second (m^3/s) (20,000 standard cubic feet per minute [scfm]). During testing, a gas flow rate of 5.0 standard m^3/s (10,700 scfm) was measured. Therefore, the collection efficiency during testing would be expected to be below the design efficiency (96 to 99 percent) reported by Napco, Inc., because of the low contact and turbulence generated between the liquid and gas streams, as indicated by the flue gas flow rate and pressure drop monitored.

The mist eliminator was manufactured and installed downstream of the scrubber by KCH Services, Inc., in August 1987. The pressure drop across the mist eliminator was not measured during testing. The wash down spray system for the mist eliminator was not installed at the time of the test. This system is necessary to provide adequate rinsing of the mist eliminator blades to remove accumulations of chromic acid. Inadequate rinsing could adversely affect the performance of the mist eliminator.

1.3 CONCLUSIONS

The results of the screening method tests can be compared to the results from the mass emission tests to evaluate the screening method as alternative to EPA Method 13-B because samples for both tests were taken at the same locations simultaneously. These results are discussed later in the report.

Because the double packed-bed scrubber was operating at a pressure drop and gas flow rate well below design and because the mist eliminator rinse system had not been installed, performance data of these units in combination or individually should not be considered representative of performance levels achievable with properly installed, operated, and maintained double packed-bed scrubbers and mist eliminators.

This report is organized into several sections addressing various aspects of the testing program. Immediately following this introduction is the "Process Operation" section which includes a description of the process and control device tested. Following this is the "Summary of Results" section which presents table summaries of the test data and discusses these results. The next section, "Sampling Locations and Test Methods" describes and illustrates the sampling locations for emissions testing and grab sampling and then explains the sampling strategies used. The Appendices present the complete Test Results and Example Calculations (Appendix A); Field and Analytical Data (Appendix B); Sampling and Analytical Procedures (Appendix C); Calibration Data (Appendix D); MRI Process Data (Appendix E); and Test Participants and Observers (Appendix F).

2.0 PROCESS OPERATION

2.1 PROCESS DESCRIPTION

Roll Technology, Inc., is a job shop specializing in precision finishing and refinishing of industrial rolls. Operations performed at this facility include hard chromium plating, sulfamate nickel plating, machining, grinding, and mirror finishing. The plant plates rolls that are used primarily in the paper manufacturing, roofing, laminating, and coating industries.

There are seven hard chromium plating tanks at this facility, arranged as shown in Figure 2.1. On the average, the tanks are charged for a total of 20 hours per day. Approximately 4 hours per day are required for the change-over of rolls. During a change-over, the roll that has been plated is raised out of the plating tank, rinsed with water from a hose, and transferred to the grinding area. Then, the roll to be plated is cleaned with an abrasive cleanser and lowered into the plating solution. Plating times range from 1 to 36 hours, depending on the surface area of the roll and the plate thickness required. Rolls that require longer plating times typically are plated overnight, and rolls that require shorter plating times are plated during the day when personnel are available to perform the change-over.

Tank Nos. 1, 2, 3, and 7 were tested during this source test program. The tanks are situated below floor level and are oriented with the longest dimension in the vertical direction. Each tank is serviced by an electric hoist that lowers and raises the rolls into and out of the plating solution. In addition, each tank is equipped with a timer that automatically turns off the electrodes at the end of the specified plating time.

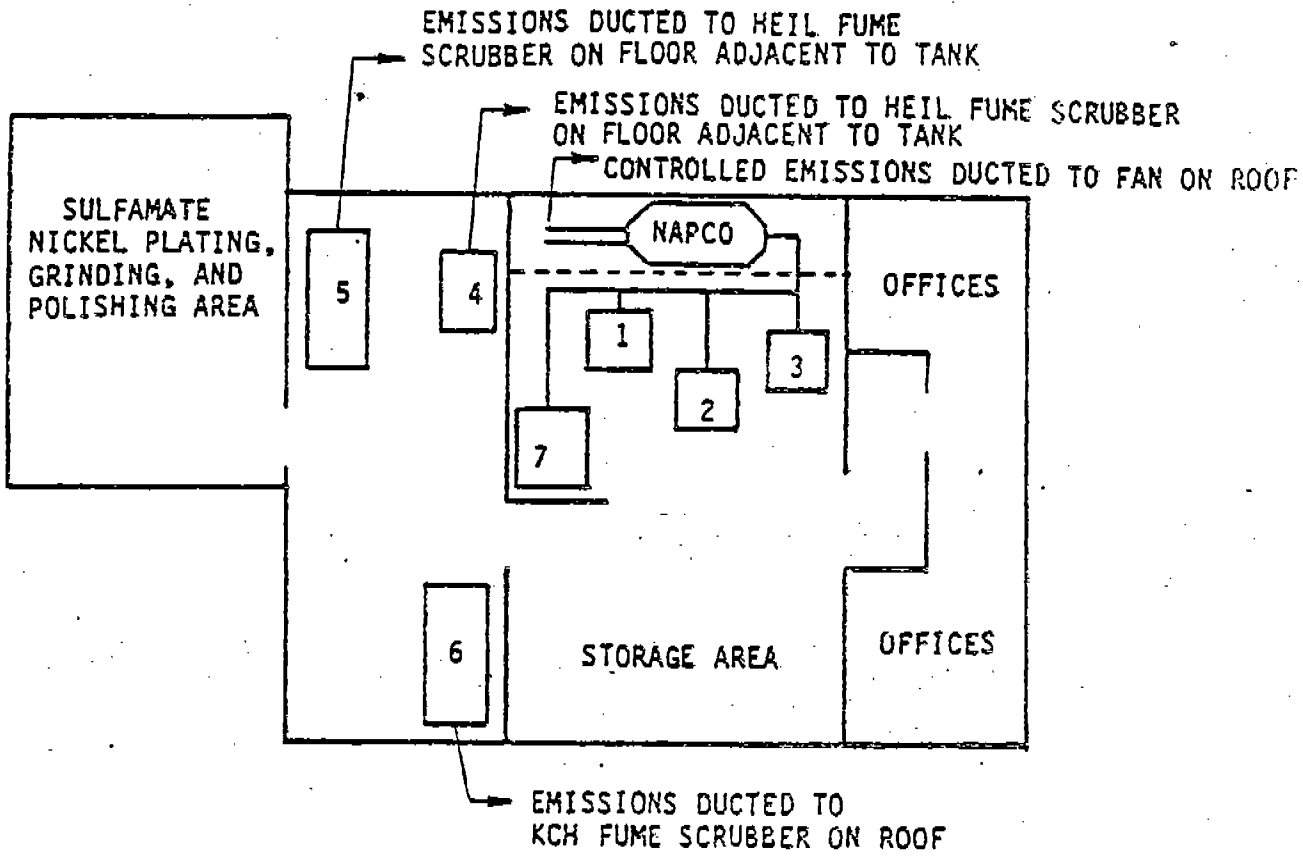


Figure 2-1. Plan view of ROLL TECHNOLOGY CORPORATION

The plating tanks are typical of other hard chromium plating tanks in the electroplating industry, based on operating parameters such as current, voltage, plating time, and chromic acid concentration. Table 2-1 presents the process operating parameters for the four tanks. Although the composition of the plating solution remains constant, the operating voltage and current vary with each roll that is plated.

2.2 AIR POLLUTION CONTROL

Prior to August 1987, the emission control system on the four tanks consisted of double-sided draft hoods on each tank connected to a common duct and vented to a double packed-bed scrubber located on a mezzanine adjacent to the plating tanks (see Figure 2-3). During August, the emission control system was reconditioned; and a mist eliminator was installed downstream of the scrubber. The mist eliminator was installed to circumvent any carry-over of chromic acid from the scrubber. KCH Services, Inc., was the contractor who reconditioned the capture system and installed the mist eliminator.

During the reconditioning of the capture system, the original hoods on Tank Nos. 2 and 7 were replaced with new double-sided draft hoods and new ductwork was installed from each of the four ventilation hoods up to the entrance to the scrubber. In addition to these modifications, an epoxy coating was added to the outside of all the ductwork in the emission control system to prevent corrosion and leakage from the ducts. A plan view of the exhaust system is shown in Figure 2-2.

The double packed-bed scrubber was manufactured and installed by Napco, Inc., in 1978 (Model No. MA-101). Each bed is 30 centimeters (12 inches) in depth and contains polypropylene mass packing. The beds are sprayed continuously with water, which drains into a remote holding tank and is recirculated to the scrubber. The design liquid flow rate is

TABLE 2-1. SPECIFICATIONS OF HARD CHROMIUM PLATING TANKS AT ROLL TECHNOLOGY, INC.

Tank No.	Dimensions, l,w,d m (ft)	Capacity, ℓ (gal)	Voltage, volts[a]	Current, amperes[a]	Method of cooling	Constituents, g/ℓ (oz/gal) CrO_3	H_2SO_4
1	1.07,1.22,3.66 (3.5,4.0,12.0)	4,361 (1,152)	15	8,000	Water	250 (33)	2.5 (0.33)
2	1.22,1.36,5.33 (4.0,4.5,17.5)	8,146 (2,152)	15	15,000	Water	250 (33)	2.5 (0.33)
3	1.83, 1.83, 4.27 (6.0,6.0,14.0)	12,265 (3,240)	15	20,000	Water	250 (33)	2.5 (0.33)
7	1.83,1.22,4.27 (6.0,4.0,14.0)	10,221 (2,700)	15	15,000	Water	250 (33)	2.5 (0.33)

[a]Values represent maximum operating values.

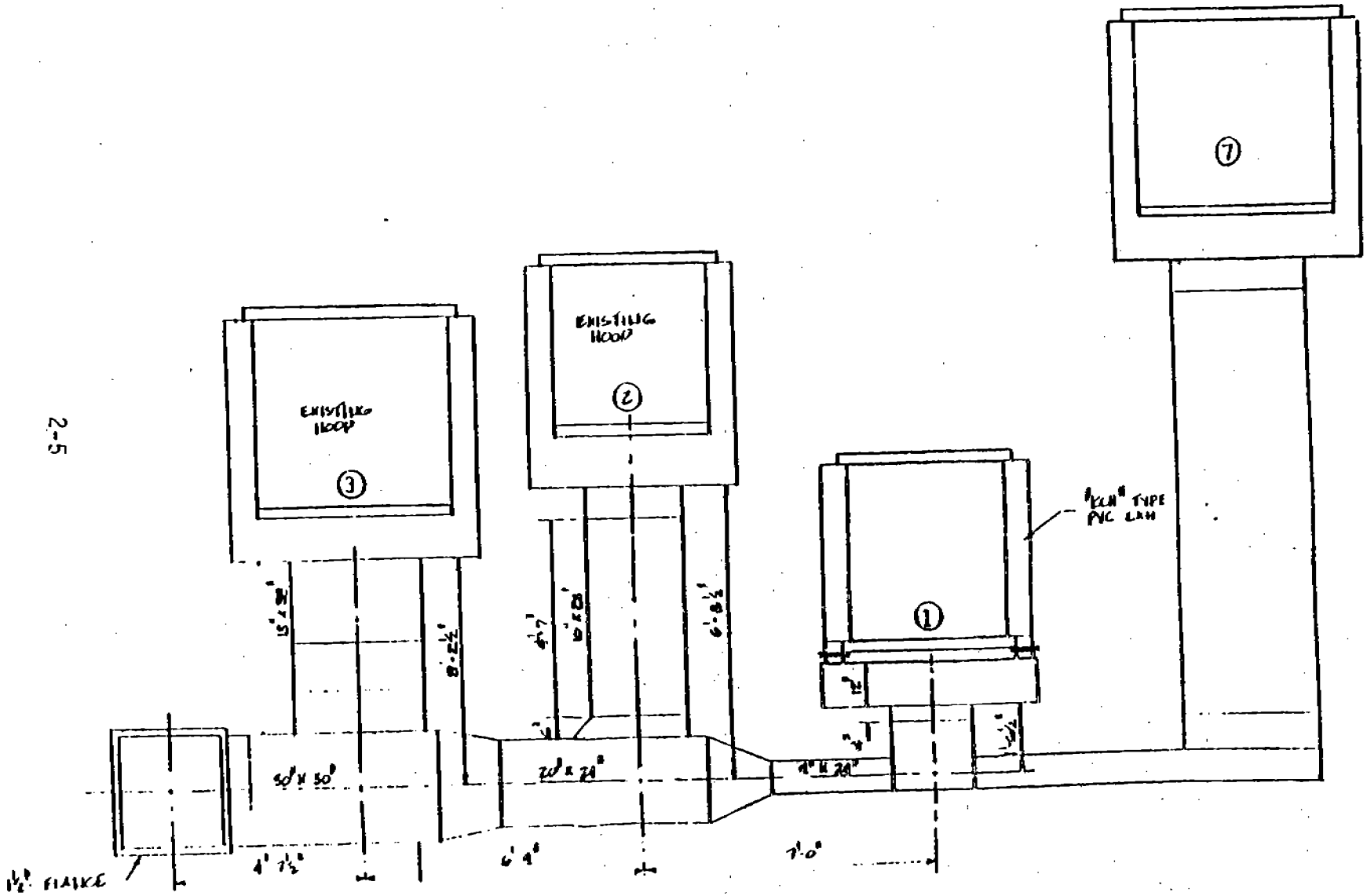


Figure 2-2. Plan view of exhaust system on Tank Nos. 1, 2, 3, and 7.

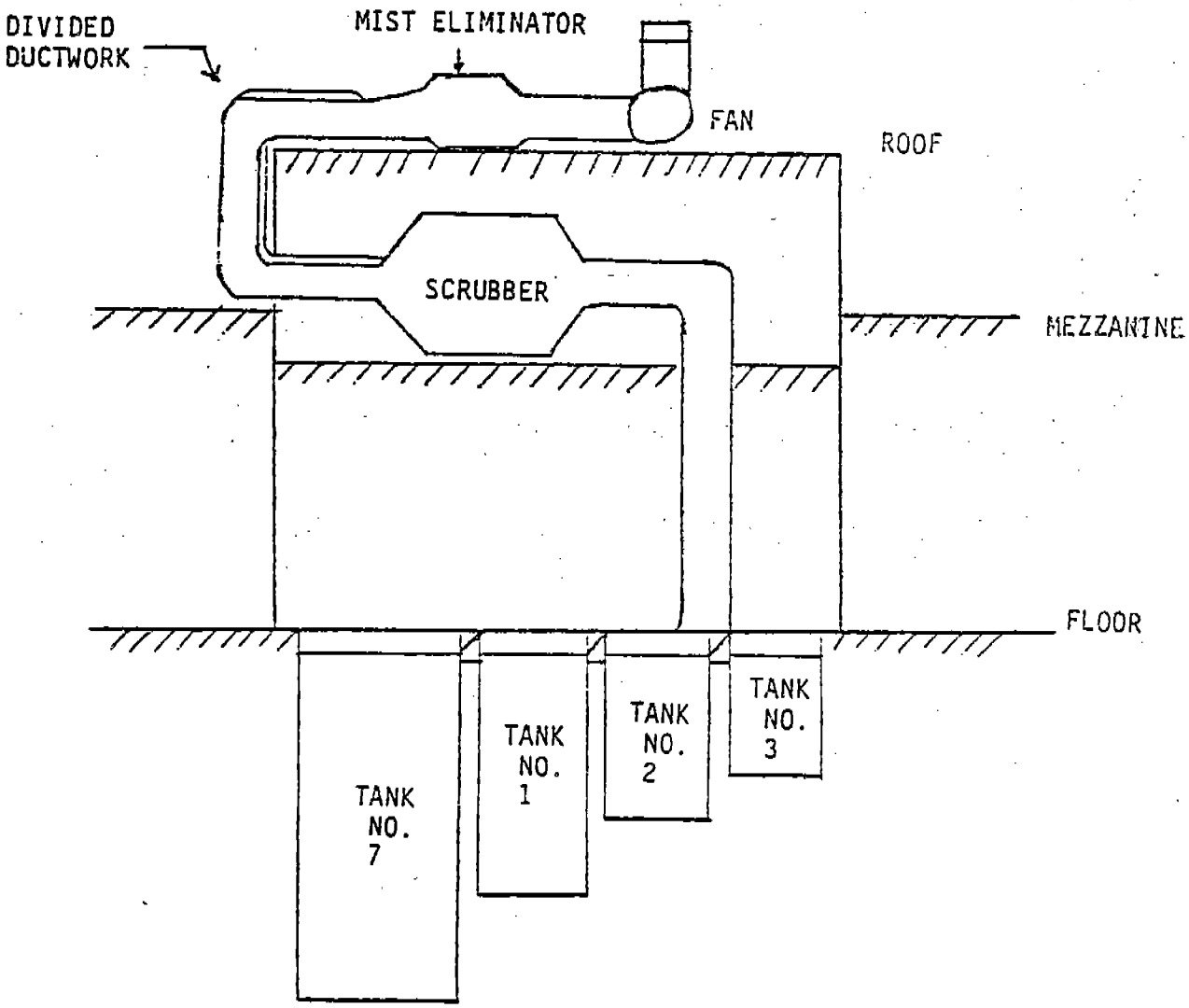


Figure 2-3. Schematic of Emission Control System at Roll Technology, Greenville, South Carolina

75 to 225 liters per minute (20 to 60 gallons per minute) and the design gas flow rate is 564 cubic meters per minute (m^3/min)(20,000 standard cubic feet per minute [scfm]). However, the gas flow rate during testing was 311 m^3/min (11,550 actual cubic feet per minute).

The 568-liter (150-gallon) holding tank is flushed and filled with clean water two or three times a day. The spent liquid is either used as makeup solution for the plating tanks or is treated on site in a wastewater treatment system. The scrubber also contains a chevron-blade mist eliminator stage for the removal of water droplets entrained in the exhaust gas stream. The entire scrubbing unit has a design control efficiency of 96 to 99 percent for the removal of chromic acid.

The ductwork is divided at the outlet of the scrubber and is rejoined at the inlet to the mist eliminator. The mist eliminator was installed on the roof of the plating shop. The mist eliminator contains a double set of wave-type blades that change the direction of gas flow four times at 30° angles, which causes chromic acid droplets to impinge on the blades by inertial force. In addition, spray nozzles are mounted at the inlet of the mist eliminator. The nozzles are activated periodically to wash down the blades with water to remove chromic acid. The wash down water is drained to the scrubber holding tank. During testing, the piping for the water spray system had not been installed to allow for rinsing of the mist eliminator.

During the reconditioning of the control system, the original exhaust fan was relocated from the outlet of the scrubber to a location downstream of the mist eliminator. The fan was manufactured by Duall Industries, Inc. (Model No. NH-66) and is rated at 564 m^3/min (20,000 standard cubic feet per minute [scfm]) for air at 21°C (70°F). During testing a gas flow rate of 288 m^3/min (10,700d scfm) was measured.

2.3 PROCESS CONDITIONS DURING TESTING

Mass emission tests were conducted at the inlet and outlet of the scrubber and at the outlet of the mist eliminator to characterize the performance of the control devices independently and in series.

Process operating parameters such as plating solution temperature, operating voltage, and operating current were monitored and recorded during each test run. The process was operating normally during emission testing. Process data sheets documenting the process operating parameters monitored during testing are presented in Appendix E. Data on the average operating parameters recorded for each test run are presented in Table 2.2. Also recorded were descriptions (dimensions and surface area) and plating requirements (current and plating time) of each individual job or item being plated during each test run. This information was obtained from log sheets maintained by plant personnel and is also presented in Appendix E. The total current supplied to the tanks during each test run was calculated in terms of ampere-hours and is reported in Appendix E. A summary of the total current values is presented in Table 2-3.

The pressure drop across the scrubber was measured twice during testing and averaged 0.31 kilopascals (kPa)(1.25 inches of water). Due to the low pressure drop monitored, personnel at Napco, Inc., were contacted to determine the design pressure for the unit. Napco, Inc., reported that the scrubber was designed to operate at a pressure drop of 0.75 kPa (3.0 in w.c.). The low pressure drop and gas flow rate monitored during testing indicate that the scrubber was operating below optimum conditions.

Grab samples were taken from each plating tank to determine the chromic acid concentration of the plating solulution during emission testing. The grab samples were taken immediately after test run No. 3 was completed. Grab samples

TABLE 2-2. AVERAGE OPERATING PARAMETERS RECORDED DURING EACH MASS EMISSION TEST RUN

Run No.	Tank No.	Operating voltage, volts	Operating current, amperes	Temp. of plating solution, °C (°F)
1	1	5.4	800	54 (129)
	2	7.6	2,550	52 (126)
	3	10.1	4,400	54 (130)
	7	6.9	1,500	53 (128)
2	1	7.0	3,000	54 (130)
	2	9.0	4,000	54 (130)
	3	10.2	4,400	54 (129)
	7	7.6	2,200	54 (130)
3	1	6.4	1,855	53 (128)
	2	6.1	1,500	53 (128)
	3	9.8	4,400	54 (129)
	7	6.4	800	53 (128)
4	1	6.6	3,000	55 (131)
	2	9.5	3,020	54 (129)
	3	10.0	4,400	55 (131)
	7	7.2	2,200	54 (130)
5	1	6.4	1,636	54 (130)
	2	7.4	7,117	54 (130)
	3	8.0	1,800	53 (128)
	7	8.0	1,800	54 (129)
6	1	7.3	2,800	54 (130)
	2	7.1	3,010	54 (129)
	3	12.2	4,254	55 (131)
	7	6.8	2,300	54 (130)

TABLE 2-3. TOTAL CURRENT SUPPLIED TO TANKS DURING EACH SOURCE TEST RUN

Run No.	Tank No.	Total current, ampere-hours
1	1	827
	2	5,243
	3	8,507
	7	3,013
	TOTAL	17,590
2	1	6,250
	2	8,333
	3	9,167
	7	4,770
	TOTAL	28,520
3	1	3,170
	2	2,657
	3	4,547
	7	987
	TOTAL	11,361
4	1	3,900
	2	5,872
	3	9,020
	7	2,860
	TOTAL	21,652
5	1	3,170
	2	14,233
	3	0
	7	3,330
	TOTAL	20,733
6	1	3,034
	2	5,027
	3	7,986
	7	4,326
	TOTAL	20,373

Run 6 only from Table C-9 (Tank 2 + Total)

of the scrubber water were taken at the end of test run Nos. 2 and 3. The chromic acid concentrations of the grab samples are reported in Section 3 of this report.

Test run Nos. 1, 2, and 4 were each interrupted twice. Each of the three runs was interrupted approximately 15 to 20 minutes to change test ports. Run No. 1 was interrupted 30 minutes due to a low current loading, run Nos. 2 and 4 were interrupted for 20 to 3 minutes due to power losses to the meter boxes. Test run No. 5 was interrupted for 7 minutes due to a broken U-tube connector in the sample train. Test run No. 5 also was interrupted for 15 minutes to change test ports and for 30 minutes due to a low current loading in the tank. Test run No. 3 was interrupted only once for 15 minutes to change the test port. Test run No. 6 was interrupted four times for brief periods; once to change the test port and three times because of power losses to the meter boxes.

Where in Sect 3 are grab sample results reported?

3.0 SUMMARY OF RESULTS

Method 13-B runs were conducted at the scrubber inlet, scrubber outlet (two locations), and the demister outlet. (Note that the scrubber outlet is also the demister inlet.) Screening method runs were performed at the scrubber inlet and the demister outlet. Table 3.1 summarizes the testing schedule for the Method 13-B runs.

In brief, from the results of the Method 13-B testing, the uncontrolled emissions from the tanks (scrubber inlet) averaged .085 pounds per hour of hexavalent chromium and .109 lbs per hour total chromium. The controlled emissions at the scrubber outlet (which is also the demister inlet) averaged .0054 pounds per hour hexavalent chromium (total chromium was not analyzed at the outlet). The resulting collection efficiency for the scrubber was 93.7 percent for hexavalent chromium.

It is possible to use the scrubber outlet data to determine the efficiency of the demister by comparing scrubber outlet data with demister outlet data. The demister outlet averaged .0033 pounds per hour total chromium for runs two through six. Using the demister inlet values for the corresponding runs, the average emission rate at the demister inlet was .0056 pounds per hour of chromium six. The resulting collection efficiency of the demister is 40.7 percent.

By using the scrubber inlet data and the demister outlet data, it is possible to determine the overall efficiency of the two control devices based upon chromium six results. The inlet average is .0854 pounds per hour hexavalent chromium and the outlet average at the demister is .0033 pounds per hour, the efficiency is then 96.1 percent.

TABLE 3.1 TESTING SCHEDULE FOR ROLL TECHNOLOGY CORPORATION

DATE (1987)	SAMPLE TYPE	Scrubber Inlet		Scrubber Outlet		Demister Outlet	
		Run No	Test Time 24 Hr Clock	Run No	Test Time 24 Hr Clock	Run No	Test Time 24 Hr Clock
9/22	13 B	SI-1	11:56-14:52	SO-A1 SO-B1	11:56-14:52		
9/22	13 B	SI-2	17:58-20:25	SO-A2 SO-B2	17:58-20:25	ME-02	17:58-20:25
9/23	13 B	SI-3	09:40-12:02	SO-A3 SO-B3	09:40-12:02	ME-03	09:40-12:02
9/23	13 B	SI-4	15:39-18:00	SO-A4 SO-B4	15:39-18:00	ME-04	15:39-18:00
9/24	13 B	SI-5	09:33-12:27	SO-A5 SO-B5	09:33-12:27	ME-05	09:33 12:27
9/24	13 B	SI-6	14:23-17:06	SO-A6 SO-B6	4:23-17:06	ME-06	14:23-17:06

The preceding discussion covers the Method 13-B results only. Screening results are discussed separately in Section 3.4.

In the following sections, the results addressed above and additional results are presented and discussed in detail according to emission type and sampling location. The handheld computer printouts and emission calculations can be found in Appendix A. The original field data sheets and the analytical data are located in Appendix B.

3.1 HEXAVALENT CHROMIUM AND TOTAL CHROMIUM

Hexavalent chromium tests (EPA Method 13-B) along with the associated flue gas flow rates were conducted at the scrubber inlet, scrubber outlet, and demister outlet. All samples were analyzed on site for hexavalent chromium and the six inlet samples (from the 13-B trains) were also analyzed for total chromium. Complete descriptions of each sampling location and the sampling and analytical procedure are given in Chapter 4 (and Appendix C).

3.1.1 Scrubber Inlet

The scrubber inlet represents the uncontrolled emissions from plating tanks No. 1, 2, 3, and 7. The circular horizontal inlet duct did not meet the minimum sampling specifications of Reference Method 1, so the ports were located 0.8 of the total length of straight run downstream of the vertical pipe elbow. (The location is the same as the May 1985 Emission Measurement Branch test except that both horizontal and vertical traverse were performed in 1987). Prior to Method 13-B testing at the scrubber inlet, a type S pitot traverse was conducted along the two axes of the duct. The duct was checked for cyclonic flow. The absolute

angle of deviation was 11.6° which is well within the 20° allowed by Reference Method 1.

3.1.1.1 Flue Gas Conditions and Isokinetic Sampling Rate

A summary of flue gas conditions at the scrubber inlet, scrubber outlet, and demister outlet is presented in Table 3.2. The volumetric flow rates were quite consistent and averaged 10900 Dry Standard Cubic Feet per minute. Average flow rates at the scrubber inlet, scrubber outlet and demister outlet were 11,100, 10,900, 10,700 Dry Standard Cubic Feet (dscf) per minute. Comparing these locations with the average, the maximum variation is less than 2 percent for the scrubber inlet and demister outlet, while the scrubber outlet did not vary at all. (All tests should be so good).

The flue gas temperature averaged 78°F (26°C) with a moisture content of 1.6 percent. The oxygen, carbon dioxide, and carbon monoxide content was that of air at 20.9, 0.0, and 0.0 percent respectively. The volumetric flow rate at standard conditions averaged 10,900 dry standard cubic feet per minute (654,000 dry standard, cubic feet per hour). This equals 309 dry standard cubic meters per minute on 18519 dry standard cubic meters per hour. Standard conditions are 20°C (68°F) and 760mm Hg (29.92 in Hg) dry. The isokinetic sampling for all runs was acceptable.

TABLE 3.2 SUMMARY OF FLUE GAS CONDITIONS

RUN NO.	DATE (1987)	TEST TIME AM/PM	VOLUMETRIC FLOW RATES ACTUAL ACFM	ACMM	DRY STANDARD DSCFM	DSCMM	STACK TEMPERATURE °C	°F	MOISTURE %	O_2 %	CO_2 %	CO %	MOLECULAR WEIGHT DRY	ISOKINETIC %
SCRUBBER INLET														
SI-1	22 Sep	AM	12096	343	11268	319	27	81	1.6	20.9	0.0	0.0	28.95	99.3
SI-2	22 Sep	PM	12699	360	11779	334	29	85	1.1	20.9	0.0	0.0	28.95	98.1
SI-3	23 Sep	AM	11784	334	11027	312	25	77	1.9	20.9	0.0	0.0	28.95	100.6
SI-4	23 Sep	PM	11877	336	11034	312	28	83	1.6	20.9	0.0	0.0	28.95	101.6
SI-5	24 Sep	AM	11956	339	11191	317	26	78	1.6	20.9	0.0	0.0	28.95	101.3
SI-6	24 Sep	PM	11291	320	10361	293	29	84	2.4	20.9	0.0	0.0	28.95	102.7
Average			11951	338	11110	315	27	81	1.7	20.9	0.0	0.0	28.95	100.6
SCRUBBER OUTLET A														
SOA-1	22 Sep	AM	6137	174	5829	165	23	73	0.85	20.9	0.0	0.0	28.95	94.9
SOA-2	22 Sep	PM	6066	172	5713	162	24	75	1.2	20.9	0.0	0.0	28.95	94.0
SOA-3	23 Sep	AM	5992	170	5665	160	22	71	1.6	20.9	0.0	0.0	28.95	96.2
SOA-4	23 Sep	PM	6104	173	5743	163	23	74	1.6	20.9	0.0	0.0	28.95	95.2
SOA-5	24 Sep	AM	5846	166	5524	156	22	71	1.7	20.9	0.0	0.0	28.95	95.4
SOA-6	24 Sep	PM	5721	162	5376	152	23	73	1.8	20.9	0.0	0.0	28.95	94.8
Average			5978	170	5642	160	23	73	1.5	20.9	0.0	0.0	28.95	95.1
SCRUBBER OUTLET B														
SOB-1	22 Sep	AM	5654	160	5312	150	24	75	1.6	20.9	0.0	0.0	28.95	102.3
SOB-2	22 Sep	PM	5650	160	5301	150	26	78	.96	20.9	0.0	0.0	28.95	98.1
SOB-3	23 Sep	AM	6109	173	5739	163	23	73	1.9	20.9	0.0	0.0	28.95	97.5
SOB-4	23 Sep	PM	5919	168	5532	157	26	78	1.6	20.9	0.0	0.0	28.95	97.3
SOB-5	24 Sep	AM	5170	146	4865	138	23	73	1.6	20.9	0.0	0.0	28.95	99.9
SOB-6	24 Sep	PM	5096	144	4755	135	25	77	1.7	20.9	0.0	0.0	28.95	102.0
Average														
DEMISTER OUTLET														
ME02		PM	11238	318	10427	295	29	85	1.7	20.9	0.0	0.0	28.95	98.6
ME03		AM	11651	330	10958	310	26	79	1.6	20.9	0.0	0.0	28.95	98.1
ME04		PM	11635	329	10788	305	30	86	1.7	20.9	0.0	0.0	28.95	99.6
ME05		AM	11456	324	10680	302	27	81	1.7	20.9	0.0	0.0	28.95	99.7
ME06		PM	11617	329	10745	304	30	86	1.4	20.9	0.0	0.0	28.95	97.7
Average			11519	326	10720	303	28	83	1.6	20.9	0.0	0.0	28.95	98.7

TABLE 3.3 SUMMARY OF HEXAVALENT AND TOTAL CHROMIUM EMISSIONS

RUN NO.	DATE (1987)	HEXAVALENT CHROMIUM CONCENTRATION mg/dscm	HEXAVALENT CHROMIUM CONCENTRATION gr/dscf	HEXAVALENT CHROMIUM MASS EMISSIONS kg/hr	HEXAVALENT CHROMIUM MASS EMISSIONS lb/hr	TOTAL CHROMIUM CONCENTRATION mg/dscm	TOTAL CHROMIUM CONCENTRATION gr/dscf	TOTAL CHROMIUM MASS EMISSIONS kg/hr	TOTAL CHROMIUM MASS EMISSIONS lb/hr
SCRUBBER INLET									
SCI-1	22 Sep	1.99	.00087	.038	.084	2.900	.0013	.056	.1224
SCI-2	22 Sep	2.35	.00102	.047	.103	2.809	.0012	.056	.1239
SCI-3	23 Sep	3.78	.00165	.071	.156	5.303	.0023	.099	.2190
SCI-4	23 Sep	1.74	.00760	.033	.072	1.939	.0008	.036	.080
SCI-5	24 Sep	0.80	.00035	.015	.033	.859	.0004	.016	.036
SCI-6	24 Sep	1.61	.00070	.028	.063	1.932	.0008	.034	.075
Average		2.05	.00203	.039	.085	2.624	.0011	.050	.109
SCRUBBER OUTLET A									
SOA-1	22 Sep	.079	.00003	.0008	.0017				
SOA-2	22 Sep	.215	.00009	.0021	.0046				
SOA-3	23 Sep	.060	.00003	.0006	.0013				
SOA-4	23 Sep	.192	.00008	.0019	.0041				
SOA-5	24 Sep	.091	.00004	.0009	.0019				
SOA-6	24 Sep	.123	.00005	.0011	.0025				
Average		.127	.00005	.0012	.0027				
SCRUBBER OUTLET B									
SOB-1	22 Sep	.137	.00006	.0012	.0027				
SOB-2	22 Sep	.217	.00009	.0020	.0043				
SOB-3	23 Sep	.066	.00003	.0006	.0014				
SOB-4	23 Sep	.190	.00008	.0018	.0039				
SOB-5	24 Sep	.088	.00004	.0007	.0016				
SOB-6	24 Sep	.119	.00005	.0010	.0021				
Average		.136	.00006	.0010	.0027				
DEMISTER OUTLET									
RUN #1 NOT PERFORMED									
ME02	22 Sep	.136	.00006	.0024	.0053				
ME03	23 Sep	.048	.00002	.0009	.0020				
ME04	23 Sep	.118	.00005	.0022	.0048				
ME05	24 Sep	.054	.00002	.0010	.0022				
ME06	24 Sep	.050	.00002	.0009	.0020				
Average		.081	100003	.0015	.0033				

3.1.1.2 Hexavalent Chromium Emissions (Scrubber Inlet)

The hexavalent chromium emissions for each test run (see Table 3.3) vary, but plating conditions also varied. Note that in the table that total chromium emissions were given for the inlet location only. Only the inlet samples were analyzed for total chromium. Also note that only runs two through six are listed at the demister outlet. This is because the first run at the demister outlet was not performed since screening method equipment was not available at that location at that time.

At the scrubber inlet, emissions averaged 2.05 milligrams per dry standard cubic meter (.00089 grains per dry standard cubic foot) and 0.039 kilograms per hour (.085 pounds per hour).

3.1.1.3 Total Chromium Emissions (Scrubber Inlet)

The total chromium emissions for each test run (see Table 3.3) for the inlet tests averaged 2.624 milligrams per dry standard cubic meter (.0011 grain per dry standard cubic foot) and .050 kilograms per hour (.121 pounds per hour).

3.1.2 Scrubber Outlet

The scrubber outlet represents the controlled emissions from plating tanks No. 1, 2, 3, and 7. Two vertical ducts were sampled simultaneously at the outlet location (the two ducts merged into a single duct at the demister inlet). Prior to testing, the ducts were checked for cyclonic flow and gave average angles of deviation of 11.6^{o} for duct A and 7° for duct B. This is well within the maximum allowable angle of deviation of 20° as specified in Reference Method 1.

3.1.2.1 Flue Gas Conditions and Isokinetic Sampling Rate (Scrubber Outlets A & B)

A summary of flue gas conditions at the scrubber inlet, scrubber outlet, and demister outlet is presented in Table 3.2. The volumetric flow rate of the scrubber outlet A location had a higher flow rate than scrubber outlet B, (5641 vs 5251 average DSCF/M) but the two volumes added together almost equal to the scrubber inlet volume or the demister outlet volume. (Volumetric flow rates are actually much closer than would normally be expected on a source test). The flue gas temperature averaged 73°F for scrubber outlet A and B. The oxygen, carbon dioxide, and carbon monoxide concentrations were that of ambient air at 20.9, 0.0, and 0.0 percent respectively. The volumetric flow rates averaged 5641 dry standard cubic feet per minute (338,460 dry standard cubic feet per hour) at scrubber outlet A and 5251 dry standard cubic feet per minute (315,060 dry standard cubic feet per hour) at scrubber outlet B. Combining these two locations gives the total average scrubber outlet flow rate of 10,892 dry standard cubic feet per minute (653,520 dry standard cubic feet per hour).

The isokinetic sampling rates were well within the allowable range for all runs.

3.1.2.2 Hexavalent Chromium Emissions (Scrubber Outlets A & B)

At scrubber outlet A, hexavalent chromium emissions averaged 0.127 milligrams per dry standard cubic meter (.00005 grains per dry standard cubic foot) and 0.0012 kilograms per hour (0.0027 pounds per hour.

At scrubber outlet B, hexavalent chromium emissions averaged 0.136 milligrams per dry standard cubic meter (.00006 grains per dry standard cubic foot) and 0.0010 kilograms per hour (0.0027 pounds per hour.

Total scrubber outlet emissions can be determined by combining the values determined for scrubber outlet A and scrubber outlet B. The milligrams per dry standard cubic meter and the grains per dry standard cubic foot will remain relatively the same; however, the mass emission rates will approximately double since the kilograms per hour at each location (A&B) are added. Thus, the combined A and B milligrams per dry standard cubic meter are 0.131 (.000057 grains per dry standard cubic foot) and the kilograms per hour emission rate is .0024 (.0054 pounds per hour).

3.1.2.3 Total Chromium Emissions (Scrubber Outlets A & B)

Total chromium emissions were not determined for this location.

3.1.3 Demister Outlet

The demister outlet represents the final controlled emissions from plating tanks No. 1, 2, 3, and 7. Emissions from this location are those that are emitted to the atmosphere. This vertical duct met the criteria specified in Reference Method 1. The duct was checked for cyclonic flow prior to sampling and the average angle of deflection was 12°, which was less than the 20° angle of deflection allowed in Reference Method 1.

3.1.3.1 Flue Gas Conditions and Isokinetic Sampling Rate (Demister Outlet)

A summary of flue gas conditions at the scrubber inlet, scrubber outlet, and demister outlet is presented in Table 3.2. The demister outlet volumetric flow rate averaged 10720 dry standard cubic feet per minute (643,200 dry standard cubic feet per hour) with an average stack temperature of 83°F and a moisture content of 1.7 percent. The stack gas composition was that of ambient air.

The isokinetic sampling rates were well within the allowable range for all runs.

3.1.3.2 Hexavalent Chromium Emissions (Demister Outlet)

At the demister outlet hexavalent chromium emission averaged 0.081 milligrams per dry standard cubic meter (0.00003 grains per dry standard cubic foot) and 0.0015 kilogram per hour (.0033 pounds per hour).

3.1.3.3 Total Chromium Emissions (Demister Outlet)

Total chromium emissions were not determined at this location.

3.2 SCREENING METHOD INTRODUCTION

Prior to this test, developmental work has been progressing in an effort to find an inexpensive screening method for chromium six. The method would be used in place of Method 13-B sampling to provide an approximate mass emission number and hopefully provide accuracy within ±50 percent.

Early efforts in this project involved detector tubes, midget impingers, and cassette filters as a means of determining chromium six concentrations. The detector tubes proved to be too difficult to use and too insensitive to the range of concentrations encountered. Midget impingers were also disguarded since the majority of the chromic acid collected was caught prior to the impinger solution. The cassette filter appears to offer the most promise of the three aforementioned techniques. The cassette filters are the same as those worn by employees in a workplace that is

being sampled for pollutants. (The sample is drawn into the cassette holder/filter assembly by a personal sampling pump worn by the individual).

Initial efforts with the cassette filters gave encouraging results. Subsequent tests using the cassette filters were plagued with problems - primarily leaks in the apparatus, imprecise sampling volumes, and poor sample recovery. As the project progressed, sample recovery was improved and apparatus leaks were eliminated. Hypodermic needles will be used in future test efforts to control the flow.

In addition to cassette filters, 8 inch pieces of 1/8" I.D. Teflon^{R} tubing were used to collect samples. The tubing appears to work as well as the cassette filter and holder and if successful, the tubing will be much easier and less expensive to use than the cassette filter and holder.

3.2.1 Screening Method Procedure and Results

A description of the screening method efforts for the test work at Roll Technology Corporation follows. The discussion is a memo that was sent to people associated with the chromium sampling programs and the screening method. In addition to the memo, Table 3.3 summarizes screening method results.

3.2.2 MEMORANDUM

SUBJECT: Screening Method Results from Roll Technology Corporation

FROM: Frank R. Clay
Emission Measurement Branch

TO: Chromium Electroplaters General File

The screening method samples taken at Roll Technology Corporation (formerly Carolina Platers) are the best in the series to be performed by the Emission Measurement Branch. Sample results are all the same order of magnitude and there appears to be a modicum of consistency to the data. While the degree of accuracy of the method is not what is desired, there are steps that can be taken to improve accuracy, and the effort is, at least, encouraging.

It appears that several of the earlier problems with the method have been solved. The waiting period between sample collections and sample results has been eliminated by performing sample analysis on site. It also appears that problems due to poor sample recovery technique have been eliminated as well. The major problem that remains is that of sample volume.

An effort was made prior to the test at Roll Technology to insure accurate sample volumes. Before the test, all Thomas^R pumps were run for one hour while being connected to a wet test meter. The sampling apparatus (cassette filter or Teflon^R tubing) was also connected to the pump. Wet test meter volumes were determined and corrected for temperature and pressure to ascertain the standard cubic feet per hour sampling rate. The rotameter adjustment knobs were then fixed into position by using silicone rubber cement. The sample volumes determined in the laboratory were used for field calculations of chromium concentrations from screening method runs. Upon return from the field, the pumps were run

again in the laboratory to see if the sample volumes were unchanged. Unfortunately, they were not, and the true volumes sampled in the field remain unknown.

Although the true volumes sampled in the field remain unknown, some of the pumps were relatively close when a comparison was made between the initial volume and the post test volume. The closest inlet number was 2 percent high, and the closest outlet number was 3 percent low. (This comparison uses the initial numbers as the standard or numerator.) The largest variation for the inlet pumps was 53 percent low while the greatest variation at the outlet was 47 percent low.

Three of the eight pumps used for the screening samples were fairly close in pretest and post-test volumes. One was at the inlet and two were at the outlet. If it is possible to consider data from these three pumps as good (which it probably is not), then comparing these numbers with the Method 13-B values may give some indication as to how accurate the screening method is.

The accuracy range of the inlet pump varied from 84 percent below the Method 13-B number to 395 percent above the 13-B number. The average of the positive and negative percent values is 73.7. The absolute average is 112.8. Either way, the values are something greater than the desired accuracy of ±50 percent.

At the outlet, two of the pumps had volumes after the test that were close to the original volumes determined prior to the test. Emission numbers determined from these pumps varied from 31.0 percent to +121 percent for one of the pumps and 5.7 percent to 119.2 percent for the other pump. The average absolute values for these two pumps were 54.9 and 54 percent respectively, and the average of the values was 42.5 and 54 percent respectively.

During the last run of the test, two spare pumps were operated at the outlet in addition to the four regular pumps. The spare pumps were run for 292 minutes (4 hrs 52 minutes). These pumps did not incorporate surge tanks or rotameters as used on the regular screening trains, but simply ran at maximum capacity during the run. Tapered tubes were used for sample extraction, and while the spare pumps were similar in size, one pump sampled a volume about ten times that of the other.

Without a surge tank on the inlet side of the pump, the net effect of the pump is to extract a sample, but in the process, the pump pulses and puffs in the inlet direction. This may make it difficult to determine the direction of flow of the pump and is probably the reason that one of two pumps that sampled at maximum volume had the flow direction marked backwards. As a result of this mismarking of the pump, the pump was hooked up backwards. Thus, ambient air was being pumped into the outlet stack instead of being extracted from it. Nevertheless, the sample collected from this train was within 75 percent of the real concentration determined from the 13-B train and was low by only 25 percent. The other pump, through extracting a smaller sample, sampled in the right direction and was only 2 percent greater than the real (13-B) number.

Data from the two unrestricted pumps were based on a sample rate determined in the lab from 15 minutes of pump operation. During the test, these two pumps ran for over 4 hours, so a 15-minute run may not have given an accurate sampling volume. The variation, however, would not have been sufficient to change the data significantly. Thus, the pump that blew ambient air into the stack provided some of the most accurate data of all.

From the above discussion of the two pumps, it is possible to conclude that it is more accurate to extract a sample from the stack rather than to blow ambient air into it if the determination of chrome 6 concentrations is the goal. This is just another way in which science works for you here at the United States Environmental Protection Agency.

If the percent error of the screening run concentrations is averaged, it is possible to see how close the screening method comes overall to the concentration determined from the Method 13-B trains. The average and absolute average have been determined for each location using the two sets of Thomas^R pump volumetric flow rates determined in the lab both before and after the test.

At the inlet, the average error of the screening method during the test, when compared to the 13-B concentrations, was +59.6 percent. The value of the absolute average was +93 percent. After the test (and using post-test sampling volumes) the average error at the inlet was 143 percent and the value of the absolute average was 172.5 percent.

At the outlet, the averages looked much better. The average error of the screening method during the test, when compared with the 13-B concentrations, was +40.3 percent. The value of the absolute average was 49.2 percent. After the test (and using post-test sampling volumes) the average error at the outlet was 32.4 percent while the value of the absolute average was 43.9 percent.

The range of the numbers varied quite a bit. For the inlet location during the test, percents varied from a high of +404 percent to a low of -87.1 percent. Using the volumes determined after the test, inlet values varied from a high of 787.4 percent to a low of 83.9 percent.

At the outlet, the range was smaller. During the test, the percents varied from a high of 125.4 percent to a low of

-30.8 percent. Using sample volumes determined in the lab after the test, values ranged from a high of +121 percent to a low of -40.7 percent.

Clearly, the inlet numbers are less accurate than the outlet numbers. Normally, this would not be expected since inlet concentrations are higher than the outlet and a larger sample is usually more accurate. There may be many reasons for this anomaly. The inlet location was very poor and did not meet the criteria of Reference Method I. It is also possible that the point of average velocity was not sampled. The outlet, on the other hand, was an ideal location with a better velocity profile. At the outlet, even a point that was not of average velocity would probably give good results.

For the next phase of this project, some procedural changes will be made. First, no sample will be taken without determining that the sample point represents a point of average velocity. Second, only samples using tapered tubing will be collected and tubing holders will be modified to insure that the tubing faces directly into the stack flows. Third, only hypodermic needles encased in epoxy will be used as flow regulating devices. Needle gauge will be chosen based on velocities determined on the pretest survey visit. Fourth, pump volumes will be determined in the lab before and after the test with each pump in its sampling configuration. Fifth, the same sample recovery procedures that were used in Greenville, SC, will be used again.

For the next test, only tapered tubing will be used to collect the samples. This is not because the tapered tubing is better for collecting a sample than the cassette filter, but it is easier to use. On the upcoming test, the goal will be to achieve reproducibility first and accuracy second. Using all tapered tubing samples will also give a better statistical number.

Hypodermic needles give accurate and reproducible volumes in the lab - even when used with our worn out pumps. It is possible to select one of three needle gauges to sample within ±30 percent isokinetic of the range of flow encountered in chromium plating operations. (The gauge size assumes a 1/8" diameter tapered tube.) A cassette filter will be used as a protective device for the hypodermic needle, and gauge size for the next test will be determined when the test site is selected and the pretest survey has been completed. Prior to the test, Thomas^R pumps will be checked for sample volumes in the test apparatus configuration, and during the 13-B test runs at the facility, an attempt will be made to get 8 one- hour samples at both the inlet and outlet locations. This will provide a total of 24 samples at each location. Upon return to the lab, Thomas^R pumps will again be checked for sample volume.

If the upcoming test work is successful, there are some questions that still remain. How specifically, will the screening method be used? Will there be a specification as to tank loading and amperes that must be met before the screening method can be used? Lastly, if the technique is successful, how much additional testing will be needed to show that the method is accurate?

cc: John Brown (MD-19)
Bill DeWees (Entropy)
Bill Grimley (MD-19)
Gail Lacy (MD-13)
Robin Segall (Entropy)
Randy Straight (MRI)
Al Vervaert (MD-13)

The following tables summarize the results of the screening runs using the pump volumes before and after the test at Roll Technology. In looking at the tables, the screening method percent of the Method 13-B train is given in the Percent of Real Value column. Thus a percent of real value number of 138.8 would mean that the screening value was 138.8 percent of the Method 13-B value. To the right of the Percent of Real Value column is the Percent High or Low column. This value is the difference between the Method 13-B run and the screening run. A screening value of 71 percent of the real value (Method 13-B) would be 29 percent low which is given in the table of -29 percent.

When the four screening runs are averaged and compared with the corresponding Method 13-B run, a mathematical average can be determined. The mathematical average does not always reflect the true difference between the screening method and the Method 13-B runs. (If two screening samples were 50 percent low and two were 50 percent high, the mathematical average would be zero.) The righthand column of the chart gives the absolute average of the difference between the Method 13-B run and the screening samples showing the variation of the screening average from the 13-B number.

SCREENING METHOD RESULTS VS. METHOD 13-B RESULTS (INLET LOCATION - BEFORE TEST PUMP VOLUMES)

RUN NO.	SAMPLE NUMBER	SAMPLE TYPE	SCREENING Mg/M^3	M13B Mg/M^3	PERCENT OF REAL VALUE	(Mathematical Average) PERCENT HIGH OR LOW	(Absolute Average) PERCENT HIGH OR LOW
1	1ITT1	Tapered Tube 1	2.76		138.8	+ 38.8	
1	1ITT2	Tapered Tube 2	2.61		131.3	+ 31.3	
1	1ICC1	Cassette Cone 1	3.50		176.1	+ 76.1	
1	1ICCL2	Cassette Cone Long Nozzle 2	2.60		130.8	+ 30.8	
1	SI-1	13-B		1.988			
Ave			2.87	1.988	144.2	44.2	44.2
2	2ITT1	Tapered Tube 1	4.684		199.7	+ 99.7	
2	2ITT2	Tapered Tube 2	11.819		504.0	+404.0	
2	2ICC1	Cassette Cone 1	9.845		419.8	+319.8	
2	2ICCL2	Cassette Cone Long Nozzle 2	4.708		200.8	+100.8	
2	SI-2	13-B		2.345			
Ave			7.764	2.345	331.1	+231.1	231.1
3	3ITT1	Tapered Tube 1	.2432		6.4	- 93.6	
3	3ITT2	Tapered Tube 2	.3099		8.2	- 91.8	
3	3ICC1	Cassette Cone 1	.2970		7.9	- 92.1	
3	3ICCL2	Cassette Cone Long Nozzle 2	.4115		10.9	- 89.1	
3	SI-3	13-B		3.778			
Ave			.3154	3.778	8.3	- 91.7	91.7
4	4ITT1	Tapered Tube 1	1.2353		71.0	- 29.0	
4	4ITT2	Tapered Tube 2	1.1801		67.9	- 32.1	
4	4ICC1	Cassette Cone 1	1.3658		78.5	- 21.5	
4	4ICC12	Cassete Cone Long Nozzle 2	.5538		31.8	- 68.2	
4	SI-4	13-B		1.739			
Ave			1.0838	1.739	62.3	- 37.7	37.7
5	5ITT1	Tapered Tube 1	.3924		49.4	- 50.6	
5	5ITT2	Tapered Tube 2	.2700		34.0	- 66.0	
5	5ICC1	Cassette Cone 1	1.0367		130.4	- 30.4	
5	5ICC12	Cassete Cone Long Nozzle 2	.7921		99.6	- 0.4	
5	SI-5	13-B		.795			
Ave			.6228	.795	78.3	- 21.7	36.9
6	6ITT1	Tapered Tube 1	1.6484		102.4	2.4	
6	6ITT2	Tapered Tube 2	1.6492		102.4	2.4	
6	6ICC1	Cassette Cone 1	1.6949		105.3	5.3	
6	6ICC12	Cassete Cone Long Nozzle 2	.9219		57.3	- 42.7	
6	SI-6	13-B		1.610			
Ave			1.4786	1.610	91.8	- 8.2	13.2

SCREENING METHOD RESULTS VS. METHOD 13-B RESULTS (OUTLET LOCATION - BEFORE TEST PUMP VOLUMES)

RUN NO.	SAMPLE NUMBER	SAMPLE TYPE	SCREENING Mg/M3	M13B Mg/M3	PERCENT OF REAL VALUE	(Mathematical Average) PERCENT HIGH OR LOW	(Absolute Average) PERCENT HIGH OR LOW
1		THIS TEST NOT PERFORMED					
1							
1							
1							
1							
Ave							
2	2OTT1	Tapered Tube 1	.1986		146.6	46.6	
2	2OTT2	Tapered Tube 2	.2401		177.2	77.2	
2	2OCC1	Cassette Cone 1	.2645		195.2	95.2	
2	2OCCL2	Cassette Cone Long Nozzle 2	.2432		179.5	79.5	
2	MEO2	13-B		.1355			
Ave			.2366	.1355	174.6	74.6	74.6
3	3OTT1	Tapered Tube 1	.0445		91.9	- 8.1	
3	3OTT2	Tapered Tube 2	.0430		88.8	- 11.2	
3	3OCC1	Cassette Cone 1	.0335		69.2	- 30.8	
3	3OCCL2	Cassette Cone Long Nozzle 2	.0750		155.0	- 55.0	
3	MEO3	13B		.0484			
Ave			.0490	.0484	101.2	- 1.2	26.2
4	4OTT1	Tapered Tube 1	.1411		119.6	19.6	
4	4OTT2	Tapered Tube 2	.1815		153.8	53.8	
4	4OCC1	Cassette Cone 1	.1431		121.3	21.3	
4	4OCC12	Cassete Cone Long Nozzle 2	.1513		128.2	28.2	
4	MEO4	13-B		.1180			
Ave			.1543	.1180	130.7	30.7	30.7
5	5OTT1	Tapered Tube 1	.0388		65.3	- 34.7	
5	5OTT2	Tapered Tube 2	.0488	.0594	82.2	- 17.8	
5	5OCC1	Cassette Cone 1	.0596	.0594	100.3	0.3	
5	5OCC12	Cassete Cone Long Nozzle 2	.0646		108.8	8.8	
5	MEO5	13-B		.0544			
Ave			.0530	.0544	89.2	- 10.9	15.4
6	6OTT1	Tapered Tube 1	.0953		189.1	89.1	
6	6OTT2	Tapered Tube 2	.0776		154.0	54.0	
6	6OCC1	Cassette Cone 1	.1118		221.8	121.8	
6	6OCC12	Cassete Cone Long Nozzle 2	.1136		225.4	125.4	
6	MEO6	13-B		.0504			
Ave			.0996	.0504	197.6	97.6	97.6

SCREENING METHOD RESULTS VS. METHOD 13-B RESULTS (INLET LOCATION-AFTER TEST PUMP VOLUMES)

RUN NO.	SAMPLE NUMBER	SAMPLE TYPE	SCREENING Mg/M^3	M13B Mg/M^3	PERCENT OF REAL VALUE	(Mathematical Average) PERCENT HIGH OR LOW	(Absolute Average) PERCENT HIGH OR LOW
1	1ITT1	Tapered Tube 1	4.551		228.9	128.9	
1	1ITT2	Tapered Tube 2	2.569		129.2	29.2	
1	1ICC1	Cassette Cone 1	7.395		372.0	272.0	
1	1ICCL2	Cassette Cone Long Nozzle 2	3.327		167.4	67.4	
1	SI-1	13-B		1.988			
Ave			4.461	1.988	224.4	124.4	124.4
2	2ITT1	Tapered Tube 1	7.710		328.8	+228.8	
2	2ITT2	Tapered Tube 2	11.617		495.4	395.4	
2	2ICC1	Cassette Cone 1	20.809		887.4	787.4	
2	2ICCL2	Cassette Cone Long Nozzle 2	6.033		257.3	157.3	
2	SI-2	13-B		2.345			
Ave			11.542	2.345	492.2	392.2	392.2
3	3ITT1	Tapered Tube 1	.801		21.2	- 78.8	
3	3ITT2	Tapered Tube 2	.609		16.1	- 83.9	
3	3ICC1	Cassette Cone 1	1.256		33.2	- 66.8	
3	3ICCL2	Cassette Cone Long Nozzle 2	1.054		27.9	- 72.1	
3	SI-3	13-B		3.778			
Ave			.9300	3.778	24.6	- 75.4	75.4
4	4ITT1	Tapered Tube 1	4.067		233.9	133.9	
4	4ITT2	Tapered Tube 2	2.320		133.4	33.4	
4	4ICC1	Cassette Cone 1	5.774		332.0	232.0	
4	4ICC12	Cassete Cone Long Nozzle 2	1.419		81.6	18.4	
4	SI-4	13-B		1.739			
Ave			3.395	1.739	195.2	95.2	104.4
5	5ITT1	Tapered Tube 1	1.292		162.5	62.5	
5	5ITT2	Tapered Tube 2	.531		66.8	- 33.2	
5	5ICC1	Cassette Cone 1	4.383		551.3	451.3	
5	5ICC12	Cassete Cone Long Nozzle 2	2.030		255.3	155.3	
5	SI-5	13-B		.795			
Ave			2.059	.795	259.0	159.0	175.6
6	6ITT1	Tapered Tube 1	5.427		337.1	237.1	
6	6ITT2	Tapered Tube 2	3.242		201.4	101.4	
6	6ICC1	Cassette Cone 1	7.165		445.0	345.0	
6	6ICC12	Cassete Cone Long Nozzle 2	2.362		146.7	46.7	
6	SI-6	13-B		1.610			
Ave			4.549	1.610	282.6	182.5	182.5

SCREENING METHOD RESULTS VS. METHOD 13-B RESULTS (OUTLET LOCATION - AFTER TEST PUMP VOLUMES)

RUN NO.	SAMPLE NUMBER	SAMPLE TYPE	SCREENING Mg/M^3	M13B Mg/M^3	PERCENT OF REAL VALUE	(Mathematical Average) PERCENT HIGH OR LOW	(Absolute Average) PERCENT HIGH OR LOW
1		THIS TEST NOT PERFORMED					
1							
1							
1							
1							
Ave							
2	2OTT1	Tapered Tube 1	.1348		99.5	0.5	
2	2OTT2	Tapered Tube 2	.2131		157.3	57.3	
2	2OCC1	Cassette Cone 1	.2731		201.5	101.5	
2	2OCCL2	Cassette Cone Long Nozzle 2	.2303		170.0	70.0	
2	MEO2	13-B		.1355	174.6		
Ave			.2128	.1355	157.1	57.1	57.3
3	3OTT1	Tapered Tube 1	.0403		83.3	- 16.7	
3	3OTT2	Tapered Tube 2	.0438		90.5	- 9.5	
3	3OCC1	Cassette Cone 1	.0334		69.0	- 31.0	
3	3OCCL2	Cassette Cone Long Nozzle 2	.0729		150.6	50.6	
3	MEO3	13B		.0484			
Ave			.0476	.0484	98.3	- 1.7	27.0
4	4OTT1	Tapered Tube 1	.1279		108.4	8.4	
4	4OTT2	Tapered Tube 2	.1847		156.5	56.5	
4	4OCC1	Cassette Cone 1	.1426		120.8	20.8	
4	4OCC12	Cassete Cone Long Nozzle 2	.1472		124.7	24.7	
4	MEO4	13-B		.1180			
Ave			.1499	.1180	127.6	27.6	27.6
5	5OTT1	Tapered Tube 1	.0352		59.3	- 40.7	
5	5OTT2	Tapered Tube 2	.0496		83.5	- 16.5	
5	5OCC1	Cassette Cone 1	.0594		100.0	0.0	
5	5OCC12	Cassete Cone Long Nozzle 2	.0628		105.7	5.7	
5	MEO5	13-B		.0594			
Ave			.0518	.0594	87.1	- 12.9	15.7
6	6OTT1	Tapered Tube 1	.0864		171.4	71.4	
6	6OTT2	Tapered Tube 2	.0789		156.5	56.5	
6	6OCC1	Cassette Cone 1	.1114		221.0	121.0	
6	6OCC12	Cassete Cone Long Nozzle 2	.1105		219.2	119.2	
6	MEO6	13-B		.0504			
Ave			.0968	.0504	192.1	92.1	92.1

4.0 SAMPLING LOCATIONS

The test program consisted of simultaneous sampling of the inlet to the scrubber, the outlet of the scrubber (two ducts) and the outlet from the mist eliminator. The purpose of sampling these four sites was to collect data in order to compare the results of the Screening Method with the results from the MM13B. To maintain sample integrity, EPA Reference Methods 1-5 were adhered to as closely as possible and Method 13-B was modified to achieve consistency with other test programs. A flow diagram illustrating the sampling locations on the emission control devices servicing chromium plating Tanks 1, 2, 3, and 7 at the ROLL TECHNOLOGY facility is shown in Figure 4.1. No calculations are presented in this test program description; however, the field data sheets from this program are presented, by sample location, in Appendix B.

4.1 SCRUBBER INLET

Emission sampling was performed on the duct leading from the plating tanks to the scrubber. The duct was 36 inches in diameter and had a straight run of approximately 48 inches. Two sampling ports were installed by the test crew and were situated such that one port was located in the horizontal plane and the other was located 90° from the horizontal. The location of one of the sampling ports required that a vertical traverse be made during each of the runs. To accomplish this, a chain hoist was suspended from a platform over the horizontal duct. Since the duckwork did not meet the minimum length specifications of Reference Method 1, the parts were located 0.8 of the distance downstream from the vertical elbow. This was 38.4 inches and maintained the

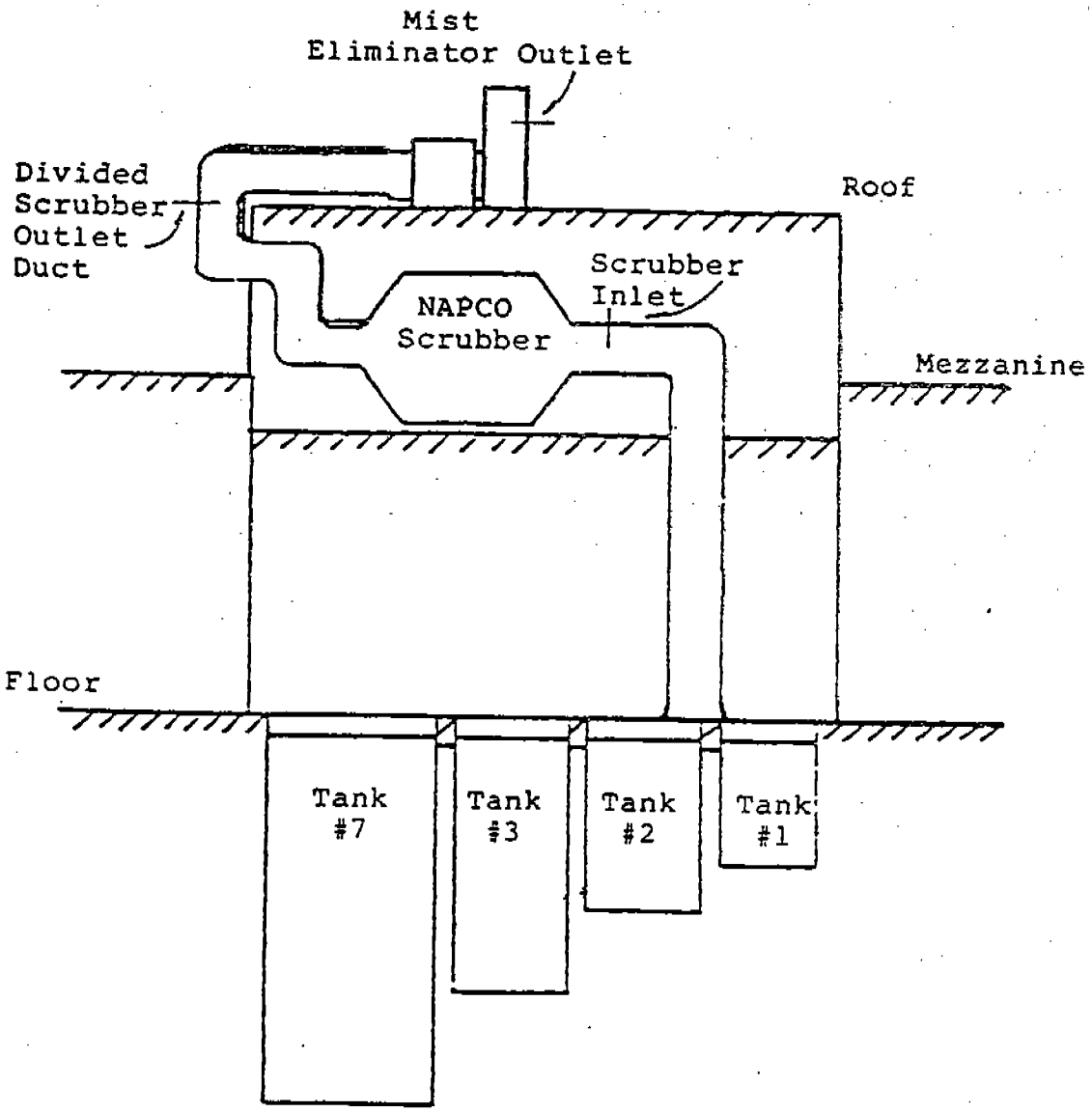


Figure 4-1 Simplified Process Flow Diagram Showing Proposed Sample Port Location.

4 to 1 downstream ratio found in Reference Method 1 (See Figure 4.2).

The number of traverse points for the inlet was 24. This determination of the total number of traverse points was based on an earlier testing program where the velocity profile did not indicate the presence of cyclonic or turbulent flow. However, a verification of the absence of cyclonic or turbulent flow was conducted during the collection of preliminary flow data. Each traverse point was sampled for 5.0 minutes for a total test time of 120 minutes. After the samples from the MM13B were collected, they were analyzed for Cr^{+6} concentration.

4.2 SCRUBBER OUTLET (MIST ELIMINATOR INLET)

Gases exit from the scrubber through either of two parallel ducts which join into one common duct just prior to the mist eliminator. Emission sampling was performed on each of the 23-inch diameter ducts prior to joining to the common duct. Sampling at this location almost allowed the minimum sampling criteria to be met, and was considerably better than sampling in the common duct after the two ducts joined. The two ducts were sampled simultaneously, and a total of 24 traverse points were sampled at each of these two sites. Sampling time per point was 5.0 minutes, for a total test time of 120 minutes at each site. Secure sampling platforms for these sites were erected using lumber and scaffolding. (For port location, see Figure 4.3)

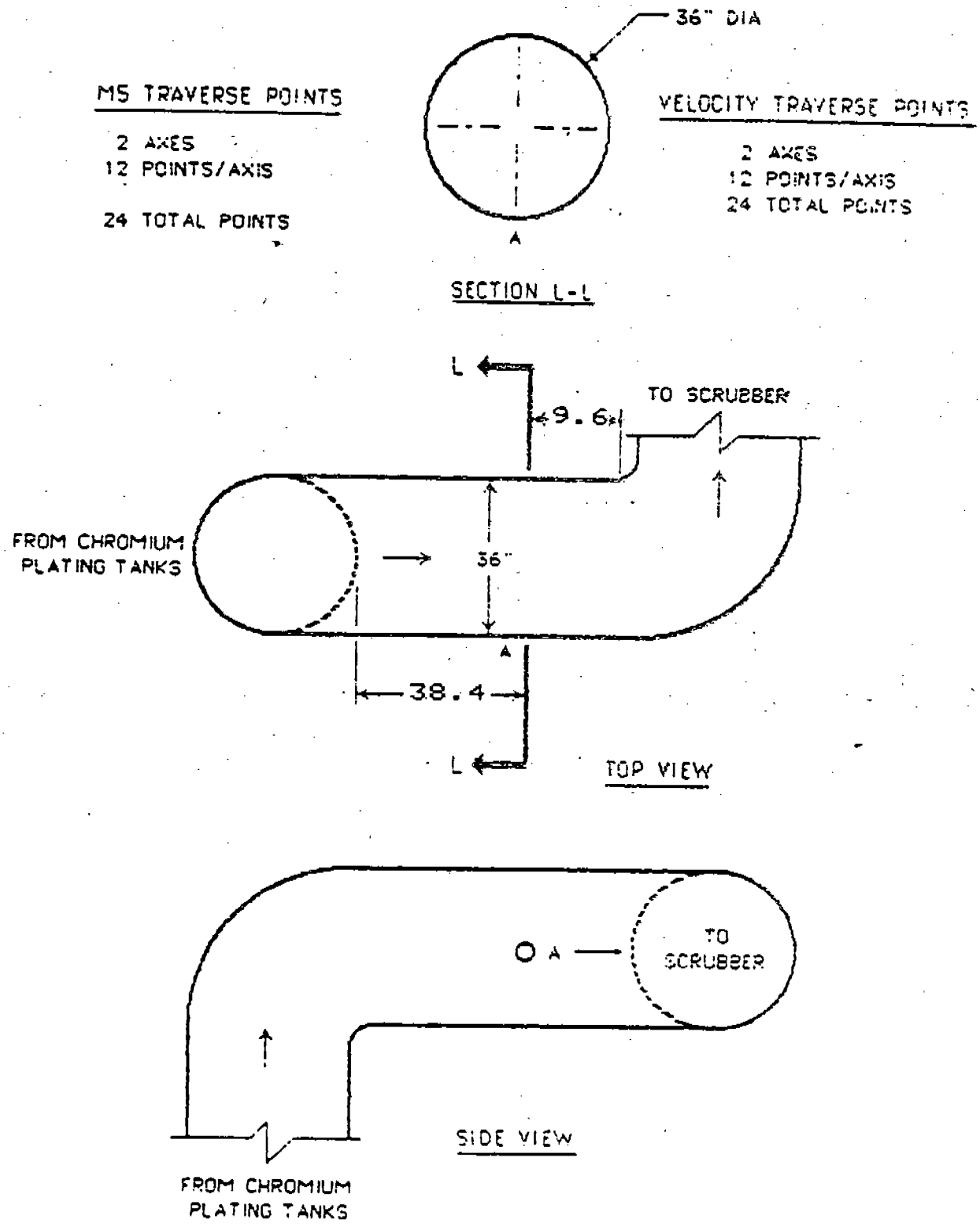


FIGURE 4-2 SCRUBBER INLET (SAMPLING LOCATION A)

ROLL TECHNOLOGY

SCRUBBER OUTLET LOCATIONS

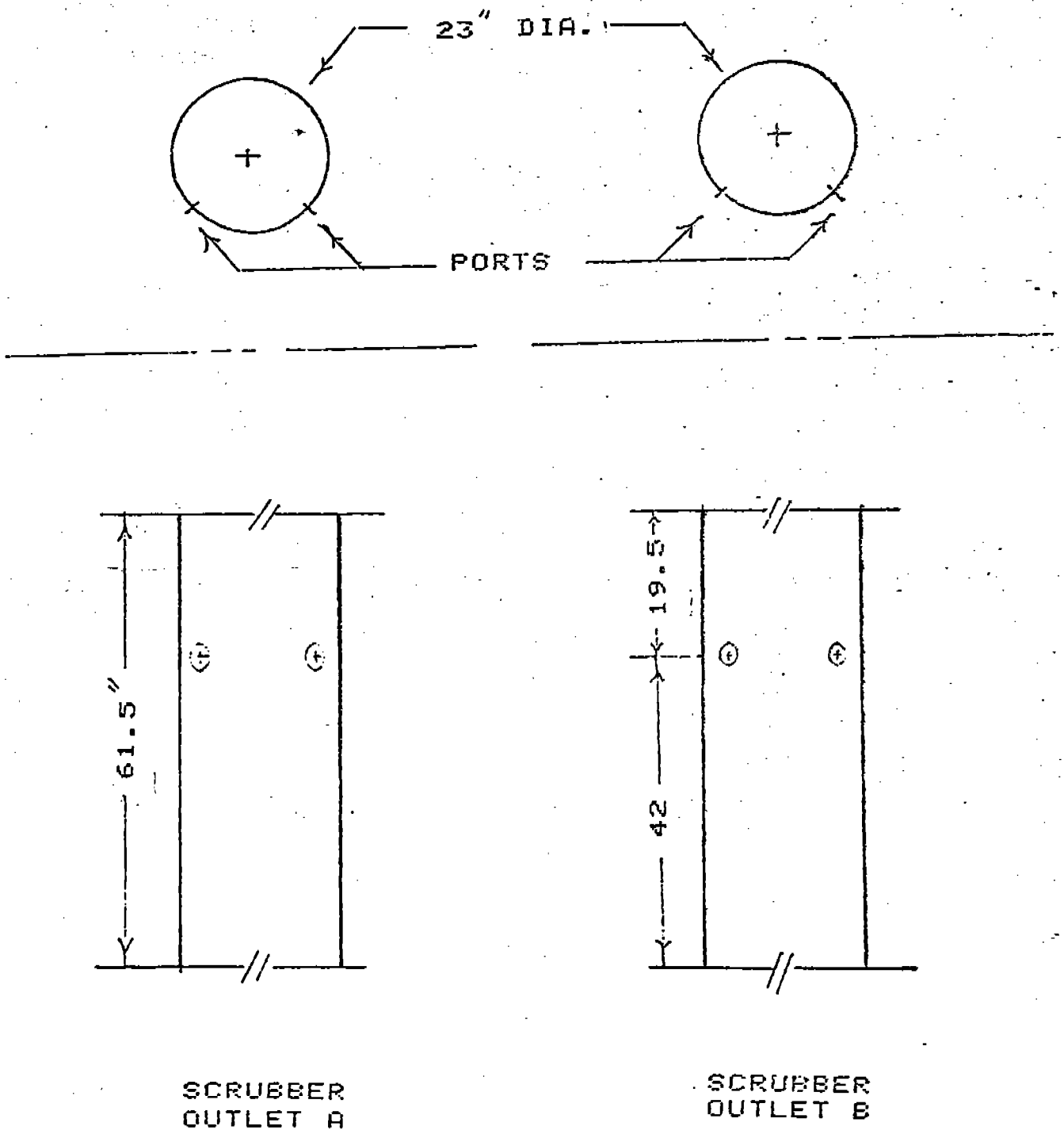


FIGURE 4.3

4.3 MIST ELIMINATOR OUTLET

Emission sampling was conducted on the outlet from the mist eliminator downstream of the fan. This site required some modifications to meet the minimum sampling point location criteria. Modifications were made with a "stack extension" fabricated and installed by KCH Services, Inc., the manufacturer of the mist eliminator. This stack extension included a transition duct from rectangular to a 22-inch diameter duct that was 8 feet in length. Drawings of the existing duct configuration and the modifications that were made to the mist eliminator outlet are presented in Figures 4.4 and 4.5. The total number of sample points for this location was 24 and the sample time per point 5.0 minutes for a total test time of 120 minutes. A secure sampling platform was erected with scaffolding that was rented locally.

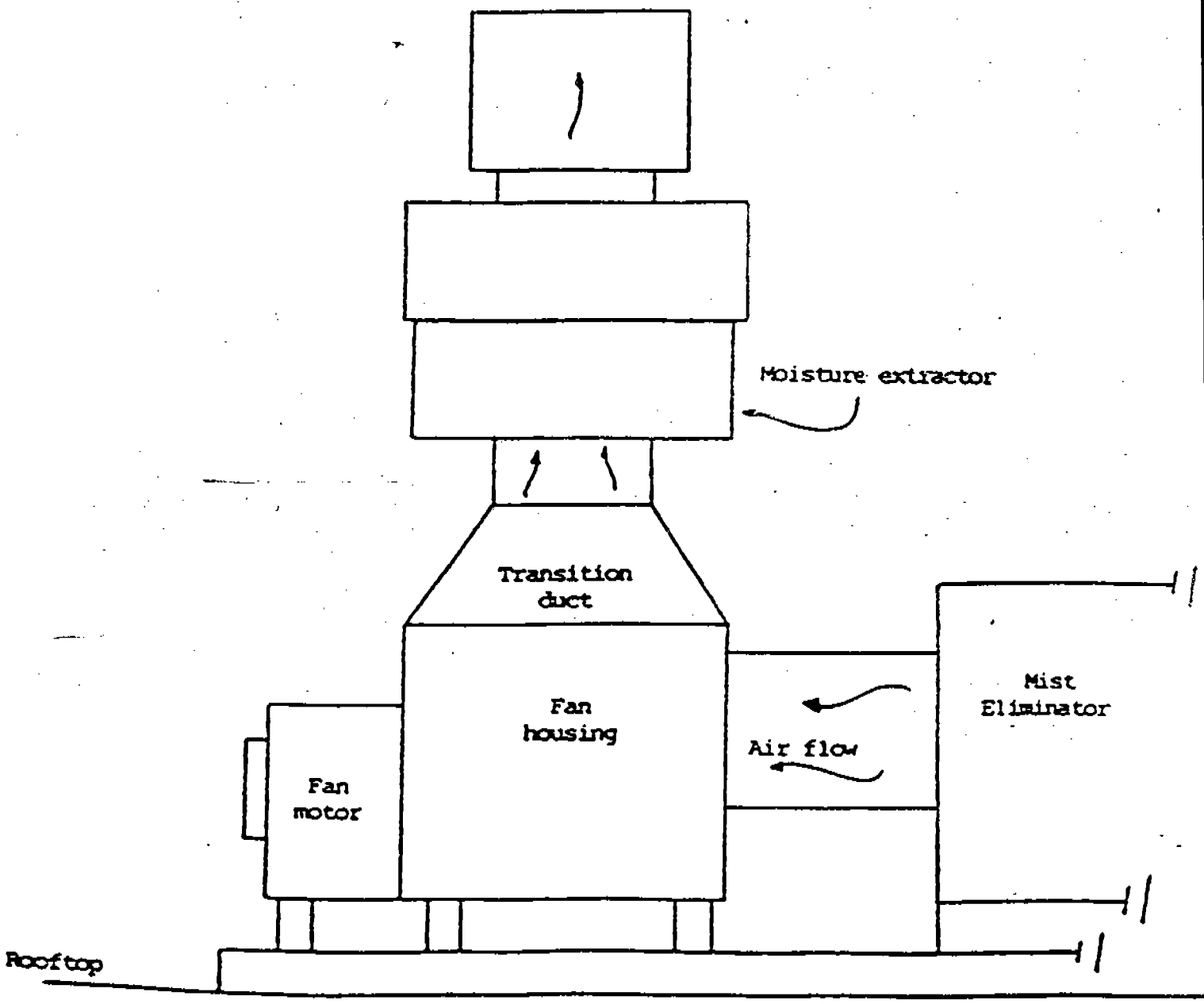


Figure 4.4 Existing Mist Eliminator Outlet At ROLL Technology Corp.

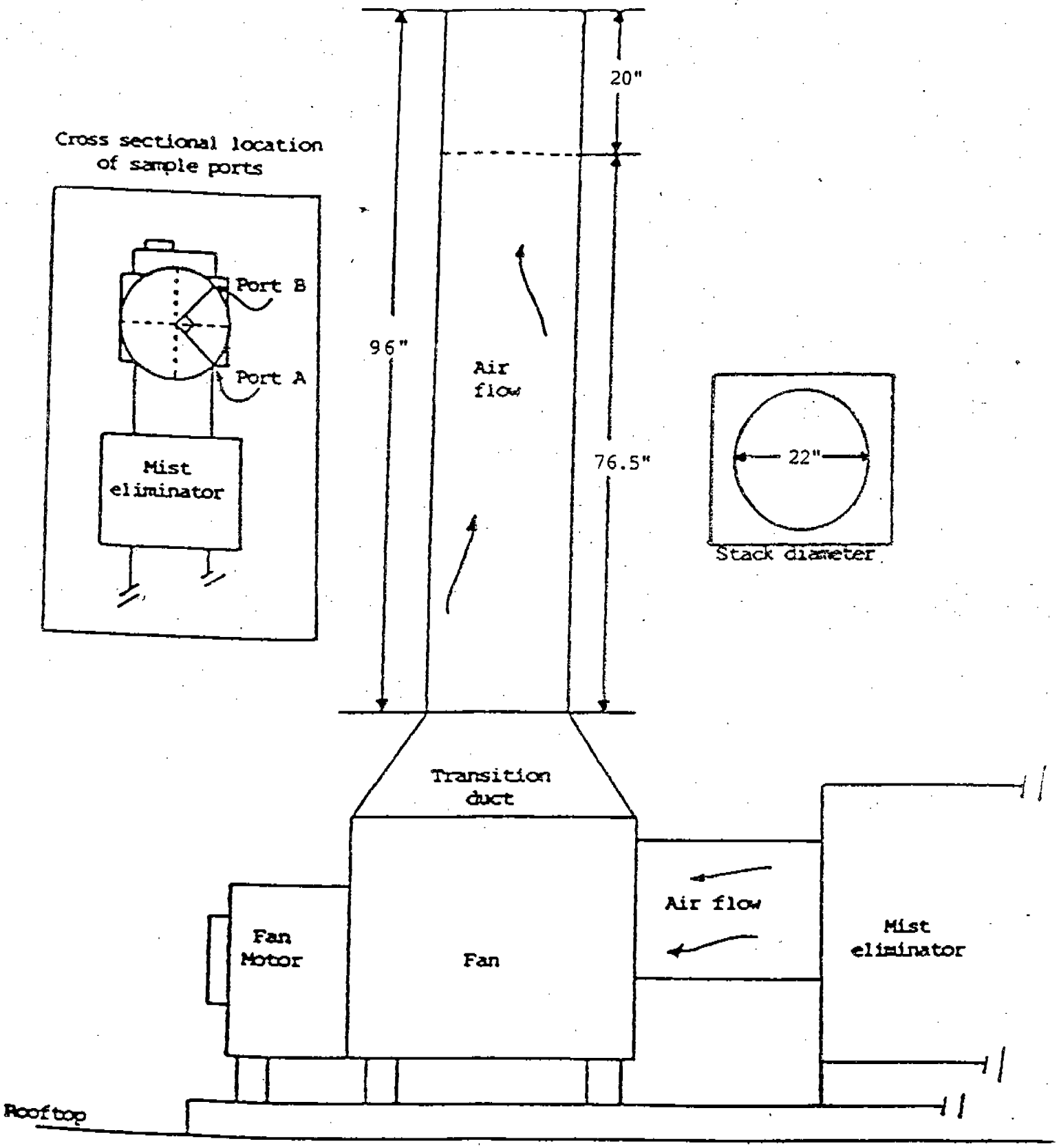


Figure 4.5 modifications to the mist eliminator outlet at ROLL TECHNOLOGY CORPORATION.

5.0 QUALITY ASSURANCE

5.1 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 that were performed; these are presented in the paragraphs that follow.

5.2 FIELD QUALITY ASSURANCE PROCEDURES

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

5.2.1 Sample Blanks

5.2.1.1 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. One blank was collected daily.

5.2.2 "Spiked" Samples

A Cr^{+6} stock standard solution was made up in the laboratory. This stock solution was used to make up samples of known concentrations. The resultant samples were used to prepare random "spiked" samples which were analyzed for QA/QC check purposes.

5.2.3 Emissions Samples

One sample per day from the MM13B emission sampling was split, volume permitting, in the field to produce a duplicate sample. The minimum volume required for analysis was 200 milliliters. This sample was submitted as a "blind" duplicate.

5.2.4 Chain of Custody

In an effort to maintain the integrity of all samples taken at the test facility, a detailed chain of custody procedure was followed. A copy of the "Chain of Custody" data sheets are included in Appendix B. These sheets include the sample identification, date of sample recovery, name of person who performed the recovery, place of recovery as well as the name of the responsible person from the analytical group who is taking custody of the samples. Once the samples were placed in custody of the analytical group, that group was to provide for safe storage and maintenance of records sufficient to maintain sample integrity.

5.3 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.

5.4 LABORATORY ANALYSIS

In addition to quality assurance activities in the field, the laboratory QA techniques will be a requirement. Since the laboratory selected to perform the on-site analyses was Entropy Environmentalists, Inc., quality assurance activities followed those outlined in the Entropy Environmentalist, Inc.'s, "Laboratory Quality Assurance Plan."

APPENDIX A

HAND HELD COMPUTER PRINT-OUTS

SCRUBBER INLET

Scrubber Inlet
Point Location

```
XROM "METH 1"

DIA INCHES?
          36.00    RUN
NIPPLE INCH ?
           0.00    RUN
POINTS ONE TRY?
          12.00    RUN
POINT  1.
                    1.0
POINT  2.
                    2.4
POINT  3.
                    4.3
POINT  4.
                    6.4
POINT  5.
                    9.0
POINT  6.
                   12.8
POINT  7.
                   23.2
POINT  8.
                   27.0
POINT  9.
                   29.6
POINT  10.
                   31.7
POINT  11.
                   33.6
POINT  12.
                   35.0
```

```
XROM "METH 2"
SITE ?
ROLL TECH
SCRUBBER INLET
                    RUN
STACK DIA INCH?
          36.0      RUN
NO TRAY PTS. ?
          24.0      RUN
BAR PRESS ?
         29.11      RUN
STATIC IN HOH ?
          -2.2      RUN
% MOISTURE ?
           2.0      RUN
PITOT CP ?
           .84      RUN
% CO2 ?
            .7      RUN
% OXYGEN ?
          21.0      RUN
% CO ?
                    RUN
MOL WT OTHER ?
                    RUN

MWd = 28.95
MW WET = 28.73


DELTA P 1.
            .3      RUN
STACK TEMP?
          85.       RUN
FPS = 32.

DELTA P 2.
            .2      RUN
STACK TEMP?
          85.       RUN
FPS = 26.

DELTA P 3.
           .18      RUN
STACK TEMP?
          85.       RUN
FPS = 25.

DELTA P 4.
            .2      RUN
STACK TEMP?
          85.       RUN
FPS = 26.
```

```
DELTA P 5.
           .22      RUN
STACK TEMP?
          85.       RUN
FPS = 27.

DELTA P 6.
           .24      RUN
STACK TEMP?
          85.       RUN
FPS = 28.

DELTA P 7.
           .33      RUN
STACK TEMP?
          85.       RUN
FPS = 33.

DELTA P 8.
           .35      RUN
STACK TEMP?
          85.       RUN
FPS = 34.

DELTA P 9.
           .36      RUN
STACK TEMP?
          85.       RUN
FPS = 35.

DELTA P 10.
           .38      RUN
STACK TEMP?
          85.       RUN
FPS = 36.

DELTA P 11.
           .38      RUN
STACK TEMP?
          85.       RUN
FPS = 36.

DELTA P 12.
           .36      RUN
STACK TEMP?
          85.       RUN
FPS = 35.
```

```
DELTA P 13.
                .27     RUN
STACK TEMP?
                85.     RUN
FPS = 30.

DELTA P 14.
                .26     RUN
STACK TEMP?
                85.     RUN
FPS = 30.

DELTA P 15.
                .28     RUN
STACK TEMP?
                85.     RUN
FPS = 31.

DELTA P 16.
                .29     RUN
STACK TEMP?
                85.     RUN
FPS = 31.

DELTA P 17.
                .3      RUN
STACK TEMP?
                85.     RUN
FPS = 32.

DELTA P 18.
                .32     RUN
STACK TEMP?
                85.     RUN
FPS = 33.

DELTA P 19.
                .16     RUN
STACK TEMP?
                85.     RUN
FPS = 23.

DELTA P 20.
                .14     RUN
STACK TEMP?
                85.     RUN
FPS = 22.

DELTA P 21.
                .11     RUN
STACK TEMP?
                85.     RUN
FPS = 19.

DELTA P 22.
                .12     RUN
STACK TEMP?
                85.     RUN
FPS = 20.

DELTA P 23.
                .11     RUN
STACK TEMP?
                85.     RUN
FPS = 19.

DELTA P 24.
                .12     RUN
STACK TEMP?
                85.     RUN
FPS = 20.

AVE FPS = 28.
AVE FPM = 1,710.
AVE DELTA P = 0.25
STK PRS. ABS = 28.95
AVE STK TEMP = 85.
STACK ACFM = 12,085.
DSCFM = 11,102.

            XROM "NOZZLE"
STATIC HOH ?
            -2.20     RUN
BAR PRESS ?
            29.11     RUN
STK TEMP ?
            85.00     RUN
% HOH ?
             2.00     RUN
STACK FPS ?
            28.00     RUN
ACT. DIA. = 0.2984
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER INLET
SI-1
                    RUN
METER BOX Y?
          .9932     RUN
DELTA H?
         2.2000     RUN
BAR PRESS ?
        29.1900     RUN
METER VOL ?
        99.7600     RUN
MTR TEMP F?
       102.0000     RUN
STATIC HOH IN ?
        -2.2000     RUN
STACK TEMP.
        81.0000     RUN
ML. WATER ?
        31.8000     RUN

SAT % = 3.7

IMP. % HOH = 1.6

% HOH=1.6

% CO2?
          .7000     RUN
% OXYGEN?
        21.0000     RUN

MWd =28.95
MW WET=28.78

SQRT PSTS ?
        11.4780     RUN
TIME MIN ?
       120.0000     RUN
NOZZLE DIA ?
          .2970     RUN
STK DIA INCH ?
        36.0000     RUN
```

```
* VOL MTR STD = 91.319
  STK PRES ABS = 29.03
  VOL HOH GAS = 1.50
  % MOISTURE = 1.61
  MOL DRY GAS = 0.984
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.78
  VELOCITY FPS = 28.52
  STACK AREA = 7.07
  STACK ACFM = 12,896.
* STACK DSCFM = 11,268.
  % ISOKINETIC =  99.28

END OF FIELD DATA
```

```
* VOL MTR STD = 94.290
  STK PRES ABS = 28.98
  VOL HOH GAS = 1.09
  % MOISTURE = 1.14
  MOL DRY GAS = 0.989
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.83
  VELOCITY FPS = 29.94
  STACK AREA = 7.07
  STACK ACFM = 12,699.
* STACK DSCFM = 11,779.
  % ISOKINETIC =  98.06

END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER INLET
SI-2
                    RUN
METER BOX Y?
          .9932     RUN
DELTA H?
         2.4500     RUN
BAR PRESS ?
        29.1400     RUN
METER VOL ?
       104.4010     RUN
MTR TEMP F?
       109.0000     RUN
STATIC HOH IN ?
        -2.2000     RUN
STACK TEMP.
        85.0000     RUN
ML. WATER ?
        23.2000     RUN

SAT % = 4.2

IMP. % HOH = 1.1

% HOH=1.1

% CO2?
          .7000     RUN
%  YGEN?
        21.0000     RUN

MWd =28.95
MW WET=28.83

SQRT PSTS ?
        12.0511     RUN
TIME MIN ?
       120.0000     RUN
NOZZLE DIA ?
          .2970     RUN
STK DIA INCH ?
        36.0000     RUN
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER INLET
SI-3
                    RUN
METER BOX Y?
          .9932     RUN
DELTA H?
         2.2200     RUN
BAR PRESS ?
        29.2000     RUN
METER VOL ?
        98.1950     RUN
MTR TEMP F?
        98.0000     RUN
STATIC HOH IN ?
        -2.2000     RUN
STACK TEMP.
        77.0000     RUN
ML. WATER ?
        38.1000     RUN


SAT % = 3.2


IMP. % HOH = 1.9

% HOH=1.9


% CO2?
          .7000     RUN
% OXYGEN?
        21.0000     RUN

MWd =28.95
MW WET=28.74


SQRT PSTS ?
        11.1774     RUN
TIME MIN ?
       120.0000     RUN
NOZZLE DIA ?
          .2970     RUN
STK DIA INCH ?
        36.0000     RUN
```

```
* VOL MTR STD = 90.566
  STK PRES ABS = 29.04
  VOL HOH GAS = 1.79
  % MOISTURE = 1.94
  MOL DRY GAS = 0.981
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.74
  VELOCITY FPS = 27.79
  STACK AREA = 7.07
  STACK ACFM = 11,784.
* STACK DSCFM = 11,027.
  % ISOKINETIC =  100.62


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER INLET
SI-4
                    RUN
METER BOX Y?
          .9932     RUN
DELTA H?
         2.1300     RUN
BAR PRESS ?
        29.2000     RUN
METER VOL ?
        99.7900     RUN
MTR TEMP F?
       104.0000     RUN
STATIC HOH IN ?
        -2.2000     RUN
STACK TEMP.
        83.0000     RUN
ML. WATER ?
        30.6000     RUN


SAT % = 3.9


IMP. % HOH = 1.6

% HOH=1.6


% CO2?
          .7000     RUN
% OXYGEN?
        21.0000     RUN

MWd =28.95
MW WET=28.78


SQRT PSTS ?
        11.2735     RUN
TIME MIN ?
       120.0000     RUN
NOZZLE DIA ?
          .2970     RUN
STK DIA INCH ?
        36.0000     RUN
```

```
* VOL MTR STD = 91.045
  STK PRES ABS = 29.04
  VOL HOH GAS = 1.44
  % MOISTURE = 1.56
  MOL DRY GAS = 0.984
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.78
  VELOCITY FPS = 28.00
  STACK AREA = 7.07
  STACK ACFM = 11,877.
* STACK DSCFM = 11,034.
  % ISOKINETIC =  101.09


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER INLET
SI-5
                    RUN
METER BOX Y?
          .9932     RUN
DELTA H?
         2.2900     RUN
BAR PRESS ?
        29.1500     RUN
METER VOL ?
       100.2870     RUN
MTR TEMP F?
        97.0000     RUN
STATIC HOH IN ?
         9.0000     CLX
        -2.2000     RUN
STACK TEMP.
        78.0000     RUN
ML. WATER ?
        31.1000     RUN


SAT % = 3.3


IMP. % HOH = 1.6

% HOH=1.6


% CO2?
          .7000     RUN
% OXYGEN?
        21.0000     RUN

MWd =28.95
MW WET=28.78


SQRT PSTS ?
        11.3392     RUN
TIME MIN ?
       120.0000     RUN
NOZZLE DIA ?
          .2970     RUN
STK DIA INCH ?
        36.0000     RUN
```

```
* VOL MTR STD = 92.520
  STK PRES ABS = 28.99
  VOL HOH GAS = 1.46
  % MOISTURE = 1.56
  MOL DRY GAS = 0.984
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.78
  VELOCITY FPS = 28.19
  STACK AREA = 7.07
  STACK ACFM = 11,956.
* STACK DSCFM = 11,191.
  % ISOKINETIC =  101.28


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER INLET
SI-6
                    RUN
METER BOX Y?
          .9932     RUN
DELTA H?
         2.0500     RUN
BAR PRESS ?
        29.1500     RUN
METER VOL ?
        95.5440     RUN
MTR TEMP F?
       105.0000     RUN
STATIC HOH IN ?
        -2.2000     RUN
STACK TEMP.
        84.0000     RUN
ML. WATER ?
        45.7000     RUN


SAT % = 4.0


IMP. % HOH = 2.4

% HOH=2.4


% CO2?
          .7000     RUN
% OXYGEN?
        21.0000     RUN

MWd =28.95
MW WET=28.69


SQRT PSTS ?
        10.6906     RUN
TIME MIN ?
       120.0000     RUN
NOZZLE DIA ?
          .2970     RUN
STK DIA INCH ?
        36.0000     RUN
```

```
* VOL MTR STD = 86.844
  STK PRES ABS = 28.99
  VOL HOH GAS = 2.15
  % MOISTURE = 2.42
  MOL DRY GAS = 0.976
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.69
  VELOCITY FPS = 26.62
  STACK AREA = 7.07
  STACK ACFM = 11,291.
* STACK DSCFM = 10,361.
  % ISOKINETIC =  102.69


END OF FIELD DATA
```

SCRUBBER OUTLET A

XROM "METH 1"

```
DIA INCHES?
          23.0    RUN
NIPPLE INCH ?
           0.0    RUN
POINTS ONE TRV?
          12.0    RUN
POINT  1.
                  0.5
POINT  2.
                  1.5
POINT  3.
                  2.7
POINT  4.
                  4.1
POINT  5.
                  5.8
POINT  6.
                  8.2
POINT  7.
                 14.8
POINT  8.
                 17.3
POINT  9.
                 18.9
POINT  10.
                 20.3
POINT  11.
                 21.5
POINT  12.
                 22.5
```

XROM "METH 2"

```
SITE ?
ROLL TECH
SCRUBBER OUTLET A
                  RUN
STACK DIA INCH?
        23.0000   RUN
NO TRAV PTS. ?
        23.0000   RUN
BAR PRESS ?
        29.1100   RUN
STATIC IN HOH ?
        -3.5000   RUN
% MOISTURE ?
         2.0000   RUN
PITOT CP ?
          .8400   RUN
% CO2 ?
          .7000   RUN
% OXYGEN ?
        21.0000   RUN
% CO ?
                  RUN
MOL WT OTHER ?
                  RUN

MWd = 28.95
MW WET = 28.73


DELTA P 1.
            .36   RUN
STACK TEMP?
           81.    RUN
FPS = 35.

DELTA P 2.
            .25   RUN
STACK TEMP?
           80.    RUN
FPS = 29.

DELTA P 3.
            .21   RUN
STACK TEMP?
           80.    RUN
FPS = 27.

DELTA P 4.
            .21   RUN
STACK TEMP?
           80.    RUN
FPS = 27.

DELTA P 5.
            .22   RUN
STACK TEMP?
           80.    RUN
FPS = 27.

DELTA P 6.
            .24   RUN
STACK TEMP?
           80.    RUN
FPS = 28.

DELTA P 7.
            .39   RUN
STACK TEMP?
           81.    RUN
FPS = 36.

DELTA P 8.
            .44   RUN
STACK TEMP?
           81.    RUN
FPS = 38.

DELTA P 9.
            .48   RUN
STACK TEMP?
           80.    RUN
FPS = 40.

DELTA P 10.
            .49   RUN
STACK TEMP?
           79.    RUN
FPS = 41.

DELTA P 11.
            .44   RUN
STACK TEMP?
           79.    RUN
FPS = 38.

DELTA P 12.
            .89   RUN
STACK TEMP?
           81.    RUN
FPS = 55.
```

```
DELTA P 13.
                .95    RUN
STACK TEMP?
                79.    RUN
FPS = 56.

DELTA P 14.
                .40    RUN
STACK TEMP?
                79.    RUN
FPS = 40.

DELTA P 15.
                .33    RUN
STACK TEMP?
                79.    RUN
FPS = 33.

DELTA P 16.
                .32    RUN
STACK TEMP?
                79.    RUN
FPS = 33.

DELTA P 17.
                .28    RUN
STACK TEMP?
                80.    RUN
FPS = 31.

DELTA P 18.
                .28    RUN
STACK TEMP?
                79.    RUN
FPS = 31.

DELTA P 19.
                .28    RUN
STACK TEMP?
                79.    RUN
FPS = 31.

DELTA P 20.
                 .3    RUN
STACK TEMP?
                79.    RUN
FPS = 32.

DELTA P 21.
                .32    RUN
STACK TEMP?
                79.    RUN
FPS = 33.

DELTA P 22.
                 .3    RUN
STACK TEMP?
                79.    RUN
FPS = 32.

DELTA P 23.
                .22    RUN
STACK TEMP?
                79.    RUN
FPS = 27.

AVE FPS = 35.
AVE FPM = 2,084.
AVE DELTA P = 0.38
STK PRS. ABS = 28.85
AVE STK TEMP = 80.
STACK ACFM = 6,013.
DSCFM = 5,560.

          XROM "NOZZLE"
STATIC HOH ?
            -3.50    RUN
BAR PRESS ?
            29.11    RUN
STK TEMP ?
            80.00    RUN
% HOH ?
             2.00    RUN
STACK FPS ?
            35.00    RUN
ACT. DIA. = 0.2661
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET A
SOA-5
                    RUN
METER BOX Y?
          .9840     RUN
DELTA H?
         2.9600     RUN
BAR PRESS ?
        29.1500     RUN
METER VOL ?
       116.4920     RUN
MTR TEMP F?
       100.0000     RUN
STATIC HOH IN ?
        -3.5000     RUN
STACK TEMP.
        71.0000     RUN
ML. WATER ?
        36.6000     RUN

SAT % = 2.6

IMP. % HOH = 1.6

% HOH=1.6

% CO2?
          .7000     RUN
% OXYGEN?
        21.0000     RUN

MWd =28.95
MW WET=28.78

SQRT PSTS ?
        13.5595     RUN
TIME MIN ?
       120.0000     RUN
NOZZLE DIA ?
          .2980     RUN
STK DIA INCH ?
        23.0000     RUN
```

```
* VOL MTR STD = 106.082
  STK PRES ABS = 28.89
  VOL HOH GAS = 1.72
  % MOISTURE = 1.60
  MOL DRY GAS = 0.984
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.78
  VELOCITY FPS = 33.77
  STACK AREA = 2.89
  STACK ACFM = 5,846.
* STACK DSCFM = 5,524.
  % ISOKINETIC =  95.39

END OF FIELD DATA
```

```
* VOL MTR STD = 102.625
  STK PRES ABS = 28.89
  VOL HOH GAS = 1.84
  % MOISTURE = 1.76
  MOL DRY GAS = 0.982
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.76
  VELOCITY FPS = 33.05
  STACK AREA = 2.89
  STACK ACFM = 5,721.
* STACK DSCFM = 5,376.
  % ISOKINETIC =  94.82

END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET A
SOA-6
                    RUN
METER BOX Y?
          .9840     RUN
DELTA H?
         2.8300     RUN
BAR PRESS ?
        29.1500     RUN
METER VOL ?
       113.5370     RUN
MTR TEMP F?
       104.0000     RUN
STATIC HOH IN ?
        -3.5000     RUN
STACK TEMP.
        73.0000     RUN
ML. WATER ?
         2.0000     CLX
        39.1000     RUN

SAT % = 2.8

IMP. % HOH = 1.8

% HOH=1.8

% CO2?
          .7000     RUN
% OXYGEN?
        21.0000     RUN

MWd =28.95
MW WET=28.76

SQRT PSTS ?
        13.2651     RUN
TIME MIN ?
       120.0000     RUN
NOZZLE DIA ?
          .2980     RUN
STK DIA INCH ?
        23.0000     RUN
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET A
SOA-1
                        RUN
METER BOX Y?
            .9840       RUN
DELTA H?
           3.2000       RUN
BAR PRESS ?
          29.1900       RUN
METER VOL ?
         122.0080       RUN
MTR TEMP F?
         100.0000       RUN
STATIC HOH IN ?
          -3.5000       RUN
STACK TEMP.
          73.0000       RUN
ML. WATER ?
          20.3000       RUN


SAT % = 2.8


IMP. % HOH = 0.9

% HOH=0.9


% CO2?
            .7000       RUN
% OXYGEN?
          21.0000       RUN

MWd =28.95
MW WET=28.86


SQRT PSTS ?
          14.2653       RUN
TIME MIN ?
         120.0000       RUN
NOZZLE DIA ?
            .2980       RUN
STK DIA INCH ?
          23.0000       RUN
```

```
* VOL MTR STD = 111.346
  STK PRES ABS = 28.93
  VOL HOH GAS = 0.96
  % MOISTURE = 0.85
  MOL DRY GAS = 0.991
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.86
  VELOCITY FPS = 35.45
  STACK AREA = 2.89
  STACK ACFM = 6,137.
* STACK DSCFM = 5,829.
  % ISOKINETIC =  94.88


END OF FIELD DATA
```

```
* VOL MTR STD = 108.086
  STK PRES ABS = 28.88
  VOL HOH GAS = 1.26
  % MOISTURE = 1.15
  MOL DRY GAS = 0.989
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.83
  VELOCITY FPS = 35.04
  STACK AREA = 2.89
  STACK ACFM = 6,066.
* STACK DSCFM = 5,713.
  % ISOKINETIC =  93.97


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET A
SOA-2
                        RUN
METER BOX Y?
            .9840       RUN
DELTA H?
           3.1600       RUN
BAR PRESS ?
          29.1400       RUN
METER VOL ?
         120.5800       RUN
MTR TEMP F?
         109.0000       RUN
STATIC HOH IN ?
          -3.5000       RUN
STACK TEMP.
          75.0000       RUN
ML. WATER ?
          26.7000       RUN


SAT % = 3.0


IMP. % HOH = 1.1

% HOH=1.1


% CO2?
            .7000       RUN
% OXYGEN?
          21.0000       RUN

MWd =28.95
MW WET=28.83


SQRT PSTS ?
          14.0000       RUN
TIME MIN ?
         120.0000       RUN
NOZZLE DIA ?
            .2980       RUN
STK DIA INCH ?
          23.0000       RUN
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET A
SOA-3
                    RUN
METER BOX Y?
          .9840     RUN
DELTA H?
         3.1300     RUN
BAR PRESS ?
        29.1800     RUN
METER VOL ?
       119.7110     RUN
MTR TEMP F?
        97.0000     RUN
STATIC HOH IN ?
        -3.5000     RUN
STACK TEMP.
        71.0000     RUN
ML. WATER ?
        38.9000     RUN


SAT % = 2.6


IMP. % HOH = 1.6

% HOH=1.6


% CO2?
          .7000     RUN
% OXYGEN?
        21.0000     RUN

MWd =28.95
MW WET=28.77


SQRT PSTS ?
        13.9934     RUN
TIME MIN ?
       120.0000     RUN
NOZZLE DIA ?
          .2980     RUN
STK DIA INCH ?
        23.0000     RUN
```

```
* VOL MTR STD = 109.759
  STK PRES ABS = 28.92
  VOL HOH GAS = 1.83
  % MOISTURE = 1.64
  MOL DRY GAS = 0.984
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.77
  VELOCITY FPS = 34.61
  STACK AREA = 2.89
  STACK ACFM = 5,992.
* STACK DSCFM = 5,665.
  % ISOKINETIC =  96.24


END OF FIELD DATA
```

```
* VOL MTR STD = 110.100
  STK PRES ABS = 28.94
  VOL HOH GAS = 1.82
  % MOISTURE = 1.63
  MOL DRY GAS = 0.984
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.77
  VELOCITY FPS = 35.26
  STACK AREA = 2.89
  STACK ACFM = 6,104.
* STACK DSCFM = 5,743.
  % ISOKINETIC =  95.22


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET A
SOA-4
                    RUN
METER BOX Y?
          .9840     RUN
DELTA H?
         3.2200     RUN
BAR PRESS ?
        29.2000     RUN
METER VOL ?
       122.1280     RUN
MTR TEMP F?
       107.0000     RUN
STATIC HOH IN ?
        -3.5000     RUN
STACK TEMP.
        74.0000     RUN
ML. WATER ?
        38.7000     RUN


SAT % = 2.9


IMP. % HOH = 1.6

% HOH=1.6


% CO2?
          .7000     RUN
% OXYGEN?
        21.0000     RUN

MWd =28.95
MW WET=28.77


SQRT PSTS ?
        14.1691     RUN
TIME MIN ?
       120.0000     RUN
NOZZLE DIA ?
          .2980     RUN
STK DIA INCH ?
        23.0000     RUN
```

SCRUBBER OUTLET B

```
XROM "METH 1"

DIA INCHES?
        23.0000     RUN
NIPPLE INCH ?
         0.0000     RUN
POINTS ONE TRY?
        12.0000     RUN
POINT  1.
                     0.5
POINT  2.
                     1.5
POINT  3.
                     2.7
POINT  4.
                     4.1
POINT  5.
                     5.8
POINT  6.
                     8.2
POINT  7.
                    14.8
POINT  8.
                    17.3
POINT  9.
                    18.9
POINT  10.
                    20.3
POINT  11.
                    21.5
POINT  12.
                    22.5
```

```
XROM "METH 2"
SITE ?
ROLL TECH
SCRUBBER OUTLET B
                     RUN
STACK DIA INCH?
            23.0     RUN
NO TRAV PTS. ?
            22.0     RUN
BAR PRESS ?
           29.11     RUN
STATIC IN HOH ?
            -3.5     RUN
% MOISTURE ?
             2.0     RUN
PITOT CP ?
             .84     RUN
% CO2 ?
              .7     RUN
% OXYGEN ?
            21.0     RUN
% CO ?
                     RUN
MOL WT OTHER ?
                     RUN
 . .
MWd = 28.95
MW WET = 28.73

DELTA P 1.
             .23     RUN
STACK TEMP?
             81.     RUN
FPS = 28.

DELTA P 2.
             .17     RUN
STACK TEMP?
             81.     RUN
FPS = 24.

DELTA P 3.
             .17     RUN
STACK TEMP?
             81.     RUN
FPS = 24.

DELTA P 4.
             .18     RUN
STACK TEMP?
             81.     RUN
FPS = 25.
```

```
DELTA P 5.
              .2     RUN
STACK TEMP?
             81.     RUN
FPS = 26.

DELTA P 6.
             .25     RUN
STACK TEMP?
             81.     RUN
FPS = 29.

DELTA P 7.
              .4     RUN
STACK TEMP?
             81.     RUN
FPS = 37.

DELTA P 8.
             .45     RUN
STACK TEMP?
             81.     RUN
FPS = 39.

DELTA P 9.
             .45     RUN
STACK TEMP?
             80.     RUN
FPS = 39.

DELTA P 10.
             .46     RUN
STACK TEMP?
             80.     RUN
FPS = 39.

DELTA P 11.
             .46     RUN
STACK TEMP?
             80.     RUN
FPS = 39.

DELTA P 12.
             .35     RUN
STACK TEMP?
             83.     RUN
FPS = 34.
```

```
DELTA P 13.
                .27     RUN
STACK TEMP?
                83.     RUN
FPS = 30.

DELTA P 14.
                .17     RUN
STACK TEMP?
                81.     RUN
FPS = 24.

DELTA P 15.
                .16     RUN
STACK TEMP?
                81.     RUN
FPS = 23.

DELTA P 16.
                .17     RUN
STACK TEMP?
                81.     RUN
                        RUN
FPS = 24.

DELTA P 17.
                 .2     RUN
STACK TEMP?
                81.     RUN
FPS = 26.

DELTA P 18.
                .35     RUN
STACK TEMP?
                81.     RUN
FPS = 34.

DELTA P 19.
                .42     RUN
STACK TEMP?
                81.     RUN
FPS = 38.

DELTA P 20.
                .44     RUN
STACK TEMP?
                82.     RUN
FPS = 39.
```

```
DELTA P 21.
                .42     RUN
STACK TEMP?
                82.     RUN
FPS = 38.

DELTA P 22.
                .39     RUN
STACK TEMP?
                82.     RUN
FPS = 36.

AVE FPS = 32.
AVE FPM = 1,893.
AVE DELTA P = 0.31
STK PRS. ABS = 28.85
AVE STK TEMP = 81.
STACK ACFM = 5,463.
DSCFM = 5,037.

            XROM "NOZZLE"
STATIC HOH ?
               -3.50    RUN
BAR PRESS ?
               29.11    RUN
STK TEMP ?
               81.00    RUN
% HOH ?
                2.00    RUN
STACK FPS ?
               32.00    RUN
ACT. DIA. = 0.2786
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET B
SOB-5
                    RUN
METER BOX Y?
          1.0060    RUN
DELTA H?
          2.0900    RUN
BAR PRESS ?
         29.1500    RUN
METER VOL ?
        106.2060    RUN
MTR TEMP F?
        101.0000    RUN
STATIC HOH IN ?
         -3.5000    RUN
STACK TEMP.
         73.0000    RUN
ML. WATER ?
         34.9000    RUN


SAT % = 2.8


IMP. % HOH = 1.6

% HOH=1.6


% CO2?
           .7000    RUN
% OXYGEN?
         21.0000    RUN

MWd =28.95
MW WET=28.77


SQRT PSTS ?
         11.9915    RUN
TIME MIN ?
        120.0000    RUN
NOZZLE DIA ?
           .2990    RUN
STK DIA INCH ?
         23.0000    RUN
```

```
* VOL MTR STD = 98.487
  STK PRES ABS = 28.89
  VOL HOH GAS = 1.64
  % MOISTURE = 1.64
  MOL DRY GAS = 0.984
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.77
  VELOCITY FPS = 29.87
  STACK AREA = 2.89
  STACK ACFM = 5,170.
* STACK DSCFM = 4,865.
  % ISOKINETIC =  99.88


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET B
SOB-6
                    RUN
METER BOX Y?
          1.0060    RUN
DELTA H?
          2.2000    RUN
BAR PRESS ?
         29.1500    RUN
METER VOL ?
        107.8530    RUN
MTR TEMP F?
        111.0000    RUN
STATIC HOH IN ?
         -3.5000    RUN
STACK TEMP.
         77.0000    RUN
ML. WATER ?
         36.9000    RUN


SAT % = 3.2


IMP. % HOH = 1.7

% HOH=1.7


% CO2?
           .7000    RUN
% OXYGEN?
         21.0000    RUN

MWd =28.95
MW WET=28.76


SQRT PSTS ?
         11.8177    RUN
TIME MIN ?
        120.0000    RUN
NOZZLE DIA ?
           .2990    RUN
STK DIA INCH ?
         23.0000    RUN
```

```
* VOL MTR STD = 98.289
  STK PRES ABS = 28.89
  VOL HOH GAS = 1.74
  % MOISTURE = 1.74
  MOL DRY GAS = 0.983
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.76
  VELOCITY FPS = 29.44
  STACK AREA = 2.89
  STACK ACFM = 5,096.
* STACK DSCFM = 4,755.
  % ISOKINETIC =  101.99


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET B
SOB-3
                    RUN
METER BOX Y?
          1.0060    RUN
DELTA H?
          2.8600    RUN
BAR PRESS ?
         29.1800    RUN
METER VOL ?
        122.9960    RUN
MTR TEMP F?
        106.0000    RUN
STATIC HOH IN ?
         -3.5000    RUN
STACK TEMP.
         73.0000    RUN
ML. WATER ?
         46.7000    RUN


SAT % = 2.8


IMP. % HOH = 1.9

% HOH=1.9


% CO2?
           .7000    RUN
% OXYGEN?
         21.0000    RUN

MWd =28.95
MW WET=28.74


SQRT PSTS ?
         14.1698    RUN
TIME MIN ?
        120.0000    RUN
NOZZLE DIA ?
           .2990    RUN
STK DIA INCH ?
         23.0000    RUN
```

```
* VOL MTR STD = 113.383
  STK PRES ABS = 28.92
  VOL HOH GAS = 2.20
  % MOISTURE = 1.90
  MOL DRY GAS = 0.981
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.74
  VELOCITY FPS = 35.29
  STACK AREA = 2.89
  STACK ACFM = 6,109.
* STACK DSCFM = 5,739.
  % ISOKINETIC =  97.47


END OF FIELD DATA
```

```
* VOL MTR STD = 109.106
  STK PRES ABS = 28.94
  VOL HOH GAS = 1.73
  % MOISTURE = 1.56
  MOL DRY GAS = 0.984
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.78
  VELOCITY FPS = 34.19
  STACK AREA = 2.99
  STACK ACFM = 5,919.
* STACK DSCFM = 5,532.
  % ISOKINETIC =  97.32


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET B
SOB-4
                    RUN
METER BOX Y?
          1.0060    RUN
DELTA H?
          2.6700    RUN
BAR PRESS ?
         29.2000    RUN
METER VOL ?
        119.3300    RUN
MTR TEMP F?
        111.0000    RUN
STATIC HOH IN ?
         -3.5000    RUN
STACK TEMP.
         78.0000    RUN
ML. WATER ?
         36.8000    RUN


SAT % = 3.3


IMP. % HOH = 1.6

% HOH=1.6


% CO2?
           .7000    RUN
% OXYGEN?
         21.0000    RUN

MWd =28.95
MW WET=28.78


SQRT PSTS ?
         13.7420    RUN
TIME MIN ?
        120.0000    RUN
NOZZLE DIA ?
           .2990    RUN
STK DIA INCH ?
         23.0000    RUN
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET B
SOB-1
                    RUN
METER BOX Y?
          1.0060    RUN
DELTA H?
          2.4500    RUN
BAR PRESS ?
         29.1900    RUN
METER VOL ?
        117.4940    RUN
MTR TEMP F?
         96.0000    RUN
STATIC HOH IN ?
         -3.5000    RUN
STACK TEMP.
         75.0000    RUN
ML. WATER ?
         36.8000    RUN

SAT % = 3.0

IMP. % HOH = 1.5

% HOH=1.5

% CO2?
           .7000    RUN
% OXYGEN?
         21.0000    RUN

MWd =28.95
MW WET=28.78

SQRT PSTS ?
         13.1241    RUN
TIME MIN ?
        120.0000    RUN
NOZZLE DIA ?
           .2990    RUN
STK DIA INCH ?
         23.0000    RUN
```

```
* VOL MTR STD = 110.183
  STK PRES ABS = 28.93
  VOL HOH GAS = 1.73
  % MOISTURE = 1.55
  MOL DRY GAS = 0.985
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.78
  VELOCITY FPS = 32.66
  STACK AREA = 2.89
  STACK ACFM = 5,654.
* STACK DSCFM = 5,312.
  % ISOKINETIC =  102.34

END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
SCRUBBER OUTLET B
                    RUN
METER BOX Y?
          1.0060    RUN
DELTA H?
          2.4200    RUN
BAR PRESS ?
         29.1400    RUN
METER VOL ?
        116.3960    RUN
MTR TEMP F?
        115.0000    RUN
STATIC HOH IN ?
         -3.5000    RUN
STACK TEMP.
         78.0000    RUN
ML. WATER ?
         21.6000    RUN

SAT % = 3.3

IMP. % HOH = 1.0

% HOH=1.0

% CO2?
           .7000    RUN
% OXYGEN?
         21.0000    RUN

MWd =28.95
MW WET=28.85

SQRT PSTS ?
         13.1185    RUN
TIME MIN ?
        120.0000    RUN
NOZZLE DIA ?
           .2990    RUN
STK DIA INCH ?
         23.0000    RUN
```

```
* VOL MTR STD = 105.359
  STK PRES ABS = 28.88
  VOL HOH GAS = 1.02
  % MOISTURE = 0.96
  MOL DRY GAS = 0.990
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.85
  VELOCITY FPS = 32.64
  STACK AREA = 2.89
  STACK ACFM = 5,650.
* STACK DSCFM = 5,301.
  % ISOKINETIC =  98.05

END OF FIELD DATA
```

DEMISTER OUTLET

```
XROM "METH 1"

DIA INCHES?
          22.0    RUN
NIPPLE INCH ?
           0.0    RUN
POINTS ONE TRY?
          12.0    RUN
POINT  1.
                  0.5
POINT  2.
                  1.5
POINT  3.
                  2.6
POINT  4.
                  3.9
POINT  5.
                  5.5
POINT  6.
                  7.8
POINT  7.
                 14.2
POINT  8.
                 16.5
POINT  9.
                 18.1
POINT  10.
                 19.4
POINT  11.
                 20.5
POINT  12.
                 21.5
```

```
XROM "METH 2"
SITE ?
ROLL TECH
DEMISTER OUTLET
                  RUN
STACK DIA INCH?
        22.0000   RUN
NO TRAV PTS. ?
        24.0000   RUN
BAR PRESS ?
        29.1300   RUN
STATIC IN HOH ?
          .8000   RUN
% MOISTURE ?
        2.0000    RUN
PITOT CP ?
          .8400   RUN
% CO2 ?
          .7000   RUN
% OXYGEN ?
        21.0000   RUN
% CO ?
                  RUN
MOL WT OTHER ?
                  RUN

MWd = 28.95
MW WET = 28.73

DELTA P 1.
          1.25    RUN
STACK TEMP?
          85.     RUN
FPS = 65.

DELTA P 2.
          1.4     RUN
STACK TEMP?
          85.     RUN
FPS = 68.

DELTA P 3.
          1.4     RUN
STACK TEMP?
          85.     RUN
FPS = 68.

DELTA P 4.
          1.5     RUN
STACK TEMP?
          85.     RUN
FPS = 71.

DELTA P 5.
          1.5     RUN
STACK TEMP?
          85.     RUN
FPS = 71.

DELTA P 6.
          1.5     RUN
STACK TEMP?
          85.     RUN
FPS = 71.

DELTA P 7.
          1.5     RUN
STACK TEMP?
          85.     RUN
FPS = 71.

DELTA P 8.
          1.5     RUN
STACK TEMP?
          85.     RUN
FPS = 71.

DELTA P 9.
          1.55    RUN
STACK TEMP?
          85.     RUN
FPS = 72.

DELTA P 10.
          1.5     RUN
STACK TEMP?
          85.     RUN
FPS = 71.

DELTA P 11.
          1.5     RUN
STACK TEMP?
          85.     RUN
FPS = 71.

DELTA P 12.
          1.4     RUN
STACK TEMP?
          85.     RUN
FPS = 68.
```

```
DELTA P 13.
                1.3     RUN
STACK TEMP?
                85.     RUN
FPS = 66.

DELTA P 14.
                1.3     RUN
STACK TEMP?
                85.     RUN
FPS = 66.

DELTA P 15.
               1.35     RUN
STACK TEMP?
                85.     RUN
FPS = 67.

DELTA P 16.
               1.35     RUN
STACK TEMP?
                85.     RUN
FPS = 67.

DELTA P 17.
                1.3     RUN
STACK TEMP?
                85.     RUN
FPS = 66.

DELTA P 18.
                1.4     RUN
STACK TEMP?
                85.     RUN
FPS = 68.

DELTA P 19.
                1.5     RUN
STACK TEMP?
                85.     RUN
FPS = 71.

DELTA P 20.
                1.5     RUN
STACK TEMP?
                85.     RUN
FPS = 71.
```

```
DELTA P 21.
                1.5     RUN
STACK TEMP?
                85.     RUN
FPS = 71.

DELTA P 22.
               1.45     RUN
STACK TEMP?
                85.     RUN
FPS = 70.

DELTA P 23.
               1.45     RUN
STACK TEMP?
                85.     RUN
FPS = 70.

DELTA P 24.
                1.6     RUN
STACK TEMP?
                85.     RUN
FPS = 73.

AVE FPS = 69.
AVE FPM = 4,162.
AVE DELTA P = 1.44
STK PRS. ABS = 29.19
AVE STK TEMP = 85.
STACK ACFM = 10,388.
DSCFM = 10,177.

              XROM "NOZZLE"
STATIC HOH ?
                .80     RUN
BAR PRESS ?
              29.13     RUN
STK TEMP ?
              85.00     RUN
% HOH ?
               2.00     RUN
STACK FPS ?
              69.00     RUN
ACT. DIA. = 0.1893
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
DEMISTER OUTLET
TRIAL RUN, FIXED POINT
                        RUN
METER BOX Y?
          1.0120        RUN
DELTA H?
          1.4200        RUN
BAR PRESS ?
         29.1300        RUN
METER VOL ?
        132.6370        RUN
MTR TEMP F?
        120.0000        RUN
STATIC HOH IN ?
          -.0000        RUN
STACK TEMP.
         87.0000        RUN
ML. WATER ?
                        RUN
% MOISTURE ?
          2.0000        RUN

SAT % = 4.4

IMP. % HOH = 0.0

% HOH=2.0

% CO2?
           .7000        RUN
% OXYGEN?
         21.0000        RUN

MWd =28.95
MW WET=28.73

SQRT PSTS ?
         27.8687        RUN
TIME MIN ?
        180.0000        RUN
NOZZLE DIA ?
           .1780        RUN
STK DIA INCH ?
         22.0000        RUN
```

```
* VOL MTR STD = 119.394
  STK PRES ABS = 29.07
  VOL HOH GAS = 0.00
  % MOISTURE = 2.00
  MOL DRY GAS = 0.980
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.73
  VELOCITY FPS = 69.25
  STACK AREA = 2.64
  STACK ACFM = 10,968.
* STACK DSCFM = 10,081.
  % ISOKINETIC =  100.57

END OF FIELD DATA
```

```
* VOL MTR STD = 80.686
  STK PRES ABS = 29.14
  VOL HOH GAS = 1.36
  % MOISTURE = 1.66
  MOL DRY GAS = 0.983
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.77
  VELOCITY FPS = 70.95
  STACK AREA = 2.64
  STACK ACFM = 11,238.
* STACK DSCFM = 10,427.
  % ISOKINETIC =  98.56

END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
DEMISTER OUTLET
MEO-2
                        RUN
METER BOX Y?
          1.0120        RUN
DELTA H?
          1.9400        RUN
BAR PRESS ?
         29.1400        RUN
METER VOL ?
         86.5560        RUN
MTR TEMP F?
        101.0000        RUN
STATIC HOH IN ?
          -.0300        RUN
STACK TEMP.
         85.0000        RUN
ML. WATER ?
         28.9000        RUN

SAT % = 4.2

IMP. % HOH = 1.7

% HOH=1.7

% CO2?
           .7000        RUN
% OXYGEN?
         21.0000        RUN

MWd =28.95
MW WET=28.77

SQRT PSTS ?
         28.6069        RUN
TIME MIN ?
        120.0000        RUN
NOZZLE DIA ?
           .1780        RUN
STK DIA INCH ?
         22.0000        RUN
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
DEMITSER OUTLET
MEO-3
                    RUN
METER BOX Y?
          1.0120    RUN
DELTA H?
          2.0700    RUN
BAR PRESS ?
         29.2000    RUN
METER VOL ?
         88.5320    RUN
MTR TEMP F?
         90.0000    RUN
STATIC HOH IN ?
          -.0300    RUN
STACK TEMP.
         79.0000    RUN
ML. WATER ?
         29.4000    RUN


SAT % = 3.4


IMP. % HOH = 1.6

% HOH=1.6


% CO2?
           .7000    RUN
% OXYGEN?
         21.0000    RUN

MWd =28.95
MW WET=28.78


SQRT PSTS ?
         29.6920    RUN
TIME MIN ?
        120.0000    RUN
NOZZLE DIA ?
           .1780    RUN
STK DIA INCH ?
         22.0000    RUN
```

```
* VOL MTR STD = 84.378
  STK PRES ABS = 29.20
  VOL HOH GAS = 1.38
  % MOISTURE = 1.61
  MOL DRY GAS = 0.984
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.78
  VELOCITY FPS = 73.56
  STACK AREA = 2.64
  STACK ACFM = 11,651.
* STACK DSCFM = 10,958.
  % ISOKINETIC =  98.08


END OF FIELD DATA
```

```
* VOL MTR STD = 84.369
  STK PRES ABS = 29.19
  VOL HOH GAS = 1.47
  % MOISTURE = 1.71
  MOL DRY GAS = 0.983
  % NITROGEN = 78.38
  MOL WT DRY = 28.95
  MOL WT WET = 28.76
  VELOCITY FPS = 73.46
  STACK AREA = 2.64
  STACK ACFM = 11,635.
* STACK DSCFM = 10,788.
  % ISOKINETIC =  99.62


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
DEMISTER OUTLET
MEO-4
                    RUN
METER BOX Y?
          1.0120    RUN
DELTA H?
          2.1400    RUN
BAR PRESS ?
         29.1900    RUN
METER VOL ?
         91.1130    RUN
MTR TEMP F?
        106.0000    RUN
STATIC HOH IN ?
          -.0300    RUN
STACK TEMP.
         86.0000    RUN
ML. WATER ?
         31.2000    RUN


SAT % = 4.3


IMP. % HOH = 1.7

% HOH=1.7


% CO2?
           .7000    RUN
% OXYGEN?
         21.0000    RUN

MWd =28.95
MW WET=28.76


SQRT PSTS ?
         29.6390    RUN
TIME MIN ?
        120.0000    RUN
NOZZLE DIA ?
           .1780    RUN
STK DIA INCH ?
         22.0000    RUN
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
DEMISTER OUTLET
MEO-5
                    RUN
METER BOX Y?
          1.0120    RUN
DELTA H?
          2.0600    RUN
BAR PRESS ?
         29.1500    RUN
METER VOL ?
         89.1540    RUN
MTR TEMP F?
         98.0000    RUN
STATIC HOH IN ?
          -.0300    RUN
STACK TEMP.
         81.0000    RUN
ML. WATER ?
         35.3000    RUN


SAT % = 3.7


IMP. % HOH = 1.9

% HOH=1.9


% CO2?
           .7000    RUN
% OXYGEN?
         21.0000    RUN

MWd =28.95
MW WET=28.74


SQRT PSTS ?
         29.1503    RUN
TIME MIN ?
        120.0000    RUN
NOZZLE DIA ?
           .1780    RUN
STK DIA INCH ?
         22.0000    RUN
```

```
* VOL MTR STD = 83.608
  STK PRES ABS = 29.15
  VOL HOH GAS = 1.66
  % MOISTURE = 1.95
  MOL DRY GAS = 0.981
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.74
  VELOCITY FPS = 72.33
  STACK AREA = 2.64
  STACK ACFM = 11,456.
* STACK DSCFM = 10,680.
  % ISOKINETIC =  99.72


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
ROLL TECH
DEMISTER OUTLET
MEO-6
                    RUN
METER BOX Y?
          1.0120    RUN
DELTA H?
          2.1400    RUN
BAR PRESS ?
         29.1100    RUN
METER VOL ?
         90.5760    RUN
MTR TEMP F?
        113.0000    RUN
STATIC HOH IN ?
          -.0300    RUN
STACK TEMP.
         86.0000    RUN
ML. WATER ?
         30.0000    RUN


SAT % = 4.3


IMP. % HOH = 1.7

% HOH=1.7


% CO2?
           .7000    RUN
% OXYGEN?
         21.0000    RUN

MWd =28.95
MW WET=28.77


SQRT PSTS ?
         29.5543    RUN
TIME MIN ?
        120.0000    RUN
NOZZLE DIA ?
           .1780    RUN
STK DIA INCH ?
         73.3000    RUN
         22.0000 STO 36
              GTO .034
                    RUN
```

```
* VOL MTR STD = 82.622
  STK PRES ABS = 29.11
  VOL HOH GAS = 1.41
  % MOISTURE = 1.68
  MOL DRY GAS = 0.983
  % NITROGEN = 78.38
  MOL WT DRY = 28.95
  MOL WT WET = 28.77
  VELOCITY FPS = 73.34
  STACK AREA = 2.64
  STACK ACFM = 11,617.
* STACK DSCFM = 10,745.
  % ISOKINETIC =  97.94


END OF FIELD DATA
```

APPENDIX B

Field Test Data Sheets

Scrubber Inlet

SAMPLING SUMMARY SHEET

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber 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
SI-1	22SEP87	24	.9932	2.20	29.19	99.760	102	91.319		-2.2	29.03	81		31.8	1.50	1.61	.984
SI-2	22SEP87	24	.9932	2.45	29.14	104.401	109	94.290		-2.2	28.98	85		23.2	1.09	1.14	.989
SI-3	23SEP87	24	.9932	2.22	29.20	98.195	98	90.566		-2.2	29.04	77		38.1	1.79	1.94	.981
SI-4	23SEP87	24	.9932	2.13	29.20	99.798	104	91.045		-2.2	29.04	83		30.6	1.44	1.56	.984

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
SI-1	0.7	21.0	78.3			28.95	28.78	.84	11.4780	120	.297	28.5	36	7.07	12096	11268	99.3
SI-2	0.7	21.0	78.3			28.95	28.83	.84	12.0511	120	.297	29.9	36	7.07	12699	11799	98.1
SI-3	0.7	21.0	78.3			28.95	28.74	.84	11.1774	120	.297	27.8	36	7.07	11784	11027	100.6
SI-4	0.7	21.0	78.3			28.95	28.78	.84	11.2735	120	.297	28.0	36	7.07	11877	11034	101.1

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

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

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

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

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

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

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

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

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

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

$V_{w_{gas}}$ = Volumn 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

$\sqrt{\Delta P (T + 460)}$ 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.

SUMMARY OF EMISSIONS

PLANT Bell Technology Inc. LOCATION Greenville, S. C.

SAMPLED SOURCE Scrubber Inlet

RUN	DATE	(1) V_m Std.	(2) DSCFM
SI-1	22SEP87	91.319	11268
SI-2	22SEP87	94.290	11749
SI-3	23SEP87	90.566	11027
SI-4	23SEP87	91.045	11034

FRONT HALF MILLIGRAMS				Total Chromium (4)	5
PROBE	CYCLONE	FILTER	(3) TOTAL	~~BACK HALF~~	FRONT + BACK TOTAL
			5.142	7.500	
			6.269	7.500	
			9.688	13.600	
			4.482	5.000	

CONCENTRATIONS

FRONT HALF				Total Chromium ~~BACK HALF~~				TOTAL			
RUN	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
SI-1	.00087	1.988	.084	.038	.0013	2.900	.122	.056				
SI-2	.00102	2.345	.103	.047	.0012	2.809	.124	.056				
SI-3	.00165	3.778	.156	.071	.0023	5.303	.219	.099				
SI-4	.00076	1.739	.072	.033	.0008	1.939	.080	.036				
6	7	8	9	10	17	18	19	20	21	22	23

Remarks:

SAMPLING SUMMARY SHEET

PLANT Roll Technology Corporation LOCATION Greenville, S. C.

SAMPLED SOURCE Scrubber 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
ST-5	24SEP87	24	.9932	2.29	29.15	100.287	97	99.520		-2.2	28.99	78		31.1	1.46	1.56	.984
ST-6	24SEP87	24	.9932	2.05	29.15	95.544	105	96.844		-2.2	28.99	84		45.7	2.15	2.42	.976

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
ST-5	0.7	21.0	78.3			28.95	28.28	.84	11.3392	120	.297	28.2	36	7.07	11956	11191	101.3
ST-6	0.7	21.0	78.3			28.95	28.69	.84	10.6906	120	.297	26.6	36	7.07	11291	10361	102.7

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

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

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

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

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

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

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

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

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

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

$\sqrt{\Delta P_s (T_s + 460)}$ 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 Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Inlet

RUN	DATE	1 V_m Std.	2 DSCFM
ST-5	2456P87	92.520	11191
ST-6	2456P87	86.844	10361

FRONT HALF MILLIGRAMS				Total Chrome 4	5
PROBE	CYCLONE	FILTER	3 TOTAL	BACK HALF	FRONT + BACK TOTAL
			2.082	2.250	
			3.960 *	4.750	

CONCENTRATIONS

FRONT HALF				Total Chrome ~~BACK HALF~~				TOTAL			
RUN	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
ST-5	.00035	.795	.0333	.0151	.0004	.859	.036	.016				
ST-6	.00070	1.610	.0625	.0284	.0008	1.932	.075	.034				
6	7	8	9	10	17	18	19	20	21	22	23

Remarks: * Average of 2 readings

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

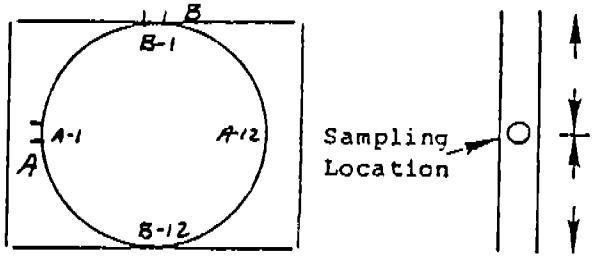
PLANT Roll Technology
DATE 9/21/87
SAMPLING LOCATION Scrubber Inlet
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) _____
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) _____
STACK I.D., (DISTANCE A - DISTANCE B) 36"
NEAREST UPSTREAM DISTURBANCE _____
NEAREST DOWNSTREAM DISTURBANCE _____
CALCULATOR _____

SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
A - 1					1.0
2					2.4
3					4.3
4					6.4
5					9.0
6					12.8
7					23.2
8					27.0
9					29.6
10					31.7
11					33.6
12					35.0
B - 1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

PRELIMINARY VELOCITY TRAVERSE

Plant: Zoll Technology
Date: 9/21/87
Location: Scrubber Inlet
Stack I.D.: 36"
Barometric Pressure, in. Hg: 29.11
Stack Gauge Pressure, in. H_2O: -2.2
Operators: J. Blau & J. Chebaske
Pitot Tube I.D. Number:
Temperature Readout I.D.:
Pitot Tube Leak Check: OK



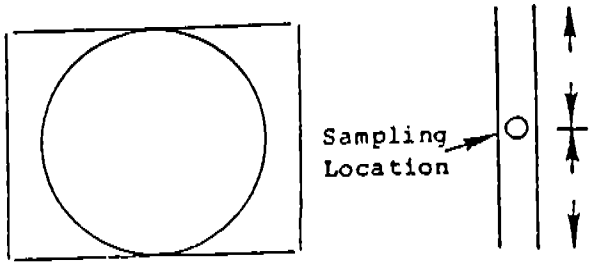
Schematic of Traverse Point Layout

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
A-1	0.30	85	
2	0.20	85	
3	0.18	85	
4	0.20	85	
5	0.22	85	
6	0.24	85	
7	0.33	85	
8	0.35	85	
9	0.36	85	
10	0.38	85	
11	0.38	85	
12	0.36	85	
Average			

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
B-1	0.27	85	
2	0.26	85	
3	0.28	85	
4	0.29	85	
5	0.30	85	
6	0.32	85	
7	0.16	85	
8	0.14	85	
9	0.11	85	
10	0.12	85	
11	0.11	85	
12	0.12	85	
Average			

PRELIMINARY VELOCITY TRAVERSE

Plant: Roll Tech.
Date: 9-23-87
Location: SCRUBBER INLET
Stack I.D.: 36"
Barometric Pressure, in. Hg: 29.20
Stack Gauge Pressure, in. H_2O:
Operators: T. Miller, J. Blau
Pitot Tube I.D. Number:
Temperature Readout I.D.:
Pitot Tube Leak Check: OK



Schematic of Traverse Point Layout

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
H-1			+15
2			+9
3			0
4			+1
5			+5
6			+14
7			0
8			-5
9			-18
10			-22
11			-26
12			-23
Average			

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
V-1			~ -30
2			~ -25
3			~ +10
4			~ +10
5			~ +5
6			~ +5
7			0
8			0
9			~ -5
10			~ -10
11			~ -10
12			~ -10
Average			

NOMOGRAPH DATA

Plant: Roll Tech. Date: 9-22-87

Sampling Location: Scrubber inlet

Calibrated Pressure Differential Across Orifice, in. H_2O	$\Delta H_@$	20003
Average Meter Temperature (ambient + 20°F), °F	$T_{m_{avg}}$	96
Percent Moisture in Gas Stream by Volume	B_{wo}	.02
Barometric Pressure at Meter, in. Hg.	P_m	29.19
Static Pressure in Stack, in. Hg. ($P_m \pm 0.073$ x stack gauge pressure in in. H_2O)	P_s	-2.2 27.59
Ratio of Static Pressure to Meter Pressure	P_s/P_m	
Average Stack Temperature, °F	$T_{s_{avg}}$	
Average Velocity Head, in. H_2O	Δp_{avg}	
Maximum Velocity Head, in. H_2O	Δp_{max}	
C Factor		
Calculated Nozzle Diameter, in.		
Actual Nozzle Diameter, in.		
Reference Δp, in. H_2O		

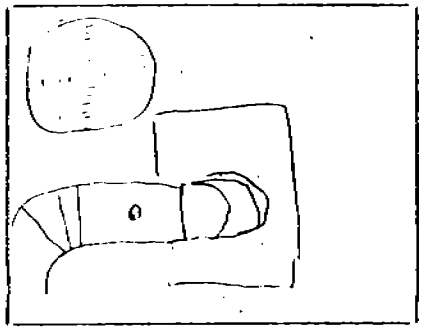
$Y_f = 0.9932$

Nozzle #

0.297, 0.295, 0.297

FIELD DATA

Plant Roll Technology
Date 9/22/87
Sampling Location Scrubber Inlet
Sample Type MM13B
Run Number SC-I-1
Operator 1140/TM/BF
Ambient Temperature 76
Barometric Pressure 29.19
Static Pressure (P_s) -2.2
Filter Number(s) N/A
Pretest Leak Rate = 0 cfm @ 15 in. Hg
Pretest Pitot Leak Check 0
Pretest Orsat Leak Check
Read and Record all Data Every 5 Minutes



Schematic of Traverse Point Layout

Probe Length and Type 4' effect.
Pitot Tube I.D. No.
Nozzle I.D. 0.297
Assumed Moisture, % 2.070
Temp. Readout S/N
Meter Box Number RAC-8
Meter $\Delta H_@$ 2.0003
C Factor HP41CX
Meter Gamma 0.9932
Heater Box Setting
Reference Δp
Post Test Leak Rate = ___ cfm @ ___ in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

379.472 (Gas meter prior to test)

post traverse change leak 21.0" Hg = 0.002 pre-horizontal leak check 0 @ 15"

Traverse Point Number	Sampling Time, (min) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
V-1	5.0 / 11:56	383.31	0.1	0.88	0.88	79	86	80	9	N/A	49
2	10.0 / 12:01	386.614	0.17	1.53	1.53	79	88	80	9	N/A	49
3	15.0 / 12:06	390.122	0.18	1.63	1.63	79	92	82	10	N/A	49
4	20.0 /	393.870	0.20	1.82	1.82	79	98	84	12	N/A	50
5	25.0 / 398.075	398.075	0.25	2.38	2.38	80	104	86	17.5	N/A	50
6	30.0 /	402.310	0.25	2.3	2.30	80	108	88	17.5	N/A	52
7	35.0 /	406.734	0.31	2.87	2.5	80	112	92	20.5	N/A	52
8	40.0 /	411.164	0.29	2.61	2.5	80	112	94	21.0	N/A	55
9	45.0 /	415.223	0.22	2.05	2.05	80	113	96	14	N/A	59
10	50.0 /	419.614	0.28	2.62	2.55	81	118	98	21.0	N/A	59
11	55.0 /	423.961	0.25	2.35	2.35	80	120	100	18	N/A	61
12	60.0 /	428.344	0.26	2.44	2.44	81	120	101	19	N/A	40
H-1	5.0 / 428.867*	432.678	0.18	1.66	1.66	79	100	98	8	N/A	67
2	10.0 /	436.419	0.19	1.76	1.76	79	106	98	8	N/A	66
3	15.00 /	439.849	0.16	1.47	1.47	81	100	94	7	N/A	50
4	20.00 /	443.405	0.18	1.66	1.66	82	105	95	8	N/A	52
5	25.0 /	447.174	0.20	1.85	1.85	83	110	96	9	N/A	53
6	30.0 /	451.051	0.21	1.94	1.94	83	112	96	10	N/A	53
7	35.0 /	455.791	0.31	2.88	2.88	83	114	98	14	N/A	53
8	40.0 /	459.989	0.33	3.08	2.95	83	118	100	20	N/A	54
9	45.0 /	465.271	0.36	3.37	2.95	83	119	102	20	N/A	55
10	50.0 /	470.078	0.37	3.47	2.95	84	120	106	20	N/A	55
11	55.0 /	474.897	0.37	3.47	2.95	83	121	104	20	N/A	55
12	60.0 /	479.755	0.36	3.39	2.95	84	124	106	20	N/A	57

plant down @ ~2.45
begin testing @ 2:50

* Gas meter reading prior to horizontal traverse

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: 7-22-87

Sampling Location: Scrubber INLET

Sample Type:

Run Number: SI-1

Sample Box Number: #1

Clean-up Man: NT/HJO

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

	#1	#2	#3
Impingers			
Final Volume:	615.2 ~~ml~~ g	589.9 ~~ml~~ g	600.7 ~~ml~~ g
Initial Volume:	606.9 ~~ml~~ g	591.4 ~~ml~~ g	598.5 ~~ml~~ g
Net Volume:	~~ml~~ g	~~ml~~ g	~~ml~~ g
Total H_2O:			
Silica Gel			
Final Volume:	760.0 g	g	g
Initial Volume	737.2 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant Roll Tech.
Date 9-22-87
Sampling Location Scrubber inlet
Sample Type MM5B
Run Number SI-2
Operator T. MILLER ; RICHARD FRONNFELKER
Ambient Temperature 87
Barometric Pressure 29.14
Static Pressure (P_s) -2.2
Filter Number(s) —
Pretest Leak Rate =0.003 cfm @ 12 in. Hg
Pretest Pitot Leak Check OK
Pretest Orsat Leak Check —
Read and Record all Data Every 5.0 Minutes

Schematic of Traverse Point Layout

Probe Length and Type 4' PYREX
Pitot Tube I.D. No.
Nozzle I.D. 0.297
Assumed Moisture, % 1.6
Temp. Readout S/N
Meter Box Number RAC-8
Meter $\Delta H_@$ 2.005
C Factor
Meter Gamma 0.9932
Heater Box Setting —
Reference Δp
Post Test Leak Rate =0.002 cfm @ 21 in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

(POST LEAK CH. B/W PORTS 0.001 cfm 21.0 in. Hg) (PRE LEAK CH B/W PORT 0.002 cfm 20.0" Hg)

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Im-pinger Temp. °F
	0	/	479.949	~~0.14~~	/						—	
V-1	5.0	/	483.050	0.14	1.26	1.26	88	89	89	5.0	—	~~85~~ 62
2	10.0	/	486.545	0.19	1.72	1.72	85	92	89	5.0	—	63
3	15.0	/	490.247	0.19	1.73	1.73	85	98	90	6.5	—	61
4	20.0	/	493.959	0.19	1.75	1.75	84	104	92	6.5	—	63
5	25.0	/	497.748	0.20	1.85	1.85	84	108	94	7.0	—	63
6	30.0	/	501.785	0.23	2.13	2.13	84	111	95	8.0	—	63
7	35.0	/	506.300	0.31	2.88	2.88	85	114	96	13.0	—	64
8	40.0	/	511.—	0.25	2.34	2.34	85	118	99	9.5	—	65
9	45.0	/	515.405	0.25	2.35	2.35	84	120	100	9.5	—	67
10	50.0	/	519.590	0.25	2.35	2.35	85	122	102	9.5	—	63
11	55.0	/	524.415	0.45	4.24	3.15	85	122	104	20.0	—	62
12	60.0	/	529.326	0.31	2.93	2.93	84	124	105	14.0	—	65
		/										
		/	(529.326)									
		/		T.M.								
		/										
		/										
		/										
		/										
		/										
		/										
		/										
		/										

Plant Name: Roll Tech.

Test Date: 9-22-87

Run Number: SI-2

Operator: T. Miller & Richard Frounfelker

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	/	—	529.549	—	—	—	—	—	—	—	—	—
H-1	65.0 /	1522	534.315	0.40	3.70	3.15	83	104	102	20.0	—	60
2	70.0 /		538.620	0.25	2.34	2.34	84	114	103	9.0	—	60
3	75.0 /		542.505	0.19	1.80	1.80	85	120	104	6.5	—	60
4	80.0 /		546.390	0.20	1.89	1.89	85	122	105	7.0	—	59
5	85.0 /		550.370	0.21	1.98	1.98	85	122	106	7.0	—	59
6	90.0 /		554.455	0.22	2.08	2.08	86	124	107	7.5	—	59
7	95.0 /		559.290	0.33	3.13	3.13	85	124	108	14.0	—	59
8	100.0 /		564.255	0.34	3.24	3.24	85	127	110	16.0	—	61
9	105.0 /		569.320	0.35	3.34	3.20	85	129	110	20.0	—	63
10	110.0 /		574.395	0.37	3.54	3.20	84	130	112	20.0	—	63
11	115.0 /		579.525	0.37	3.54	3.20	84	130	112	20.0	—	63
12	120.0 /	1622	584.573	0.35	3.36	3.20	84	131	113	20.0	—	63

SAMPLE RECOVERY DATA

Plant: ROLL TECHNOLOGY

Date: 9-21-87

Sampling Location: SCRUBBER INLET

Sample Type: @ MM13B

Run Number: S I - 2

Sample Box Number: #1

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers			
Final Volume:	601.8 ml	580.8 ml	600.5 ml
Initial Volume:	592.4 ml	590.2 ml	599.1 ml
Net Volume:	ml	ml	ml
Total H_2O:			
Silica Gel			
Final Volume:	748.5 g	g	g
Initial Volume	726.7 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant Roll Tech.
Date 9-23-87
Sampling Location Scrubber inlet
Sample Type M13B
Run Number SI-3
Operator Tim Miller, Richard F.
Ambient Temperature 65
Barometric Pressure 29.20
Static Pressure (P_s) -2.2
Filter Number(s) —
Pretest Leak Rate =0.001 cfm @ 20 in. Hg
Pretest Pitot Leak Check OK
Pretest Orsat Leak Check —
Read and Record all Data Every 5.0 Minutes

Schematic of Traverse Point Layout

Probe Length and Type 4' Pyrex
Pitot Tube I.D. No. 4'
Nozzle I.D. 0.297
Assumed Moisture, % 1.6
Temp. Readout S/N Battery operated
Meter Box Number PAC-8
Meter $\Delta H_@$ 2.0003
C Factor
Meter Gamma 0.9932
Heater Box Setting —
Reference Δp
Post Test Leak Rate =0.002 cfm @ 10 in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check —

(Post LEAK CH B/W PORTS 0.002 cfm @ 10 in Hg)(Pre LEAK CH B/W PORTS 0.001 cfm @ 10 in Hg)

Traverse Point Number	Sampling Time, (min) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	0 / 0941	585.160	—	—	—	—	—	—	—	—	—
V-1	5.0 /	588.063	0.12	1.07	1.07	74	76	76	<2	—	48
2	10.0 /	591.275	0.15	1.34	1.34	74	78	76	<2	—	48
3	15.0 /	594.395	0.14	1.26	1.26	74	85	77	<2	—	48
4	20.0 /	597.545	0.14	1.27	1.27	74	90	78	<2	—	50
5	25.0 /	601.285	0.19	1.73	1.73	74	94	80	2.0	—	52
6	30.0 /	605.240	0.24	2.20	2.20	75	98	83	2.0	—	53
7	35.0 /	609.565	0.31	2.85	2.85	75	101	85	3.0	—	53
8	40.0 /	613.930	0.29	2.44	2.44	75	105	88	3.0	—	53
9	45.0 /	618.050	0.22	2.14	2.14	75	106	90	2.5	—	54
10	50.0 /	622.340	0.25	2.33	2.33	75	107	92	3.0	—	54
11	55.0 /	626.945	0.29	2.71	2.71	75	109	93	3.0	—	55
12	60.0 / 1041	630.435	0.13	1.31	1.31	75	110	94	<2	—	56
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Plant Name: Roll Tech.

Test Date: 9-23-87

Run Number: SI-3

Operator: Tim Miller, RCHARD F.

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Im-pinger Temp. °F
		1059	630.955	—	—	—	—	—	—	—	—	—
H-1	65.0		635.090	0.27	2.48	2.48	78	97	94	3.0	—	55
2	70.0		639.585	0.28	2.59	2.59	78	103	95	3.0	—	50
3	75.0		643.315	0.18	1.67	1.67	78	108	96	2.0	—	53
4	80.0		646.915	0.17	1.58	1.58	78	109	96	2.0	—	53
5	85.0		650.765	0.20	1.87	1.87	78	110	98	2.0	—	54
6	90.0		654.635	0.20	1.87	1.87	79	112	98	2.0	—	54
7	95.0		659.305	0.30	2.81	2.81	79	112	100	3.0	—	54
8	100.0		664.040	0.33	3.10	3.10	79	115	101	3.0	—	54
9	105.0		668.955	0.33	3.11	3.11	78	116	102	3.0	—	55
10	110.0		673.965	0.34	3.20	3.20	79	117	102	3.5	—	55
11	115.0		679.040	0.35	3.30	3.30	79	118	103	4.0	—	56
12	120.0		683.875	0.31	2.93	2.93	79	119	104	3.5	—	57

SAMPLE RECOVERY DATA

Plant: RILL TECK

Date: 9/23/87

Sampling Location: SCRUBBER INLET

Sample Type: MM13B

Run Number: S I - 3

Sample Box Number: # 1

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers

Final Volume:	604.5 ~~ml~~	581.7 ml	599.9 ml
Initial Volume:	594.4 ml	580.1 ~~587.4~~ ml	594.9 ml
Net Volume:	ml	ml	ml
Total H_2O:			

Silica Gel

Final Volume:	771.1 g	g	g
Initial Volume	749.7 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant Roll Tech.
Date 4-23-87
Sampling Location Scrubber inlet
Sample Type MM13B
Run Number SI-4
Operator Tim Miller, Richard Braunfelker
Ambient Temperature 83
Barometric Pressure 29.20
Static Pressure (P_s) -2.2
Filter Number(s) —
Pretest Leak Rate = 0.002 cfm @ 15 in. Hg
Pretest Pitot Leak Check OK
Pretest Orsat Leak Check —
Read and Record all Data Every 5.0 Minutes

Schematic of Traverse Point Layout

Probe Length and Type 4' Pyrex
Pitot Tube I.D. No. 4'
Nozzle I.D. 0.297
Assumed Moisture, % 1.6
Temp. Readout S/N battery operated
Meter Box Number RAC-5
Meter $\Delta H_@$ 2.0003
C Factor
Meter Gamma 0.9932
Heater Box Setting —
Reference Δp
Post Test Leak Rate = 0.003 cfm @ 15 in. Hg
Post Test Pitot Leak Check OK
Post Test Orsat Leak Check —

(Post-Test Leak B/W Ports 0.001 cfm @ 15 inHg) (Pre-Leak Test B/W Ports 0.001 cfm @ 12 in Hg)

Traverse Point Number	Sampling Time, (min)	/ Clock / Time / (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_g) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	0	/ 1540	684.072	—	—	—	—	—	—	—	—	—
1-1	5.0	/	687.275	0.14	1.25	1.25	83	86	86	2.0	—	61
2	10.0	/	690.998	0.20	1.79	1.79	83	88	86	2.5	—	59
3	15.0	/	694.730	0.20	1.80	1.80	83	94	86	2.5	—	59
4	20.0	/	698.505	0.20	1.82	1.82	83	100	88	2.5	—	59
5	25.0	/	702.455	0.22	2.00	2.00	83	102	89	3.0	—	60
6	30.0	/	706.875	0.27	2.47	2.47	83	106	91	3.5	—	59
7	35.0	/	711.435	0.30	2.77	2.77	83	110	94	3.5	—	59
8	40.0	/	715.985	0.28	2.59	2.59	83	112	96	3.5	—	59
9	45.0	/	720.780	0.23	2.13	2.13	83	114	98	3.0	—	60
10	50.0	/	724.535	0.24	2.23	2.13	83	115	99	3.0	—	60
11	55.0	/	727.505	0.10	0.93	0.93	83	115	100	<2	—	62
12	60.0	/ 1640	731.627	0.24	0.23	0.23	84	114	102	3.0	—	63
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Page 1 of 2

Plant Name: Roll Tech.

Test Date: 9-23-87

Run Number: ST-4

Operator: T. Miller, Richard Frownfelker

Traverse Point Number	Sampling Time, (min)	/ Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Im-pinger Temp. °F
#	/	1658	732.229	—	—	—	—	—	—	—	—	—
A-1	65.0 /		736.245	0.22	2.03	2.03	83	104	100	2.5	—	66
2	70.0 /		740.230	0.21	1.94	1.94	84	109	100	2.5	—	58
3	75.0 /		743.695	0.16	1.48	1.48	85	112	102	2.0	—	59
4	80.0 /		747.280	0.17	1.58	1.58	83	114	102	2.0	—	59
5	85.0 /		750.975	0.18	1.68	1.68	84	115	102	2.0	—	59
6	90.0 /		754.860	0.18	1.68	1.68	84	116	104	2.5	—	59
7	95.0 /		759.495	0.29	2.71	2.71	84	117	104	3.0	—	53
8	100.0 /		764.105	0.32	3.00	3.00	84	120	105	3.0	—	54
9	105.0 /		769.180	0.35	3.28	3.28	84	120	106	3.5	—	55
10	110.0 /		774.420	0.37	3.48	3.48	84	122	106	4.0	—	57
11	115.0 /		779.540	0.35	3.31	3.31	83	124	108	4.0	—	57
12	120.0 /	1758	784.472	0.32	3.02	3.02	83	124	108	3.5	—	57
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SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: 9/23/87

Sampling Location: Scrubber Inlet

Sample Type: MM13B

Run Number: ~~SI-3~~ SI-4

Sample Box Number: 1 A

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers			
Final Volume:	563.1 ml	603.4 ml	536.0 ml
Initial Volume:	554.2 ~~ml~~ gr	598.8 ~~ml~~ gr	536.1 ~~ml~~ gr
Net Volume:	ml	ml	ml
Total H_2O:			
Silica Gel			
Final Volume:	736.2 g	g	g
Initial Volume	719.0 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant Roll Tech.
Date 9-24-87
Sampling Location Scrubber Inlet
Sample Type mm13B
Run Number SI-5
Operator T. Miller; R. Fraunfelker
Ambient Temperature 72°F
Barometric Pressure 29.15
Static Pressure (P_s) -2.2
Filter Number(s) —
Pretest Leak Rate 0.003 cfm @ 15 in. Hg
Pretest Pitot Leak Check OK
Pretest Orsat Leak Check —
Read and Record all Data Every 5.0 Minutes

Schematic of Traverse Point Layout

Probe Length and Type 4' PYREX
Pitot Tube I.D. No. 4'
Nozzle I.D. 0.297
Assumed Moisture, % 1.6
Temp. Readout S/N battery operated
Meter Box Number RAC-8
Meter $\Delta H_@$ 2.0003
C Factor
Meter Gamma 0.9932
Heater Box Setting —
Reference Δp
Post Test Leak Rate 0.002 cfm @ 15 in. Hg
Post Test Pitot Leak Check OK
Post Test Orsat Leak Check —

(POST LEAK CH B/W PORTS 0.001 cfm @ 15 "Hg) (PRE LEAK CH B/W PORTS 0.003 cfm @ 15 "Hg)

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	0	1042	785.205 ~~784.812~~	—	—	—	—	—	—	—	—	—
V-1	5.0		785.420	0.15	1.36	1.36	74	76	76	2.0	—	57
2	10.0		791.945	0.18	1.65	1.65	75	82	77	2.0	—	50
3	15.0		795.640	0.19	1.75	1.75	76	89	78	2.5	—	52
4	20.0		799.160	0.17	1.57	1.57	76	94	80	2.0	—	54
5	25.0		802.950	0.20	1.86	1.86	76	97	82	2.5	—	55
6	30.0		807.135	0.24	2.24	2.24	77	100	84	3.0	—	55
7	35.0		811.725	0.32	3.00	3.00	77	104	87	3.5	—	56
8	40.0		816.190	0.27	2.54	2.54	77	107	89	3.0	—	56
9	45.0		820.440	0.24	2.26	2.26	78	108	91	3.0	—	57
10	50.0		824.970	0.26	2.46	2.46	78	109	93	3.0	—	57
11	55.0		829.560	0.31	2.94	2.94	78	110	94	3.0	—	57
12	60.0	1042	834.237	0.27	2.56	2.56	79	112	96	3.0	—	57

Plant Name: Roll Tech.

Test Date: 9-24-87

Run Number: SI-5

Operator: T. MILLER, R. FRAUNFELKER.

(** stop test @ 1137)(* RE-START @ 1203)

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
		1103	834.432	0.15	—	—	—	—	—	—	—	—
H-1	65.0		837.985	~~834.432~~	1.69	1.69	80	100	96	2.0	—	65
2	70.0		841.640	0.18	1.69	1.69	80	102	96	2.0	—	54
3	75.0		845.195	0.16	1.51	1.51	80	106	96	2.0	—	55
4	80.0		848.810	0.17	1.61	1.61	80	109	97	2.0	—	55
5	85.0		852.625	0.19	1.80	1.80	80	110	98	2.5	—	56
** 6	90.0	1137	856.475	0.19	1.80	1.80	80	112	98	2.5	—	56
* 7	95.0	1203	861.050	0.30	2.85	2.85	80	113	100	2.5	—	56
8	100.0		865.920	0.32	3.00	3.00	80	98	98	3.5	—	59
9	105.0		870.625	0.33	3.11	3.11	80	104	97	3.5	—	53
10	110.0		875.680	0.35	3.31	3.31	80	109	97	4.0	—	56
11	115.0		880.755	0.35	3.32	3.32	80	113	98	4.0	—	57
12	120.0		885.687	0.32	3.05	3.05	80	115	100	3.5	—	58

SAMPLE RECOVERY DATA

Plant: Boll Technology EPA Glass

Date: 9/24/89

Sampling Location: Scrubber Inlet

Sample Type: MM13B

Run Number: SI - 5

Sample Box Number: 1A

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers	1	2	3
Final Volume:	565.3 ml	608.4 ml	537.4 ml
Initial Volume:	556.8 ml	603.3 ml	536.8 ml
Net Volume:	ml	ml	ml
Total H_2O:			

Silica Gel	4
Final Volume:	732.8 g
Initial Volume	715.9 g
Net Volume	g
Total Moisture:	

Description of Impinger Catch:

FIELD DATA

Plant: Roll Tech.
Date: 9-24-87
Sampling Location: Scrubber inlet
Sample Type: MM13B
Run Number: SI-6
Operator: T. MILLER, R. FRAUNFELKER
Ambient Temperature: 55°F
Barometric Pressure: 29.15
Static Pressure (P_s): -2.2 "Hg
Filter Number(s): —
Pretest Leak Rate = 0.002 cfm @ 15 in. Hg
Pretest Pitot Leak Check: OK
Pretest Orsat Leak Check: —
Read and Record all Data Every 5.0 Minutes

Schematic of Traverse Point Layout

Probe Length and Type: 4' Pyrex
Pitot Tube I.D. No.: 4'
Nozzle I.D.: 0.297
Assumed Moisture, %: 1.0
Temp. Readout S/N: battery operated
Meter Box Number: Rita-8
Meter $\Delta H_@$: 2.0003
C Factor:
Meter Gamma: 0.9932
Heater Box Setting: —
Reference Δp:
Post Test Leak Rate = 0.002 cfm @ 15 in. Hg
Post Test Pitot Leak Check: OK
Post Test Orsat Leak Check: —

(POST LEAK TEST B/W PORTS 0.002 cfm @ 15 "Hg) (PRE-LEAK CH B/W PORTS 0.001 cfm @ 15 "Hg)

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	0	1425	885.907	—	—	—	—	—	—	—	—	—
* V-1	5.0	1430	888.0605	0.10	0.92	0.92	84	90	90	<2	—	66
2	10.0	1438	891.730	0.13	1.19	1.19	83	90	90	2.0	—	62
3	15.0		894.490	0.10	0.92	0.92	82	96	90	<2	—	63
4	20.0		897.345	0.11	1.02	1.02	82	100	90	<2	—	67
5	25.0		900.245	0.14	1.42	1.42	84	96	92	2.5	—	60
6	30.0		904.545	0.20	1.86	1.86	82	102	93	2.5	—	56
7	35.0		908.995	0.28	2.60	2.60	83	106	94	3.0	—	58
8	40.0		912.755	0.18	1.69	1.69	84	111	96	2.0	—	58
9	45.0		916.985	0.24	2.26	2.26	84	112	98	3.0	—	59
10	50.0		921.180	0.23	2.17	2.17	84	114	100	3.0	—	59
11	55.0		—	0.16	1.51	1.51	85	115	101	2.0	—	60
12	60.0		929.298	0.30	2.84	2.84	85	115	102	3.0	—	59
		* 1445	STOP SAMPLING									
		** 1447	START SAMPLING									
		* 1450	STOP									
		**										

*(STOP SAMPLING/LOSS OF ELE. POWER TO REX) **(START SAMPLING @ 1438)

Plant Name: ROLL TECH.

Test Date: 9-24-87

Run Number: SF-6

Operator: T. MILLER / R. FRANKFALKER

Traverse Point Number	Sampling Time, (min)	/Clock / Time /(24-hour / clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Im-pinger Temp. °F
		/ 1608	929.663	—	—	—	—	—	—	—	—	—
H-1	65.0	/	933.740	~~0.130.26~~	~~2.24~~	~~2.24~~	85	106	102	2.5	--	68
2	70.0	/	937.715	0.21	1.98	1.98	85	110	102	2.5	--	55
3	75.0	/	941.280	0.16	1.51	1.51	85	114	102	2.5	--	56
4	80.0	/	944.810	0.16	1.52	1.52	84	115	103	2.0	—	57
5	85.0	/	948.580	0.18	1.71	1.71	84	116	104	2.0	—	56
6	90.0	/	952.260	0.17	1.62	1.62	83	117	104	2.0	—	57
7	95.0	/	956.870	0.28	2.67	2.67	83	118	105	3.0	—	57
8	100.0	/	961.755	0.32	3.05	3.05	83	120	106	3.0	—	57
9	105.0	/	966.720	0.32	3.07	3.07	83	122	107	3.0	—	57
10	110.0	/	971.840	0.34	3.26	3.26	83	122	108	3.5	—	58
11	115.0	/	976.980	0.35	3.31	3.31	83	124	108	3.5	—	58
12	120.0	/	981.816	0.30	2.89	2.89	83	124	110	—	—	60
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New lot of NaOH 870036 24

SAMPLE RECOVERY AND INTEGRITY DATA FORM

Plant Roll Technology Sample date 9/24/87

Sample location Scrubber Inlet Run number SI-6

Sample recovery person _____ Recovery date 9/24/87

Filter(s) number Box 6A

MOISTURE

Impingers			Silica gel		
Final volume (wt)	____ ml (g)		Final wt	____ g	____ g
Initial volume (wt)	____ ml (g)		Initial wt	____ g	____ g
Net volume (wt)	____ ml (g)		Net wt	____ g	____ g
Total moisture	____ g				

Color of silica gel _____

Description of impinger water _____

RECOVERED SAMPLE

Blank filter container number _____ Sealed _____

Filter container number _____ Sealed _____

Description of particulate on filter _____

Acetone rinse container number _____ Liquid level marked? _____

Acetone blank container number _____ Liquid level marked? _____

Samples stored and locked _____

Remarks _____

Date of laboratory custody _____

Laboratory personnel taking custody _____

Remarks _____

#1	575.9	588.8
#2	575.1	583.0
#3	596.5	599.8
#4	775.3	796.9

Scrubber Outlet

Duct A

SAMPLING SUMMARY SHEET

PLANT Roll Technology Inc. LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Outlet A

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
SOA-1	22SEP87	24	.984	3.28	29.19	122.008	100	111.346	/	-3.5	28.93	73	/	20.3	0.96	0.85	.991
SOA-2	22SEP87	24	.984	3.16	29.14	120.580	109	108.086	/	-3.5	28.88	75	/	26.7	1.26	1.15	.989
SOA-3	23SEP87	24	.984	3.13	29.18	119.711	97	109.759	/	-3.5	28.92	71	/	38.9	1.83	1.64	.984
SOA-4	23SEP87	24	.984	3.22	29.20	122.128	107	110.100	/	-3.5	28.94	74	/	38.7	1.82	1.63	.984

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
SOA-1	0.7	21.0	78.3	/	/	28.95	28.86	.84	14.2653	120	.298	35.5	23	2.89	6137	5829	94.9
SOA-2	0.7	21.0	78.3	/	/	28.95	28.83	.84	14.0800	120	.298	35.0	23	2.89	6066	5713	94.0
SOA-3	0.7	21.0	78.3	/	/	28.95	28.77	.81	13.9034	120	.298	34.6	23	2.89	5992	5665	96.2
SOA-4	0.7	21.0	78.3	/	/	28.95	28.77	.84	14.1691	120	.298	35.3	23	2.89	6104	5743	95.2

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

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

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

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

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

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

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

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

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

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

$V_{w_{gas}}$ = Volumn 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 Roll Technology Inc. LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Outlet A

RUN	DATE	(1) V_m Std.	(2) DSCFM
SOA-1	22SEP87	111.346	5829
SOA 2	22SEP87	108.086	5713
SOA-3	23SEP87	109.759	5665
SOA-4	23SEP87	110.100	5743

FRONT HALF MILLIGRAMS					
PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	5 FRONT + BACK TOTAL
			.247751		
			657.897 micrograms		
			.187030		
			.599511		

CONCENTRATIONS

FRONT HALF				BACK HALF				TOTAL			
RUN	Gr/DSCF	Mg/M^3	Lb/Hr	Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr	Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
SOA-1	.00003	.0786	.0017								
SOA-2	.00009	.2150	.0046								
SOA-3	.00003	.0602	.0013								
SOA-4	.00008	.1923	.0041								
6	7	8	9	10	17	18	19	20	21	22	23

Remarks:

SAMPLING SUMMARY SHEET

PLANT Roll Technology Inc

LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Outlet A

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
SOA5	24Sep87	24	.984	2.96	29.15	116.492	100	106.082		-3.5	28.89	71		36.6	1.72	1.60	.984
SOA-6	24Sep87	24	.984	2.83	29.15	113.537	104	102.625		-3.5	28.89	73		39.1	1.84	1.76	.982

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
SOA-5	0.7	21.0	78.3			28.95	28.78	.84	13.5595	120	.298	33.8	23.0	2.89	5846	5524	95.4
SOA-6	0.7	21.0	78.3			28.95	28.76	.84	13.2651	120	.298	33.1	23.0	289	5721	5376	94.8

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

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

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

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

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

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

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

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

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

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

$V_{w_{gas}}$ = Volum 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 = Pitot Tube Coefficient

$\sqrt{\Delta P (T_s + 460)}$ 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 Roll Technology, Inc LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Outlet A

RUN	DATE	1 V_m Std.	2 DSCFM
SOA-5	24SEP87	106.082	5524
SOA-6	24SEP87	102.625	5376

FRONT HALF MILLIGRAMS			
PROBE	CYCLONE	FILTER	3 TOTAL
			.272714
			.357639

4 BACK HALF	5 FRONT + BACK TOTAL

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
SOA-5	.00004	.0908	.0019	.0009
SOA-6	.00005	.1231	.0025	.0011
	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:

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Roll Technology
DATE 9/21/87
SAMPLING LOCATION Scrubber Outlet -A;
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) ~~23"~~ N/A
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) ~~23~~ N/A
STACK I.D., (DISTANCE A - DISTANCE B) 23"
NEAREST UPSTREAM DISTURBANCE
NEAREST DOWNSTREAM DISTURBANCE
CALCULATOR

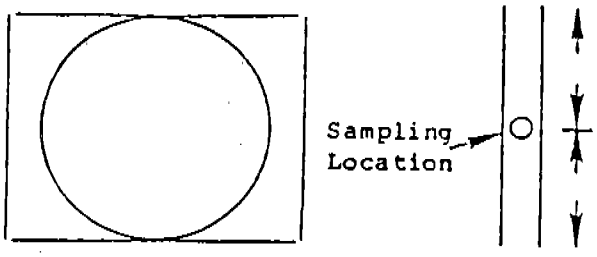
SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1 -A					0.5 *
2 -A					1.5
3 -A					2.7
4 -A					4.1
5 -A					5.8
6 -A					8.2
7 "					14.8
8 "					17.3
9 "					18.9
10 "					20.3
11 "					21.5
12 "					22.5
B-1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

* at inside edge of duct

PRELIMINARY VELOCITY TRAVERSE

Plant: Roll Technology
Date: 9/21/87
Location: Scrubber Outlet - B
Stack I.D.:
Barometric Pressure, in. Hg: 29.11
Stack Gauge Pressure, in. H_2O: -3.5
Operators: T. Miller, A. Weisman
Pitot Tube I.D. Number:
Temperature Readout I.D.:
Pitot Tube Leak Check: OK



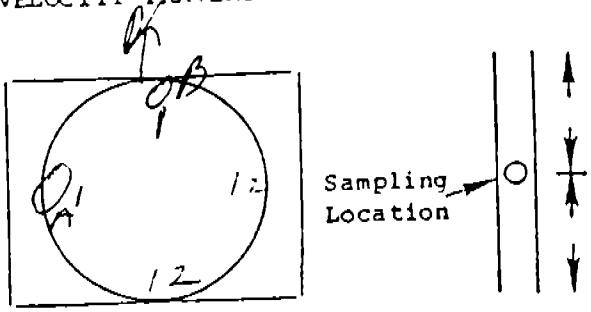
Schematic of Traverse Point Layout

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
A-1	0.36	81	
2	0.25	80	
3	0.21	80	
4	0.21	80	
5	0.22	80	
6	0.24	80	
7	0.39	81	
8	0.44	81	
9	0.48	80	
10	0.49	79	
11	0.44	79	
12	—	—	
Average			

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
B-1	0.89	81	
2	0.95	79	
3	0.48	79	
4	0.34	79	
5	0.32	79	
6	0.28	80	
7	0.28	79	
8	0.28	79	
9	0.30	79	
10	0.32	79	
11	0.30	79	
12	0.22	79	
Average			

PRELIMINARY VELOCITY TRAVERSE

Plant: Bell Jack
Date: 9-23-87
Location: Scrubber outlet A
Stack I.D.: 23"
Barometric Pressure, in. Hg: 29.20
Stack Gauge Pressure, in. H_2O:
Operators: J. Blau, T. Miller
Pitot Tube I.D. Number: 41
Temperature Readout I.D.:
Pitot Tube Leak Check: OK



Schematic of Traverse Point Layout

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
A-1			+24
2			-9
3			-4
4			0
5			+5
6			+11
7			+12
8			+10
9			+18
10			+5
11			+4
12			+6
Average			

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
B-1			+3
2			+3
3			-12
4			+2
5			-3
6			0
7			+4
8			+11
9			+17
10			+12
11			+8
12			+16
Average			

NOMOGRAPH DATA

Plant: Roll Tech. Date: 9-22-87

Sampling Location: Scrubber outlet "A"
MB-1

Calibrated Pressure Differential Across Orifice, in. H_2O	$\Delta H_@$	1.798
Average Meter Temperature (ambient + 20°F), °F	$T_{m_{avg}}$	105
Percent Moisture in Gas Stream by Volume	B_{wo}	2.0
Barometric Pressure at Meter, in. Hg.	P_m	29.19
Static Pressure in Stack, in. Hg. ($P_m \pm 0.073$ x stack gauge pressure in in. H_2O)	P_s	28.93
Ratio of Static Pressure to Meter Pressure	P_s/P_m	0.99
Average Stack Temperature, °F	$T_{s_{avg}}$	80
Average Velocity Head, in. H_2O	Δp_{avg}	0.38
Maximum Velocity Head, in. H_2O	Δp_{max}	0.95
C Factor		1.05
Calculated Nozzle Diameter, in.		0.2661
Actual Nozzle Diameter, in.		0.298
Reference Δp, in. H_2O		0.22

Nozzle Ø

0.296 0.298, 0.300

FIELD DATA

Plant Roll Tech.
Date 9-22-87
Sampling Location Scrubber outlet "A"
Sample Type MM13B
Run Number 50-A1
Operator J. Blan, A. Weisman, N. Thomas
Ambient Temperature 67°F
Barometric Pressure 29.19
Static Pressure (P_s) -3.5
Filter Number(s) —
Pretest Leak Rate = 0 cfm @ 18" in. Hg
Pretest Pitot Leak Check OK
Pretest Orsat Leak Check —
Read and Record all Data Every 5c Minutes

Schematic of Traverse Point Layout

Probe Length and Type 26" PYREX
Pitot Tube I.D. No. NT-
Nozzle I.D.
Assumed Moisture, % 2.0
Temp. Readout S/N
Meter Box Number MB-1
Meter $\Delta H_@$ 1.798
C Factor 0.85
Meter Gamma 0.984
Heater Box Setting —
Reference Δp 6.3
Post Test Leak Rate = .009 cfm @ 7 in. Hg
Post Test Pitot Leak Check O.K.
Post Test Orsat Leak Check

309930

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	0	/	309.930	0							—	
A-1	5.0	/	314.215	.37	3.0	3.0	74	84	78	2	—	57
2	10.0	/	319.365	.31	2.6	2.6	74	90	78	2		57
3	15.0	/	325.000	.42	3.6	3.6	73	98	80	2		56
4	20.0	/	329.410	.31	2.6	2.6	74	104	80	2		58
5	25.0	/	332.240	.20	1.8	1.8	71	106	84	2		61
6	30.0	/	337.100	.19	1.5	1.5	72	108	86	2		62
7	35.0	/	341.800	.34	2.9	2.9	72	110	88	2		61
8	40.0	/	348.130	.42	3.5	3.5	73	116	90	2		62
9	45.0	/	352.260	.45	3.8	3.8	73	118	94	2		6[illegible]
10	50.0	/	357.500	.49	4.0	4.0	72	118	96	2		65
11	55.0	/	364.310	.49	4.0	4.0	70	120	98	3		66
12	60.0	/	369.728	.43	3.5	3.5	69	120	98	2		67
1		/	376.100	.56	4.8	4.8	75	96	94	2		51
2		/	383.310	.56	4.8	4.8	75	94	90	2		52
3		/	388.0	.70	5.8	5.8	75	106	90	2		52
4		/	394.350	.58	4.8	4.8	75	112	92	2		53
5		/	399.340	.33	2.8	2.8	73	114	92	2		57
6		/	403.810	.29	2.4	2.4	73	114	94	2		57
7		/	408.531	.30	2.5	2.5	73	114	94	2		56
8		/	413.140	.33	2.8	2.8	74	116	96	2		57
9		/	417.410	.33	2.8	2.8	74	116	96	2		55
10		/	422.600	.35	2.9	2.8	74	118	96	2		54
11		/	427.511	.36	3.0	3.0	74	118	98	2		54
12			431.938	.31	2.6	2.6	73	118	100	2		57

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: ~~[illegible]~~ 9/22/87

Sampling Location: ~~[illegible]~~

Sample Type: MM 13B

Run Number: ~~[illegible]~~ - ~~outlet~~ SOA-1

Sample Box Number: #3

Clean-up Man: NT/HJO

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

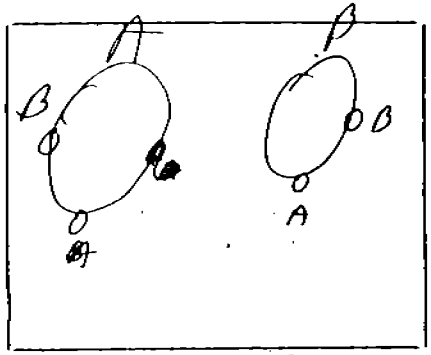
MOISTURE

	#1	#2	#3
Impingers			
Final Volume:	585.7 ml/gr	616.4 ml/gr	555.5 ml/gr
Initial Volume:	577.3 ml/gr	573.9 ml/gr	595.4 ml/gr
Net Volume:	ml/gr	ml/gr	ml/gr
Total H_2O:			
Silica Gel			
Final Volume:	724.7 g	g	g
Initial Volume	715.4 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant Roll Tack
Date 9-22-87
Sampling Location Scrubber outlet A
Sample Type
Run Number SO-A2
Operator S. Blau, A. Weisman
Ambient Temperature 77
Barometric Pressure 29.14
Static Pressure (P_s) -.35
Filter Number(s) —
Pretest Leak Rate = 0 cfm @ 10 in. Hg
Pretest Pitot Leak Check OK
Pretest Orsat Leak Check
Read and Record all Data Every 5 Minutes



Schematic of Traverse Point Layout

Probe Length and Type 26" Pyrex
Pitot Tube I.D. No.
Nozzle I.D. 0.298
Assumed Moisture, % 2.0
Temp. Readout S/N
Meter Box Number MB-1
Meter $\Delta H_@$ 1.798
C Factor 0.95
Meter Gamma .987
Heater Box Setting —
Reference Δp 0.3
Post Test Leak Rate = .001 cfm @ 10 in. Hg
Post Test Pitot Leak Check OK.
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
A-1	0	17:55	432.407					85				
1	5		438.01	.40	3.4	3.4	77	86	86	2		60
2	10		443.650	.50	4.1	4.1	77	96	88	2		62
3			449.250	.50	4.1	4.1	82	104	88	2		63
4			454.810	.43	3.6	3.6	77	110	90	2		66
5			458.810	.21	1.8	1.8	74	114	92	0		65
6			462.400	.18	1.5	1.5	73	118	94	0		65
7			466.820	.31	2.6	2.6	75	116	94	2		63
8			472.210	.40	3.4	3.4	74	120	96	2		63
9			477.790	.44	3.6	3.6	74	122	100	3		62
10			483.420	.48	3.9	3.9	73	124	100	3		62
11			490.20	.65	5.3	5.3	72	128	104	4		63
12			496.493	.60	4.9	4.9	72	128	106	3		63
B-1			502.70	.53	4.5	4.5	80	130	108	3		57
2			508.010	.39	3.3	3.3	76	114	102	2		57
3			513.110	.39	3.3	3.3	78	118	102	2		60
4			517.810	.34	2.9	2.9	76	120	102	2		61
5			522.12	.26	2.2	2.2	75	120	104	2		61
6			526.010	.21	1.8	1.8	75	120	104	2		60
7			530.240	.26	2.2	2.2	75	118	106	2		60
8			534.630	.29	2.4	2.4	74	122	106	2		61
9			539.390	.33	2.8	2.8	74	122	106	2		61
10			544.100	.35	2.9	2.9	77	124	106	2		60
11			548.910	.35	2.9	2.9	73	124	106	2		61
12			553.384	.30	2.5	2.5	73	124	107	2		61

SAMPLE RECOVERY DATA

Plant: Roll Tech.

Date: 9-22-87

Sampling Location: Scrubber Outlet - A

Sample Type: M17 B/B

Run Number: ~~50-B-2~~ 50 A - 2

Sample Box Number: #3 (Blue Box)

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

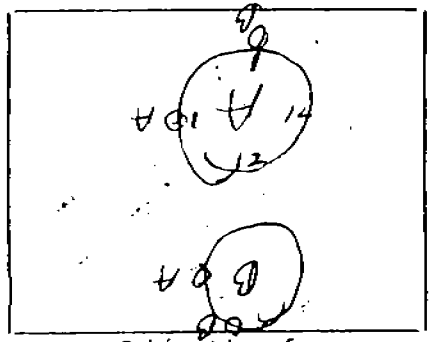
Impingers			
Final Volume:	588.3 ml	580.5 ml	596.1 ml
Initial Volume:	580.5 ml	579.4 ml	599.8 ml
Net Volume:	ml	ml	ml
Total H_2O:			
Silica Gel			
Final Volume:	749.3 g	g	g
Initial Volume	727.8 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

NT

FIELD DATA

Plant Roll Tech
Date 9-22
Sampling Location Scrubber outlet A
Sample Type 13B, Chrome
Run Number 60 A3
Operator J. Blau, A. Wiesman
Ambient Temperature
Barometric Pressure 29.18
Static Pressure (P_s) -.35
Filter Number(s)
Pretest Leak Rate = .001 cfm @ 15 in. Hg
Pretest Pitot Leak Check O.K
Pretest Orsat Leak Check
Read and Record all Data Every ___ Minutes



Schematic of Traverse Point Layout

Probe Length and Type 26" Pyrex
Pitot Tube I.D. No.
Nozzle I.D. 0.278
Assumed Moisture, % 2
Temp. Readout S/N
Meter Box Number M01
Meter $\Delta H_@$ 1.798
C Factor
Meter Gamma .984
Heater Box Setting
Reference Δp
Post Test Leak Rate = .002 cfm @ 7 in. Hg
Post Test Pitot Leak Check O.K
Post Test Orsat Leak Check

	Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
START	A-1	0	9:42	553.514									
	2	5		560.19	.57	4.8	4.8	72	72	72	4		60
	3			565.65	.46	3.8	3.8	72	84	70	3		52
	4			571.29	.46	3.8	3.8	72	92	73	2		63
	5			575.75	.32	2.6	2.6	72	98	76	2		65
	6			579.55	.18	1.5	1.5	70	106	78	2		65
	7			583.05	.18	1.5	1.5	69	102	80	2		64
	8			587.61	.32	2.8	2.8	70	104	82	2		64
	9			591.72	.40	3.3	3.3	70	107	84	2		64
	10			598.31	.45	3.7	3.7	69	110	87	3		65
	11			604.10	.47	3.9	3.9	69	113	88	3		66
	12			609.75	.47	3.9	3.9	69	115	90	2		67
STOP	A-12		10:42	614.925	.41	3.5	3.5	68	116	92	3		67
START	B-1		10:59	621.110	.66	5.7	5.7	71	98	90	4		51
	2			627.31	.45	3.7	3.7	72	106	90	3		52
	3			633.10	.51	4.2	4.2	71	110	91	3		53
	4			637.61	.28	2.4	2.4	72	114	92	2		55
	5			642.08	.30	2.5	2.5	71	114	93	2		54
	6			646.09	.23	1.9	1.9	71	114	94	2		53
	7			650.20	.25	2.1	2.1	71	112	94	2		52
	8			654.56	.29	2.4	2.4	71	118	96	2		53
	9			659.21	.31	2.6	2.6	70	115	96	2		52
	10			663.89	.34	2.9	2.9	70	116	97	2		53
	11			668.61	.34	2.7	2.7	70	116	98	2		52
STOP	12		11:59	673.225	.32	2.7	2.7	70	117	99	2		52

PACIFIC ENVIRONMENTAL SERVICES, INC.

B-22

SAMPLE RECOVERY DATA

Plant: Roll Tech

Date: 9/23/87

Sampling Location: Scrubber outlet A

Sample Type: MM13B

Run Number: 50 A 3

Sample Box Number:

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers

Final Volume:	590.3 ml	578.7 ml	598.2 ml
Initial Volume:	577.8 ml	575.5 ml	598.5 ml
Net Volume:	ml	ml	ml
Total H_2O:			

Silica Gel

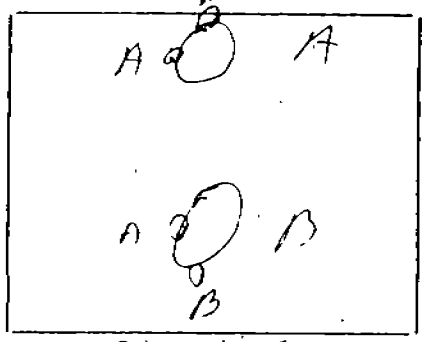
Final Volume:	779.9 g	g	g
Initial Volume	756.4 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

NT

FIELD DATA

Plant Rio Tesk
Date 9-23-87
Sampling Location Scrubber Outlet A
Sample Type MM13B
Run Number 30 A H
Operator J. Blau, A. Weisman
Ambient Temperature 77
Barometric Pressure 29.20
Static Pressure (P_s) -.35
Filter Number(s)
Pretest Leak Rate = .002 cfm @ 10 in. Hg
Pretest Pitot Leak Check 0.12
Pretest Orsat Leak Check
Read and Record all Data Every 5 Minutes



Schematic of Traverse Point Layout

Probe Length and Type 4' Pyrex
Pitot Tube I.D. No.
Nozzle I.D. .298
Assumed Moisture, % 2
Temp. Readout S/N
Meter Box Number TB-1
Meter $\Delta H_@$ 1.798
C Factor
Meter Gamma 0.984
Heater Box Setting
Reference Δp
Post Test Leak Rate = .015 cfm @ 17 in. Hg
Post Test Pitot Leak Check 0.12
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	0001 / 15:39	675.109									
A-1	/	679.73	.38	3.1	3.1	76	88	87	7		46
2	/	686.50	.73	6.1	6.1	76	94	84	15		47
3	/	692.95	.54	4.7	4.7	76	110	88	10		60
4	/	698.31	.42	3.4	3.4	76	109	88	5		60
5	/	702.22	.20	1.8	1.8	73	116	90	2		56
6	/	705.89	.18	1.5	1.5	74	115	92	2		57
7	/	710.51	.32	2.7	2.7	75	115	94	3		54
8	/	715.55	.39	3.2	3.2	75	116	96	4		54
9	/	720.16	.43	3.5	3.5	75	119	98	4		55
10	/	726.43	.46	3.8	3.8	73	121	100	6		54
11	/	732.11	.46	3.8	3.8	72	122	100	6		54
12	/ 1040	737.418	.42	3.1	3.4	71	124	102	5		55
B 1	/ 1658	744.90	.60	5.0	5.0	79	104	98	9		55
2	/	750.91	.50	4.2	4.2	75	116	100	7		54
3	/	756.51	.45	3.8	3.8	76	121	100	6		52
4	/	761.23	.31	2.7	2.7	74	122	100	3		53
5	/	765.71	.29	2.4	2.4	74	122	102	2		52
6	/	769.65	.24	2.0	2.0	73	121	102	2		52
7	/	773.71	.26	2.2	2.2	73	120	105	2		52
8	/	778.32	.31	2.6	2.6	73	120	106	3		52
9	/	783.10	.32	2.7	2.7	73	122	104	3		51
10	/	787.73	.35	2.9	2.9	73	122	104	3		51
11	/	792.41	.35	2.9	2.9	72	123	105	3		51
12	1758	797.237	.34	2.8	2.8	72	124	105	3		51

SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: 9/23/87

Sampling Location: Scrubber Output - A

Sample Type: MM13 B

Run Number: SO-A-4

Sample Box Number: 3-A

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers

Final Volume:	609.9 ml	596.5 ml	501.0 ml
Initial Volume:	580.1 ~~mlgr~~	550.3 ~~mlgr~~	560.5 ~~mlgr~~
Net Volume:	ml	ml	ml
Total H_2O:			

Silica Gel

Final Volume:	713.4 g	g	g
Initial Volume	691.2 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant ROLL TECH
Date 9-24-87
Sampling Location SCRUBBER OUTLET A
Sample Type M 13 0
Run Number ~~SOA~~ SOA 5
Operator J. OLAV, A. WEISMAN
Ambient Temperature 71
Barometric Pressure
Static Pressure (P_s) -.35
Filter Number(s)
Pretest Leak Rate = .001 cfm @ 15 in. Hg
Pretest Pitot Leak Check O.K
Pretest Orsat Leak Check
Read and Record all Data Every ___ Minutes

Schematic of Traverse Point Layout

Probe Length and Type 4' PYREX
Pitot Tube I.D. No. 4
Nozzle I.D. .298
Assumed Moisture, % 2
Temp. Readout S/N
Meter Box Number MB-1
Meter $\Delta H_@$ 1.798
C Factor
Meter Gamma 0.984
Heater Box Setting
Reference Δp
Post Test Leak Rate = .004 cfm @ 17 in. Hg
Post Test Pitot Leak Check O.K
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
RESTART AT	0	9:31	798.545	~~.40~~	~~3.3~~							
A-1	5		803.93	.40	3.3	3.3	71	76	72	7		61
2	10		809.41	.40	3.3	3.3	72	90	75	7		46
3	15		813.61	.23	1.9	1.9	69	98	78	3		57
4	20		816.82	.18	1.6	1.6	68	103	80	2		60
5	25		820.63	.20	1.7	1.7	68	105	82	3		61
6	30		824.44	.20	1.7	1.7	68	107	85	3		62
7	35		828.83	.30	2.5	2.5	69	108	87	4		62
8	40		834.10	.41	3.3	3.4	70	112	90	7		64
9	45		839.62	.46	3.8	3.8	69	116	92	9		67
10	50		845.63	.52	4.3	4.3	70	120	96	11		67
11	55		851.92	.65	5.3	5.3	72	125	96	17		67
12	60	10:42	857.968	.45	3.8	3.8	73	128	98	9		68
B 1		11:04	863.010	.40	3.3	3.3	71	98	97	7		58
2			869.20	.61	5.0	5.0	71	108	95	15		54
3			874.31	.38	3.0	3.0	71	118	95	6		62
4			878.53	.29	2.4	2.4	71	120	98	5		62
5			883.31	.30	2.5	2.5	71	120	98	5		61
6	stop		887.49	.28	2.4	2.4	71	120	99	6		60
7	AT	11:38	892.0	.27	2.2	2.2	71	120	100	5		58
8		12:04	896.40	.30	2.6	2.6	71	96	94	5		51
9			900.91	.28	2.3	2.3	72	102	94	4		47
10			905.33	.34	2.8	2.8	71	109	94	5		52
11			910.13	.36	3.1	3.1	72	114	94	6		53

SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: 9/24/87

Sampling Location: Scrubber Outlet -A

Sample Type: MM-13-B

Run Number: SO-A-5

Sample Box Number: SO - A - 5

Clean-up Man: 3-A, HO/NAT

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

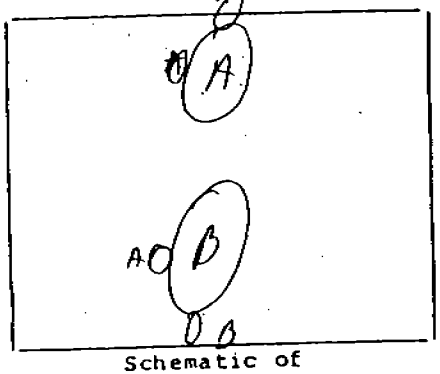
	1	2	3
Impingers			
Final Volume:	589.5 ml	553.2 ml	567.9 ml
Initial Volume:	582.5 ml	552.4 ml	565.0 ml
Net Volume:	ml	ml	ml
Total H_2O:			
Silica Gel	4		
Final Volume:	722.8 g	g	g
Initial Volume	696.9 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

N 1

FIELD DATA

Plant ROLL TECH
Date 9-24-87
Sampling Location OUTLET A
Sample Type MM 13 0
Run Number 50 A 6
Operator J. BLAU, T. MILLER
Ambient Temperature 76
Barometric Pressure 29.15
Static Pressure (P_s) -.35
Filter Number(s)
Pretest Leak Rate = .002 cfm @ 10 in. Hg
Pretest Pitot Leak Check 0.K
Pretest Orsat Leak Check
Read and Record all Data Every ___ Minutes



Schematic of Traverse Point Layout

Probe Length and Type 26' 4' PYREX
Pitot Tube I.D. No. 4
Nozzle I.D. 0.298
Assumed Moisture, % 2
Temp. Readout S/N
Meter Box Number MB 1
Meter $\Delta H_@$ 1.798
C Factor
Meter Gamma 0.984
Heater Box Setting
Reference Δp
Post Test Leak Rate = .002 cfm @ 10 in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	0	14:25	915.228									
A-1	5		920.75	.47	3.8	3.8	79	84	84	4		68
2	10		927.80	.24	2.0	2.0	74	92	86	2		57
3	15	14:49	929.13	.23	2.0	2.0	74	88	85	2		55
4	20		932.80	.18	1.6	1.6	72	96	87	2		64
5	25		936.30	.19	1.6	1.6	72	86	86	2		56
6			940.31	.21	1.7	1.7	73	101	90	2		51
7			945.16	.33	2.8	2.8	74	106	91	2		53
8			950.63	.40	3.4	3.4	25	112	93	3		53
9			956.60	.46	3.9	3.9	74	116	94	3		59
10			960.61	.48	3.9	3.9	73	120	96	3		57
11			966.33	.50	4.1	4.1	72	122	100	3		56
12	60		972.472	.45	3.8	3.8	71	127	101	4		56
B-1		16:07	977.1	.37	3.1	3.1	75	103	98	4		66
2			982.12	.36	3.0	3.0	71	110	100	2		49
3			987.12	.37	3.1	3.1	71	114	100	2		54
4			991.83	.32	2.8	2.8	72	118	100	2		55
5			996.42	.32	2.8	2.8	74	118	100	2		54
6			000.72	.25	2.1	2.1	74	120	102	2		56
7			05.06	.29	2.4	2.4	74	120	102	2		56
8			9.85	.31	2.7	2.7	73	116	103	3		55
9			14.63	.32	2.7	2.7	73	118	104	3		55
10			17.29	.35	3.0	3.0	73	121	104	2		56
			24.12	.36	3.0	3.0	72	122	105	3		56

PES

SAMPLE RECOVERY AND INTEGRITY DATA FORM

Plant Roll Technology Sample date 9/24/87

Sample location Scrubber Outlet -A Run number SO-A-6

Sample recovery person _____ Recovery date 9/24/87

Filter(s) number Box 7A

MOISTURE

Impingers			Silica gel		
Final volume (wt)	_____ ml	(g)	Final wt	_____ g	_____ g
Initial volume (wt)	_____ ml	(g)	Initial wt	_____ g	_____ g
Net volume (wt)	_____ ml	(g)	Net wt	_____ g	_____ g
Total moisture	_____ g				

Color of silica gel _____

Description of impinger water _____

RECOVERED SAMPLE

Blank filter container number _____ Sealed _____

Filter container number _____ Sealed _____

Description of particulate on filter _____

Acetone rinse container number _____ Liquid level marked? _____

Acetone blank container number _____ Liquid level marked? _____

Samples stored and locked _____

Remarks _____

Date of laboratory custody _____

Laboratory personnel taking custody _____

Remarks _____

#1	~~780.6~~	557.5	589.1
#2	~~583.2~~	555.4	593.4
#3	~~555.4~~	583.2	526.8
#4	~~557.5~~	780.5	806.4

Scrubber Outlet

Duct B

SAMPLING SUMMARY SHEET

PLANT Roll Technology Inc. LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Outlet B

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
SOB-1	23SEP87	24	1.006	2.45	29.19	117.494	96	110.183		-3.5	28.93	75		36.8	1.73	1.55	.985
SOB-2	23SEP87	24	1.006	2.42	29.14	116.396	115	105.359		-3.5	28.88	78		21.6	1.02	0.96	.990
SOB-3	23SEP87	24	1.006	2.86	29.18	122.996	106	113.383		-3.5	28.92	73		46.7	2.20	1.90	.981
SOB-4	23SEP87	24	1.006	2.67	29.20	119.380	111	109.108		-3.5	28.94	78		36.8	1.73	1.56	.984

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
SOB-1	0.7	21.0	78.3			28.95	28.78	0.84	13.1241	120	.299	32.7	23	2.89	5654	5312	102.3
SOB-2	0.7	21.0	78.3			28.95	28.85	0.84	13.1185	120	.299	32.6	23	2.89	5650	5301	98.1
SOB-3	0.7	21.0	78.3			28.95	28.74	0.84	14.1698	120	.299	35.3	23	2.89	6109	5739	97.5
SOB-4	0.7	21.0	78.3			28.95	28.78	0.84	13.7420	120	.299	34.2	23	2.89	5919	5532	97.3

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

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

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

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

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

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

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

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

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

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

$V_{w_{gas}}$ = Volumn 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.

SUMMARY OF EMISSIONS

PLANT Roll Technology Inc. LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Outlet B.

RUN	DATE	1 V_m Std.	2 DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	3 TOTAL	4 BACK HALF	5 FRONT + BACK TOTAL
SOB 1	22 Sep 87	110.183	5312				.428242		
SOB 2	22 Sep 87	105.359	5301				.647204		
SOB-3	23 Sep 87	113.383	5739				.212372		
SOB-4	23 Sep 87	109.108	5532				.587147		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr	TOTAL Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
SOB-1	.00006	.137	.0027	.0012								
SOB-2	.00009	.217	.0043	.0020								
SOB-3	.00003	.066	.0014	.0006								
SOB-4	.00008	.190	.0039	.0018								
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks:

SAMPLING SUMMARY SHEET

PLANT Roll Technology, Inc. LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Outlet B

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
SOB-5	24 SEP87	24	1.006	2.09	29.15	106.206	101	98.487	/	-3.5	28.89	73	/	34.9	1.64	1.64	.984
SOB-6	24 SEP87	24	1.006	2.20	29.15	107.853	111	98.289	/	-3.5	28.89	77	/	36.9	1.74	1.74	.983

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
SOB-5	0.7	21.0	78.3	/	/	28.95	28.77	.84	11.9915	120	.299	29.9	23.0	2.89	5170	4865	99.9
SOB-6	0.7	21.0	78.3	/	/	28.95	28.76	.84	11.8177	120	.299	29.4	23.0	2.89	5096	4755	102.0

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

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

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

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

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

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

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

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

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

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

$V_{w_{gas}}$ = Volumn 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.

SUMMARY OF EMISSIONS

PLANT Roll Technology, Inc LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Outlet B

RUN	DATE	1 V_m Std.	2 DSCFM
SOB-5	24SEP87	98.487	4865
SOB-6	24SEP87	98.289	4755

FRONT HALF MILLIGRAMS			
PROBE	CYCLONE	FILTER	3 TOTAL
			.241100
			.331484

4 BACK HALF	5 FRONT + BACK TOTAL

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
SOB-5	.00004	.088	.0016	.0007								
SOB-6	.00005	.119	.0021	.0010								
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks:

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

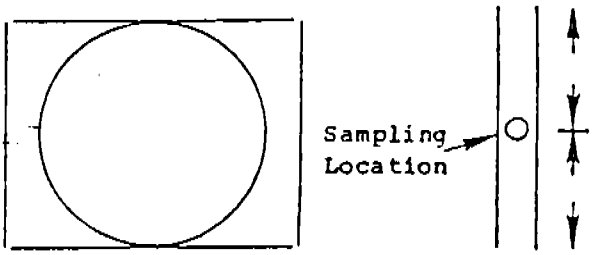
PLANT Roll Technology
DATE 9/21/87
SAMPLING LOCATION Scrubber Outlet - B
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) _____
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) _____
STACK I.D., (DISTANCE A - DISTANCE B) 23'
NEAREST UPSTREAM DISTURBANCE _____
NEAREST DOWNSTREAM DISTURBANCE _____
CALCULATOR _____

SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
A - 1					0.5
2					1.5
3					2.7
4					4.1
5					5.8
6					8.2
7					14.8
8					17.3
9					18.9
10					20.3
11					21.5
12					22.5
B - 1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

PRELIMINARY VELOCITY TRAVERSE

Plant: Roll Technology
Date: 9/21/87
Location: Scrubber Outlet - B
Stack I.D.:
Barometric Pressure, in. Hg: 29.11
Stack Gauge Pressure, in. H_2O: -3.5
Operators: T. MILLER, A. WEISMAN
Pitot Tube I.D. Number:
Temperature Readout I.D.:
Pitot Tube Leak Check: OK



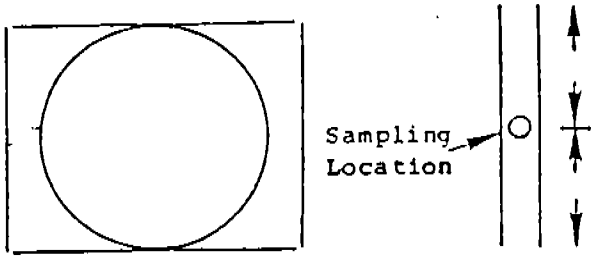
Schematic of Traverse Point Layout

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
A-1	~~3.5~~ 0.23	81	
2	~~3.5~~ 0.17	81	
3	~~3.5~~ 0.17	81	
4	~~3.5~~ 0.18	81	
5	~~3.5~~ 0.20	81	
6	~~3.5~~ 0.25	81	
7	~~3.5~~ 0.40	81	
8	~~3.5~~ 0.45	81	
9	~~3.5~~ 0.45	80	
10	~~3.5~~ 0.46	80	
11	~~3.5~~ 0.46	80	
12	—	—	
Average			

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
B-1	~~3.6~~ 0.35	83	
2	~~3.7~~ 0.27	83	
3	~~3.5~~ 0.17	81	
4	~~3.5~~ 0.16	81	
5	~~3.5~~ 0.17	81	
6	~~3.5~~ 0.20	81	
7	~~3.5~~ 0.35	81	
8	~~3.5~~ 0.42	81	
9	~~3.6~~ 0.44	82	
10	~~3.6~~ 0.42	82	
11	~~3.5~~ 0.39	82	
12	—	—	
Average			

PRELIMINARY VELOCITY TRAVERSE

Plant: Roll Tech.
Date: 9-23-87
Location: Scrubber outlet "B"
Stack I.D.: 23"
Barometric Pressure, in. Hg: 29.20
Stack Gauge Pressure, in. H_2O:
Operators: T.M ; J.B
Pitot Tube I.D. Number: NT-1
Temperature Readout I.D.: —
Pitot Tube Leak Check:



Schematic of Traverse Point Layout

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
A-1			0
2			-5
3			-18
4			-9
5			-5
6			-4
7			+16
8			+16
9			0
10			-2
11			0
12			-2
Average			

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
B-1			+4
2			-6
3			-8
4			-6
5			+18
6			+5
7			+14
8			+3
9			+20
10			+6
11			0
12			0
Average			

NOMOGRAPH DATA

Plant: Roll Tech. Date: 9-22-87

Sampling Location: Scrubber outlet "B"
MB-4

Calibrated Pressure Differential Across Orifice, in. H_2O	$\Delta H_@$	1.461
Average Meter Temperature (ambient + 20°F), °F	$T_{m_{avg}}$	105
Percent Moisture in Gas Stream by Volume	B_{wo}	2.0
Barometric Pressure at Meter, in. Hg.	P_m	29.19
Static Pressure in Stack, in. Hg. ($P_m \pm 0.073$ x stack gauge pressure in in. H_2O)	P_s	28.93
Ratio of Static Pressure to Meter Pressure	P_s/P_m	0.99
Average Stack Temperature, °F	$T_{s_{avg}}$	81
Average Velocity Head, in. H_2O	Δp_{avg}	0.31
Maximum Velocity Head, in. H_2O	Δp_{max}	0.46
C Factor		0.90
Calculated Nozzle Diameter, in.		0.285
Actual Nozzle Diameter, in.		0.299
Reference Δp, in. H_2O		0.250

NOZZLE Ø
0.298, 0.301, 0.299

FIELD DATA

Plant Roll Tech.
Date 9-22-87
Sampling Location Scrubber outlet "B"
Sample Type MM13B
Run Number 50-B1
Operator J. Brian, A. Weisman, N. Thomas
Ambient Temperature 60°F
Barometric Pressure 29.19
Static Pressure (P_g) -3.5
Filter Number(s) —
Pretest Leak Rate = ____ cfm @ ____ in. Hg
Pretest Pitot Leak Check OK
Pretest Orsat Leak Check —
Read and Record all Data Every 5.0 Minutes

Schematic of Traverse Point Layout

Probe Length and Type 4' PYREX
Pitot Tube I.D. No. 4'
Nozzle I.D. 0.29
Assumed Moisture, % 2.0
Temp. Readout S/N —
Meter Box Number 1116-4
Meter $\Delta H_@$ 1.461
C Factor 0.90
Meter Gamma 1.006
Heater Box Setting —
Reference Δp 0.3
Post Test Leak Rate = .006 cfm @ 12 in. Hg
Post Test Pitot Leak Check O.K.
Post Test Orsat Leak Check —

411.703

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	0		411.703									
A-1	5.0		416.610	.28	2.0	2.0	74	80	76			54
2	10.0		422.610	.41	3.1	3.1	74	91	77	6		55
3	15.0		426.570	.42	3.1	3.1	75	98	80	7		55
4	20.0		432.591	.41	3.0	3.0	75	108	84	6		58
5	25.0		438.561	.37	2.8	2.8	74	113	86	6		59
6	30.0		443.910	.35	2.6	2.6	74	118	90	5		60
7	35.0		447.10	.20	1.5	1.5	75	118	93	3		60
8	40.0		450.110	.14	1.1	1.1	75	118	96	2		61
9	45.0		455.270	.30	2.2	2.2	74	120	98	5		58
10	50.0		459.750	.36	2.7	2.7	75	124	101	6		60
11	55.0		465.110	.38	2.8	2.8	75	128	103	6		60
12	60.0		470.081	.25	1.8	1.8	76	131	103	5		62
1			476.110	.43	3.3	3.3	74	104	101	4		55
2			480.200	.27	2.0	2.0	74	100	96	4		50
3			485.910	.38	2.8	2.8	73	107	96	6		54
4			490.290	.36	2.6	2.6	74	116	98	6		54
5			493.740	.13	1.0	1.0	76	118	99	2		57
6			496.990	.13	1.0	1.0	76	116	100	2		57
7			501.720	.31	2.4	2.4	75	118	101	5		55
8			507.105	.40	2.9	2.9	76	126	114	6		57
9			512.610	.42	3.1	3.1	75	130	106	6		56
10			518.110	.42	3.1	3.1	75	132	108	6		58
11			523.810	.44	3.2	3.2	76	136	110	7		58
12			529.197	.38	2.7	2.7	76	138	112	6		60

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: ~~9/22/87~~ 9/22/87 Scrubber Outlet

Sampling Location: ~~Mist Eliminator Outlet~~ Mist Eliminator

Sample Type: MM 13B

Run Number: ~~preliminary~~ Scrubber Outlet ~~HE-O-I~~ SO-B Spit

Sample Box Number: #2

Clean-up Man: NT / HJO

Job Number:

Comments: Scrubber Outlet Run SO-B-1

FRONT HALF

Filter Number: _____ _____ _____

Description of Filter: _____

MOISTURE

	#1	#2	#3
Impingers			
Final Volume:	614.3 ~~ml~~ g	556.4 ~~ml~~ g	526.6 ~~ml~~ g
Initial Volume:	552.3 ~~ml~~ g	551.8 ~~ml~~ g	580.1 ~~ml~~ g
Net Volume:	~~ml~~ g	~~ml~~ g	~~ml~~ g
Total H_2O:			
Silica Gel			
Final Volume:	713.1 g	g	g
Initial Volume	689.4 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch: _____

FIELD DATA

Plant Roll Tech
Date 9-22-87
Sampling Location Scrubber outlet B
Sample Type MM13B
Run Number 50 B2
Operator J. Olay, Andy Weisman
Ambient Temperature
Barometric Pressure 29.14
Static Pressure (P_s) -3.5
Filter Number(s) —
Pretest Leak Rate = 0 cfm @ 15 in. Hg
Pretest Pitot Leak Check OK
Pretest Orsat Leak Check
Read and Record all Data Every 10 Minutes

Schematic of Traverse Point Layout

Probe Length and Type 4' Pyrex
Pitot Tube I.D. No. 4'
Nozzle I.D. ~~0.299~~ 0.299
Assumed Moisture, % 2
Temp. Readout S/N
Meter Box Number MB-4
Meter $\Delta H_@$ 1.461
C Factor 0.90
Meter Gamma 1.006
Heater Box Setting
Reference Δp 0.3
Post Test Leak Rate = .003 cfm @ 11 in. Hg
Post Test Pitot Leak Check 0.K
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min)	/Clock / Time /(24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
A-1	0:00	/ 17:35	529.270									
B-1	5	/	535.010	.42	3.1	3.1	80	88	86	5		51
B-2	10	/	540.300	.46	3.3	3.3	80	95	86	5		51
3	15	/	545.99	.47	3.4	3.4	79	106	88	5		49
4	20	/	551.300	.40	2.9	2.9	77	112	90	5		51
5	25	/	556.560	.37	2.6	2.6	77	118	94	4		51
6	30	/	561.000	.28	2.1	2.1	77	120	98	4		51
7	35	/	564.980	.19	1.4	1.4	78	122	100	4		53
8	40	/	564.710	.19	1.4	1.4	78	122	102	2		51
9	45	/	572.940	.26	2.0	2.0	80	124	104	3		52
10	50	/	577.800	.32	2.3	2.3	77	128	106	3		51
11	55	/	582.410	.27	2.0	2.0	80	130	108	2		51
12	60	/	587.701	.36	2.6	2.6	78	133	110	4		51
A-1	65	/	593.500	.52	3.8	3.8	81	122	108	6		51
2	70	/	598.400	.32	2.3	2.3	80	123	110	4		50
3	75	/	602.850	.16	1.2	1.2	77	126	110	2		53
4	80	/	605.910	.16	1.2	1.2	77	126	110	2		53
5	85	/	609.890	.20	1.5	1.5	80	128	112	2		53
6	90	/	613.610	.17	1.3	1.3	78	130	112	2		54
7		/	617.990	.25	1.8	1.8	76	130	114	2		53
8		/	622.730	.33	2.4	2.4	77	134	114	2		53
9		/	628.090	.39	2.9	2.9	77	138	116	2		59
10		/	634.250	.55	4.0	4.0	76	138	118	6		54
11		/	640.260	.49	3.6	3.6	76	145	120	5		54
			645.666	.41	3.0	3.0	76	146	122	4		54

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY DATA

Plant: Rolc Tecundogy

Date: 9-22/87

Sampling Location: SCRUBBER OUTLET B

Sample Type: MM13B

Run Number: S O B-2

Sample Box Number: # 2

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers			
Final Volume:	558.8 ml	557.8 ml	583.1 ml
Initial Volume:	556.8 ml	555.3 ml	~~525.6~~ 583.6 ml
Net Volume:	ml	ml	ml
Total H_2O:			
Silica Gel			
Final Volume:	~~[illegible]~~ 710.2 g	g	g
Initial Volume	730.6 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant Rock Tech
Date 9-23
Sampling Location SCRUBBER OUTLET B
Sample Type HM13B
Run Number S O B 3
Operator J. BLDU, ANDY WIESMAN
Ambient Temperature 70
Barometric Pressure 29.18
Static Pressure (P_s) -.35
Filter Number(s) —
Pretest Leak Rate = 0 cfm @ 10 in. Hg
Pretest Pitot Leak Check 0.K
Pretest Orsat Leak Check
Read and Record all Data Every 5.0 Minutes

Schematic of Traverse Point Layout

Probe Length and Type 4' PYREX
Pitot Tube I.D. No. 4'
Nozzle I.D. 0 299
Assumed Moisture, % 2
Temp. Readout S/N
Meter Box Number MB-4
Meter $\Delta H_@$ 1.461
C Factor
Meter Gamma 1.006
Heater Box Setting
Reference Δp
Post Test Leak Rate = .004 cfm @ 17 in. Hg
Post Test Pitot Leak Check 0.K
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
~~B-1~~	0	9:44	646.035									
B-1			650.910	.35	2.5	2.5	73	70	70	4		62
2			655.840	.40	2.8	2.8	73	78	70	5		51
3			661.00	.39	2.8	2.8	72	88	70	5		56
			665.81	.33	2.4	2.4	73	97	74	4		55
			670.40	.31	2.2	2.2	72	102	76	3		63
			674.71	.23	1.8	1.8	72	106	81	2		63
			678.52	.18	1.4	1.4	72	108	84	2		63
			681.80	.14	1.0	1.0	72	109	87	2		61
			686.91	.40	2.8	2.8	73	112	90	5		61
			691.92	.35	2.5	2.5	72	119	93	4		61
			698.24	.63	4.5	4.5	72	123	96	7		62
		10:44	705.024	.76	5.3	5.3	73	130	100	9		64
		10:01	712.801	.91	6.7	6.5	73	110	108	14		53
			719.74	.77	5.4	5.4	71	124	108	8		56
			725.61	.46	3.3	3.3	73	130	105	5		55
			730.75	.37	2.7	2.7	73	130	104	4		54
			735.02	.24	1.8	1.8	73	130	108	4		52
			738.31	.13	.98	.98	72	134	107	2		52
			742.23	.22	1.5	1.5	73	125	108	2		51
			747.11	.33	2.4	2.4	73	125	108	4		52
			752.41	.40	2.8	2.8	73	131	110	4		50
			758.00	.47	3.2	3.2	73	134	112	4		52
			763.59	.42	3.1	3.1	73	136	112	4		52
		12:01	769.02	.41	3.0	3.0	73	138	114	4		53

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY DATA

Plant: Roll Tech

Date: 9/23/87

Sampling Location: Scrubber outlet B

Sample Type: MM13B

Run Number: SOP-3

Sample Box Number: ~~SOB-3~~ #2

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers			
Final Volume:	563.1 ml	615.8 ml	530.7 ml
Initial Volume:	553.4 ml	552.3 ml	582.0 ml
Net Volume:	ml	ml	ml
Total H_2O:			

Silica Gel			
Final Volume:	~~755.7~~ 784.2 g	g	g
Initial Volume	759.4 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant: ROLL TECK
Date: 7-23-87
Sampling Location: SECONDARY OUTLET B
Sample Type: MM 13
Run Number: 50B4
Operator: J. BLN, A. WEISMAN
Ambient Temperature: 77
Barometric Pressure: 29.20
Static Pressure (P_g): -.35
Filter Number(s): —
Pretest Leak Rate = .002 cfm @ 15 in. Hg
Pretest Pitot Leak Check: 0.K
Pretest Orsat Leak Check: —
Read and Record all Data Every ___ Minutes

Schematic of Traverse Point Layout

Probe Length and Type: 26"
Pitot Tube I.D. No.: —
Nozzle I.D.: .299
Assumed Moisture, %: 2
Temp. Readout S/N: —
Meter Box Number: MB4
Meter $\Delta H_@$: 1.461
C Factor: —
Meter Gamma: 1.006
Heater Box Setting: —
Reference Δp: —
Post Test Leak Rate = .001 cfm @ 8 in. Hg
Post Test Pitot Leak Check: —
Post Test Orsat Leak Check: —

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_g) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
START 1		115.41	769.220									53
			773.850	.37	2.6	2.6	77	82	80	2		46
B 1			779.10	.40	2.9	2.9	78	88	81	2		52
2			784.51	.40	2.9	2.9	77	99	82	2		53
3			789.81	.36	2.6	2.6	78	104	86	2		52
4			793.80	.36	2.6	2.6	78	110	86	2		53
5			798.80	.29	2.1	2.1	78	114	92	2		53
6			802.33	.18	1.3	1.3	78	116	94	2		52
7			805.50	.13	.98	.98	78	116	97	2		51
8			809.80	.26	1.9	1.9	79	118	100	2		51
9			814.81	.35	2.5	2.5	78	124	102	2		51
10			820.23	.45	3.3	3.3	79	127	104	2		59
11			824.800	.28	2.0	2.0	80	130	106	2		55
12		116.42			8.5	8.5	80	112	105	11		53
STOP		1700	834.50	1.20								
START B 1			840.70	.734	4.4	4.4	81	130	107	4		50
2			846.81	.53	3.9	3.9	79	131	108	4		49
3			852.36	.41	3.0	3.0	79	132	110	3		49
4			856.10	.16	1.2	1.2	78	131	111	2		51
5			859.46	.16	1.2	1.2	77	128	112	2		51
6			863.00	.16	1.2	1.2	78	128	112	2		50
7			867.50	.28	2.0	2.0	78	128	112	2		50
8			872.62	.35	2.6	2.6	76	132	114	2		50
9			875.05	.41	2.9	2.9	76	136	116	2		50
10			883.41	.40	2.9	2.9	76	135	118	2		50
11			888.601	.37	2.6	2.6	75	140	118	2		50
STOP 12												

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: 9/24/87

Sampling Location: Scrubber Outlet

Sample Type: MM-13-B

Run Number: SO-B-4

Sample Box Number: 2A

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers			
Final Volume:	555.4 ml	582.1 ml	560.1 ml
Initial Volume:	546.6 ~~mgr~~	575.5 ~~mgr~~	558.2 ~~mgr~~
Net Volume:	ml	ml	ml
Total H_2O:			
Silica Gel			
Final Volume:	741.2 g	g	g
Initial Volume	721.7 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant ROLL TECH
Date 9-24-87
Sampling Location SCRUBBER OUTLET B
Sample Type M13B
Run Number SOB5
Operator S. OLAV, A. WEISMAN
Ambient Temperature
Barometric Pressure
Static Pressure (P_s)
Filter Number(s) —
Pretest Leak Rate = ___ cfm @ ___ in. Hg
Pretest Pitot Leak Check
Pretest Orsat Leak Check
Read and Record all Data Every ___ Minutes

Schematic of Traverse Point Layout

Probe Length and Type 26"
Pitot Tube I.D. No. 26"
Nozzle I.D. 0.299
Assumed Moisture, % 2
Temp. Readout S/N
Meter Box Number MB-4
Meter $\Delta H_@$ 1.461
C Factor —
Meter Gamma 1.006
Heater Box Setting —
Reference Δp —
Post Test Leak Rate = .001 cfm @ 7 in. Hg
Post Test Pitot Leak Check 0.12
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	0 / 9:44	889.025									
B-1	5 /	899.46	0.40	2.9	2.9	71	72	70	3	—	54
2	10 /	899.41	.40	2.9	2.9	71	81	71	3		42
3	15 /	904.72	.45	3.2	3.2	71	92	76	4		50
4	20 /	909.98	.40	2.9	2.9	71	100	76	3		54
5	25 /	919.91	.30	2.5	2.5	71	106	80	2		56
6	30 /	919.63	.32	2.3	2.3	71	108	84	2		56
7	35 /	923.27	.18	1.3	1.3	71	110	86	2		57
8	40 /	926.83	.19	1.4	1.4	71	110	90	2		56
9	45 /	930.83	.20	1.5	1.5	73	112	92	2		54
10	50 /	934.62	.18	1.5	1.5	74	113	94	2		53
11	55 /	937.73	.12	.92	.92	73	116	98	2		53
12	60 / 10:44	940.990	.13	1.0	1.0	75	116	100	2		53
A-1	/ 11:06	944.10	.12	.93	.93	75	100	98	2		61
2	/	948.45	.27	1.9	1.9	75	106	98	2		54
3	/	952.30	.18	1.4	1.4	74	112	100	2		49
4	/	955.90	.16	1.2	1.2	73	118	100	3		51
5	/	959.51	.16	1.2	1.2	74	118	102	2		51
6	STOP AT / 11:38	962.20	.19	1.4	1.4	74	120	102	2		52
7	/	967.91	.30	2.2	2.2	74	122	106	2		50
8	/	973.14	.37	2.9	2.9	73	106	100	3		47
9	/	978.43	.47	3.1	3.1	74	114	100	3		49
10	/	984.11	.45	3.2	3.2	73	122	102	3		51
11	/	989.61	.45	3.3	3.3	73	126	104	4		53

PACIFIC ENVIRONMENTAL SERVICES, INC

SAMPLE RECOVERY DATA

Plant: Roll Technology EPA-GLASS

Date: 9/24/87

Sampling Location: Scrubber Outlet - B

Sample Type: MM13B

Run Number: SO-B-5

Sample Box Number: SO - B - 5 2A

Clean-up Man: HD/NAT

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers	1	2	3
Final Volume:	554.9 ml	585.1 ml	560.9 ml
Initial Volume:	548.9 ml	578.1 ml	559.8 ml
Net Volume:	ml	ml	ml
Total H_2O:			

Silica Gel	4		
Final Volume:	735.4 g	g	g
Initial Volume	714.6 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant Roll Teeft
Date 9-24-97
Sampling Location Scrubber outlet B
Sample Type MM 13 B
Run Number SOB 6
Operator S. Dla, A. Weisman
Ambient Temperature 76
Barometric Pressure 29.15
Static Pressure (P_s) -.35
Filter Number(s) —
Pretest Leak Rate = .001 cfm @ 10 in. Hg
Pretest Pitot Leak Check O.K
Pretest Orsat Leak Check
Read and Record all Data Every 5 Minutes

Schematic of Traverse Point Layout

Probe Length and Type 26" Pyrex
Pitot Tube I.D. No. 26"
Nozzle I.D. 0.299
Assumed Moisture, % 2
Temp. Readout S/N
Meter Box Number MB 4
Meter $\Delta H_@$ 1.461
C Factor
Meter Gamma 1.006
Heater Box Setting —
Reference Δp —
Post Test Leak Rate = .002 cfm @ 11 in. Hg
Post Test Pitot Leak Check O.K
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
B	0.00	14:21	995.362									
B-1	5		999.85	.41	2.9	2.9	78	86	86	4		64
2	10		004.50	.47	3.2	3.2	76	92	86	3		50
3	15	14:51	9.80	.40	2.9	2.9	77	100	98	4		51
4	20		15.10	.42	3.0	3.0	76	101	90	4		54
5	25	15:11	19.41	.27	1.9	1.9	77	104	91	2		51
6	30		24.96	.33	3.4	3.4	77	110	94	5		51
7	35		29.25	.24	1.8	1.8	77	117	96	3		56
8	40		33.80	.23	1.8	1.8	77	119	99	3		55
9	45		37.63	.23	1.8	1.8	77	120	100	3		55
10	50		41.68	.20	1.5	1.5	79	126	104	2		55
11	55		44.92	.12	.97	.97	78	126	106	2		55
12	60		47.800	.10	.76	.76	78	127	107	2		56
A-1		16:09	54.50	.70	4.9	4.9	77	110	105	7		60
2			58.28	.18	1.3	1.3	77	110	108	2		57
3			61.42	.12	.92	.92	75	120	108	2		57
4			64.83	.15	1.1	1.1	77	121	108	2		57
5			68.21	.14	1.1	1.1	77	124	109	2		56
6			72.04	.17	1.1	1.1	77	125	110	2		56
7			76.50	.30	2.0	2.0	76	128	111	3		57
8			81.63	.37	2.6	2.6	76	130	112	3		56
9			87.01	.41	2.9	2.9	76	136	114	4		55
10			92.41	.42	3.0	3.0	75	138	116	4		55
11			97.85	.42	3.0	3.0	74	138	116	4		57
12	120		103.215	[illegible]	[illegible]	[illegible]	75	140	[illegible]	[illegible]		58

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY AND INTEGRITY DATA FORM

Plant Rull Tech Sample date 9/24/87
Sample location Scrubber Out Run number SO-B-6
Sample recovery person _____ Recovery date 9/24/87
Filter(s) number Box 5A

MOISTURE

Impingers		Silica gel		
Final volume (wt)	____ ml (g)	Final wt	____ g	____ g
Initial volume (wt)	____ ml (g)	Initial wt	____ g	____ g
Net volume (wt)	____ ml (g)	Net wt	____ g	____ g
Total moisture	____ g			

Color of silica gel _____
Description of impin water _____

RECOVERED SAMPLE

Blank filter container number _____ Sealed _____
Filter container number _____ Sealed _____
Description of particulate on filter _____

Acetone rinse container number _____ Liquid level marked? _____
Acetone blank container number _____ Liquid level marked? _____
Samples stored and locked _____
Remarks _____

Date of laboratory custody _____
Laboratory personnel taking custody _____
Remarks _____

#1 592.0 599.2
#2 582.4 584.9
#3 596.3 597.2
#4 750.8 777.1

Mist Eliminator
Outlet

SAMPLING SUMMARY SHEET

PLANT _____ LOCATION _____

SAMPLED SOURCE Trial Run Fixed Point

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	[illegible]	1	1.012	1.42	29.13	132.637	120	112.394	/	-0.5	29.07	[illegible]	/			[illegible]	[illegible]
2																	
3						108.086	108.56										
SCA-2	2220887	24	.984	3.16	29.14	120.580	109		/	-3.5		75		26.7			

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	[illegible]	[illegible]	[illegible]			28.95	[illegible]	.84	14.0800	120	.178	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2																	
3																	
4	0.7	21	78.3			28.95		.84	14.0800	120	.298		23				

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

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

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

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

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

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

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

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

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

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]

%H = 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.

SUMMARY OF EMISSIONS

PLANT _____ LOCATION _____

SAMPLED SOURCE _____

RUN	DATE	(1) V_m Std.	(2) DSCFM
		[illegible]	10051

FRONT HALF MILLIGRAMS					(4) BACK HALF	5 FRONT + BACK TOTAL
PROBE	CYCLONE	FILTER	(3) TOTAL			
			[illegible]	[illegible]		

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
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: _____

SAMPLING SUMMARY SHEET

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Demister 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
ME01	22SEP87	This	Run	Not	Performed												
ME 02	22SEP87	24	1.012	1.94	29.14	86.556	101	80.686		-.03	29.14	85		28.9	1.36	1.66	.983
ME 03	23SEP87	24	1.012	2.07	29.20	88.532	90	84.382		-.03	29.20	79		29.4	1.38	1.61	.984
ME 04	23SEP87	24	1.012	2.14	29.19	91.113	106	84.369		-.03	29.19	86		31.2	1.47	1.71	.983

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
ME 01																	
ME 02	0.7	21.0	78.3			28.95	28.77	0.84	28.6069	120	.178	71.0	22	2.64	11238	10427	98.6
ME 03	0.7	21.0	78.3			28.95	28.78	0.84	29.6920	120	.178	73.6	22	2.64	11651	10958	98.1
ME 04	0.7	21.0	78.3			28.95	28.76	0.84	29.6390	120	.178	73.5	22	2.64	11635	10788	99.6

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

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

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

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

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

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

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

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

$$\%I = \frac{0.07450 \times (T_s + 460) \times V_m \text{ Std.}}{V_s \times T_t \times P_s \times M_d \times A_n}$$

N_p = Total No. of Sampling points

Y_m = Meter Box Correction Factor

ΔH = Average 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]

%H = 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

$\sqrt{\Delta P (T + 460)}$ 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.

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Demister Outlet

RUN	DATE	(1) V_m Std.	(2) DSCFM
ME 01		This	Run
ME-02	23SEP87	80.686	10427
ME03	23SEP87	84.382	10958
ME-04	23SEP87	84.369	10788

FRONT HALF MILLIGRAMS			
PROBE	CYCLONE	FILTER	(3) TOTAL
Not	Performed		
			.3095
			.1156
			.2819

(4) BACK HALF	5 FRONT + BACK TOTAL

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
ME01				
ME-02	.00006	.1355	.0053	.0024
ME-03	.00002	.0484	.0020	.0009
ME-04	.00005	.1180	.0048	.0022
	6	7	8	9

BACK HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
10	17	18	19

TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
20	21	22	23

Remarks:

SAMPLING SUMMARY SHEET

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Demister 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
ME 05	24SEP87	24	1.012	2.06	29.15	89.154	98	83.608	/	-.03	29.15	81	/	35.3	1.66	1.95	.981
ME 06	24SEP87	24	1.012	2.14	29.11	90.576	113	82.622	/	-.03	29.11	86	/	30.0	1.41	1.68	.983

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
ME 05	0.7	21.0	78.3	/	/	28.95	28.74	.84	29.1503	120	.178	72.3	22	2.64	11456	10680	99.7
ME 06	0.7	21.0	78.3	/	/	28.95	28.77	.84	29.5543	120	.178	73.3	22	2.64	11617	10745	97.9

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

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

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

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

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

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

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

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

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

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

$V_{w_{gas}}$ = Volumn 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 = Pitot Tube Coefficient

$\sqrt{\Delta P (T + 460)}$ 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.

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Demister Outlet

RUN	DATE	1 V_m Std.	2 DSCFM
ME 05	24SEP87	83.608	10680
ME 06	24SEP87	82.622	10745

FRONT HALF MILLIGRAMS			
PROBE	CYCLONE	FILTER	3 TOTAL
			.1287
			.1178

4 BACK HALF	5 FRONT + BACK TOTAL

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
ME 05	.00002	.0544	.0022	.0010
ME 06	.00002	.0504	.0020	.0009
	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:

Roll Technology 9-21-87

22" Φ

down 20"

up 76.5"

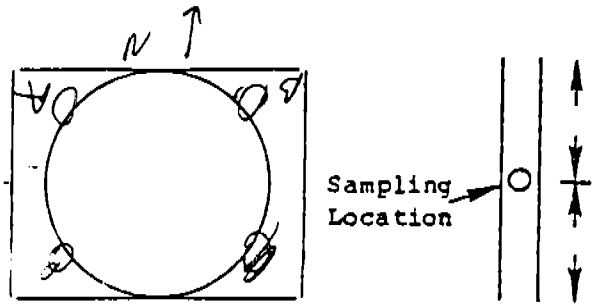
1/8" wall thickness

"demister outlet"

POINT #	TRAV.
1	0.6
2	1.6
3	2.7
4	4.0
5	5.6
6	7.9
7	14.3
8	16.6
9	18.2
10	19.5
11	20.7
12	~~21.6~~ 21.5

PRELIMINARY VELOCITY TRAVERSE

Plant: ROLL
Date: 9-21-87
Location: MIST OUTLET
Stack I.D.: 22"
Barometric Pressure, in. Hg: 29.13
Stack Gauge Pressure, in. H_2O: +0.80
Operators: J. BLAU
Pitot Tube I.D. Number: 37
Temperature Readout I.D.: OMEGA #2
Pitot Tube Leak Check: O.K.



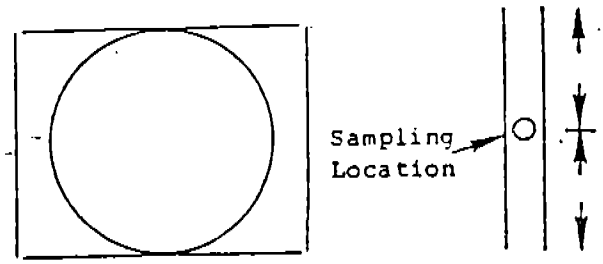
Schematic of Traverse Point Layout

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
A-1	1.25	85°F	
2	1.40		
3	1.40		
4	1.50		
5	1.50		
6	1.50		
7	1.50		
8	1.50		
9	1.55		
10	1.50		
11	1.50		
12	1.40		
Average			

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
B-1	1.30		
-2	1.30		
3	1.35		
4	1.35		
5	1.30		
6	1.40		
7	1.50		
8	1.50		
9	1.50		
10	1.45		
11	1.45		
12	1.60		
Δp_{avg}	1.44		
$\sqrt{\Delta p}$			
	29.19		
Average			

PRELIMINARY VELOCITY TRAVERSE

Plant: Roll Tech
Date: 9-23-87
Location: Demister outlet
Stack I.D.: 22
Barometric Pressure, in. Hg: 29.20
Stack Gauge Pressure, in. H_2O:
Operators: J. Blau, J. McLean
Pitot Tube I.D. Number: 41
Temperature Readout I.D.:
Pitot Tube Leak Check: 0.11



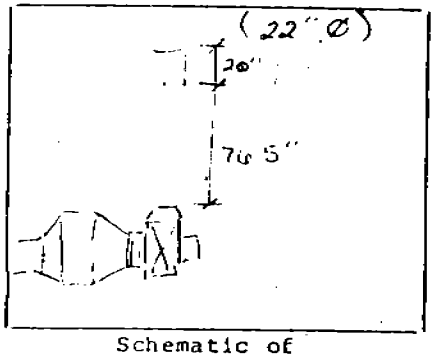
Schematic of Traverse Point Layout

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
A 1			+18
2			+32
3			+11
4			+22
5			+15
6			+18
7			-8
8			-8
9			-6
10			-10
11			-5
12			-10
Average			

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
B-1			-17
2			-20
3			-26
4			-25
5			-14
6			-17
7			-6
8			0
9			+3
10			+5
11			+10
12			+8
Average			

FIELD DATA

Plant Roll Tech.
Date 4-21-87
Sampling Location DEMISTER OUTLET
Sample Type
Run Number PRELIMINARY
Operator T MILLER / PEER CONS.
Ambient Temperature
Barometric Pressure 29.13 "Hg
Static Pressure (P_g) -0.8
Filter Number(s) —
Pretest Leak Rate = 0.00 cfm @ 10 in. Hg
Pretest Pitot Leak Check OK
Pretest Orsat Leak Check —
Read and Record all Data Every ___ Minutes



Schematic of Traverse Point Layout

Probe Length and Type 3' PYREX
Pitot Tube I.D. No. 3'
Nozzle I.D. 0.178
Assumed Moisture, % 2.0
Temp. Readout S/N OMEGA 2
Meter Box Number MB-3
Meter $\Delta H_@$ 2.163
C Factor ~~1.012~~
Meter Gamma 1.012
Heater Box Setting —
Reference Δp
Post Test Leak Rate = 0.003 cfm @ 9.0 in. Hg
Post Test Pitot Leak Check OK
Post Test Orsat Leak Check —

Traverse Point Number	Sampling Time, (min)	/Clock / Time /(24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Im-pinger Temp. °F
P	0	/ 1515	758.652	1.4	1.77	1.77	87			4.5	—	56
O	5.0	/	760.950	1.4	1.77	1.77	87	94	91	4.5	—	55
I	15.0	/	767.773	1.4	1.80	1.80	87	111	94	4.5	—	61
N	20.0	/	771.270	1.4	1.80	1.80	87	118	96	4.5	—	62
T	30.0	/	778.255	1.4	1.83	1.83	87	122	100	4.5	—	61
	45.0	/	788.810	1.4	1.86	1.86	86	131	108	4.5	—	63
#	60.0	/ 1618	799.785	1.4	1.88	1.88	86	137	113	4.5	—	64
6 rm	80.0	/		1.45	1.95	1.95	86	138.5	117.3	4.5	—	
	105.0	/	832.880	1.45	1.97	1.97	86	143	120	4.5	—	60
	135.0	/	855.375	1.45	1.98	1.98	87	150	124	4.5	—	62
	155.0	/	870.390	1.45	1.98	1.98	87	145	124	5.0	—	63
	180.0	/ 1818	889.259	1.45	1.98	1.98	87	145	124	5.0	—	63
		/										
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PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: 9/21/87

Sampling Location: Mist Eliminator outlet

Sample Type: MM13B

Run Number: preliminary-outlet

Sample Box Number: #1

Clean-up Man: NT/ MO

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

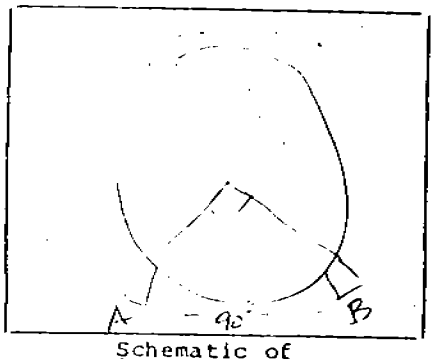
MOISTURE

	#1	#2	#3
Impingers			
Final Volume:	616.6 ~~ml~~ gr	609.2 ml	580.3 ml
Initial Volume:	604.0 ~~ml~~ gr	588.8 ml	596.2 ml
Net Volume:	~~ml~~ gr	ml	ml
Total H_2O:			
Silica Gel			
Final Volume:	761.9 g	g	g
Initial Volume	733.0 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant Roll Technology
Date 9/22/87
Sampling Location Mist Elim. - Outlet
Sample Type MM13-B
Run Number ~~ME-0-1~~ ME-0-2
Operator HO/NAT
Ambient Temperature 88
Barometric Pressure 29.14
Static Pressure (P_s) -0.03
Filter Number(s)
Pretest Leak Rate = 0.014 cfm @ 15 in. Hg
Pretest Pitot Leak Check ✓
Pretest Orsat Leak Check
Read and Record all Data Every 5.0 Minutes



Schematic of Traverse Point Layout

Probe Length and Type 4'
Pitot Tube I.D. No.
Nozzle I.D. 0.178
Assumed Moisture, % 2%
Temp. Readout S/N
Meter Box Number MB-3
Meter $\Delta H_@$ 2.163
C Factor
Meter Gamma 1.012
Heater Box Setting
Reference Δp HP41CX
Post Test Leak Rate = 0 cfm @ 3 in. Hg
Post Test Pitot Leak Check ✓
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min)	/ Clock Time / (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
		/ 5:58p	889.505	1.0 c	~~1.25c~~	~~1.25~~	~~85c~~	~~87c~~	~~86c~~	+c		
A-1	5.0	/	892.471	1.0	1.25	1.25	85	87	86	1	N/A	77
2	10.0	/	895.754	1.4	1.75	1.75	86	89	85	1	N/A	78
3	15.0	/	899.105	1.35	1.70	1.70	86	93	85	1	N/A	60
4	20.0	/	902.574	1.45	1.84	1.84	85	99	86	2	N/A	60
5	25.0	/	906.049	1.45	1.85	1.85	85	104	88	2	N/A	60
6	30.0	/	909.505	1.40	1.80	1.80	84	109	90	2	N/A	60
7	35.0	/	913.131	1.55	2.0	2.0	85	112	92	2	N/A	60
8	40.0	/	916.851	1.60	2.07	2.07	85	116	94	2	N/A	60
9	45.0	/	920.318	1.55	2.01	2.01	85	118	96	2	N/A	60
10	50.0	/	924.241	1.70	2.22	2.22	85	121	98	2.5	N/A	60
11	55.0	/	928.298	1.80	2.36	2.36	85	124	99	2.5	N/A	60
12	60.0	/ 7:05	932.275	1.80	2.37	2.37	85	127	101	2.5	N/A	60
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PACIFIC ENVIRONMENTAL SERVICES, INC.

Plant Name: Roll Technology Test Date: 9/22/87

Run Number: ~~ME-0-1~~ ME-0-2 Operator: ~~HJO~~/NAT

Traverse Point Number	Sampling Time, (min)	/Clock / Time /(24-hour / clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
B-1	5.0	17:20p *	935.892	1.2	1.53	1.53	85	98	95	1	N/A	60
2	10.0	/	939.287	1.25	1.61	1.61	80	101	93	1.5	N/A	55
3	15.0	/	942.774	1.45	1.85	1.85	85	104	92	2.0	N/A	55
4	20.0	/	946.312	1.50	1.92	1.92	85	108	92	2.0	N/A	55
5	25.0	/	949.899	1.50	1.93	1.93	85	110	92	2.0	N/A	55
6	30.0	/	953.544	1.55	2.0	2.0	85	113	93	2.0	N/A	55
7	35.0	/	957.264	1.60	2.07	2.07	85	115	94	2.0	N/A	55
8	40.0	/	960.989	1.60	2.07	2.07	85	116	94	2.0	N/A	55
9	45.0	/	964.681	1.65	2.14	2.14	84	116	95	2.0	N/A	55
10	50.0	/	968.498	1.65	2.14	2.14	84	116	95	2.0	N/A	55
11	55.0	/	972.327	1.65	2.15	2.15	84	118	95	2.0	N/A	55
12	60.0	/	976.061	1.55	2.02	2.02	83	118	96	2.0	N/A	55

* No leak check done between traverse change-

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: 9/22/87

Sampling Location: Mist Eliminator Outlet

Sample Type: M M 13 B

Run Number: ME-O-2 3

Sample Box Number: #4

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

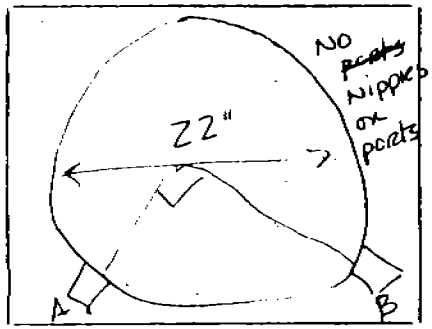
MOISTURE

	#1	#2	#3
Impingers			
Final Volume:	582.1 ~~ml~~ g	605.7 ~~ml~~	580.5 ~~ml~~
Initial Volume:	569.1 ~~ml~~	603.6 ~~ml~~	581.1 ~~ml~~
Net Volume:	~~ml~~	~~ml~~	~~ml~~
Total H_2O:			
Silica Gel	#4		
Final Volume:	727.7 g	g	g
Initial Volume	713.3 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant Roll Technology
Date 9/23/87
Sampling Location Mist Eliminator-Out
Sample Type MM13-B
Run Number HE-0-3
Operator HAO-NAT
Ambient Temperature 58° F
Barometric Pressure 29.20
Static Pressure (P_s) -0.03
Filter Number(s)
Pretest Leak Rate = 0.001 cfm @ 12 in. Hg
Pretest Pitot Leak Check ✓
Pretest Orsat Leak Check
Read and Record all Data Every 5.0 Minutes



Schematic of Traverse Point Layout

Probe Length and Type 4'
Pitot Tube I.D. No.
Nozzle I.D. 0.178
Assumed Moisture, % 2.0%
Temp. Readout S/N ~~MB-3~~
Meter Box Number MB-3
Meter $\Delta H_@$ 2.163
C Factor
Meter Gamma 1.012
Heater Box Setting
Reference Δp HP41CX
Post Test Leak Rate = 0 cfm @ 3 in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

976.270

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
A-		940	976.270				85c	70c	70c	1		
A-1	5.0		979.371	1.15	1.40	1.40	85	70	70	1	N/A	55
2	10.0		982.761	1.45	1.80	1.80	75	73	69	1	N/A	55
3	15.0		986.184	1.50	1.86	1.86	78	79	70	1	N/A	56
4	20.0		989.696	1.55	1.93	1.93	79	85	72	1.5	N/A	56
5	25.0		993.255	1.55	1.95	1.95	79	90	74	1.5	N/A	58
6	30.0		996.751	1.50	1.90	1.90	78	94	76	1.5	N/A	60
7	35.0		1000.450	1.65	2.10	2.10	78	97	79	1.5	N/A	60
8	40.0	1004.229	1004.229	1.70	2.17	2.17	78	101	81	1.5	N/A	60
9	45.0		1008.039	1.70	2.19	2.19	78	104	84	1.5	N/A	58
10	50.0		1011.981	1.80	2.33	2.33	78	107	86	1.5	N/A	57
11	55.0		1015.979	1.90	2.46	2.46	78	109	88	1.5	N/A	58
12	60.0	1040 *	1020.022	1.95	2.54	2.54	78	111	90	1.5	N/A	58

* No leak check between traverse point

PACIFIC ENVIRONMENTAL SERVICES, INC.

Plant Name: Roll Technology

Test Date: 9/23/87

Run Number: ME-D-3

Operator: HJO/NAT

Traverse Point Number	Sampling Time, (min)	/Clock / Time /(24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_g) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Im-pinger Temp. °F
		/ 1059	1020.022				78	91	88			
B-1	5.0	/	1023.526	1.5	1.91	1.91	78	91	88	1.0	N/A	55
2	10.0	/	1027.075	1.45	1.84	1.84	79	92	85	1.0	N/A	55
3	15.0	/	1030.612	1.6	2.03	2.03	81	96	84	1.0	N/A	60
4	20.0	/	1034.200	1.55	1.98	1.98	80	99	85	1.0	N/A	60
5	25.0	/	1037.977	1.70	2.17	2.17	80	100	85	1.5	N/A	60
6	30.0	/	1041.779	1.70	2.18	2.18	80	102	86	1.5	N/A	60
7	35.0	/	1045.644	1.80	2.31	2.31	80	103	86	1.5	N/A	60
8	40.0	/	1049.500	1.75	2.25	2.25	80	106	88	1.5	N/A	60
9	45.0	/	1053.345	1.75	2.25	2.25	81	105	88	1.5	N/A	60
10	50.0	/	1057.199	1.75	2.25	2.25	80	106	89	1.5	N/A	60
11	55.0	/	1060.999	1.70	2.19	2.19	80	106	90	1.5	N/A	60
12	60.0	/ 1159	1064.802	1.70	2.20	2.20	80	107	91	1.5	N/A	60

SAMPLE RECOVERY DATA

Plant: Roll Tech

Date: 9-23-87

Sampling Location: Mist Eliminator

Sample Type:

Run Number: ME 0 - 3

Sample Box Number:

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

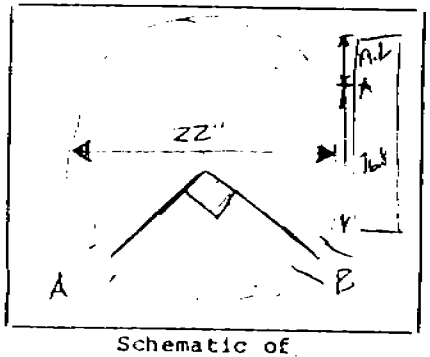
MOISTURE

Impingers			
Final Volume:	583.2 ml	609.7 ml	583.3 ml
Initial Volume:	570.9 ml	607.6 ml	583.6 ml
Net Volume:	ml	ml	ml
Total H_2O:			
Silica Gel			
Final Volume:	744.1 g	g	g
Initial Volume	728.8 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant: Roll Technology
Date: 9/23/87
Sampling Location: Mist Elim. - Outlet
Sample Type: MM13B
Run Number: ME-O-A
Operator: HO/NAT
Ambient Temperature: 87
Barometric Pressure:
Static Pressure (P_s): -0.03
Filter Number(s):
Pretest Leak Rate = 0.00 cfm @ 17 in. Hg
Pretest Pitot Leak Check: ✓
Pretest Orsat Leak Check:
Read and Record all Data Every 5 Minutes



Schematic of Traverse Point Layout

Probe Length and Type: 4'
Pitot Tube I.D. No.:
Nozzle I.D.: 0.178
Assumed Moisture, %: 2%
Temp. Readout S/N:
Meter Box Number:
Meter $\Delta H_@$: 2.163
C Factor:
Meter Gamma: 1.012
Heater Box Setting:
Reference Δp: HP41C
Post Test Leak Rate = 0.0 cfm @ 3 in. Hg
Post Test Pitot Leak Check:
Post Test Orsat Leak Check:

Traverse Point Number	Sampling Time, (min) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	/ 340p	65.012					87	86			68
A-1	5.0 /	68.314	1.25	1.61	1.61	86	87	86	1	N/A	68
2	10.0 /	71.714	1.40	1.78	1.78	85	89	84	1	N/A	60
3	15.0 /	75.329	1.55	1.99	1.99	84	95	85	1	N/A	60
4	20.0 /	78.859	1.60	2.07	2.07	85	102	87	1	N/A	60
5	25.0 /	82.585	1.60	2.08	2.08	85	107	89	1	N/A	64
6	30.0 /	86.331	1.60	2.10	2.10	85	113	92	1	N/A	62
7	35.0 /	90.179	1.65	2.18	2.18	85	117	95	1	N/A	60
8	40.0 /	94.048	1.65	2.19	2.19	85	121	98	1	N/A	61
9	45.0 /	97.951	1.70	2.27	2.27	85	124	100	1	N/A	60
10	50.0 /	102.000	1.80	2.41	2.41	85	126	102	1	N/A	60
11	55.0 /	106.010	1.75	2.34	2.34	85	124	104	1	N/A	60
12	60.0 / 440p	110.152	1.90	2.54	2.54	85	124	105	1	N/A	61
	/										
	/										
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	/										
	/										
	/										
	/										
	/										

Plant Name: Roll Technology

Test Date: 9/23/87

Run Number: HE-O-4

Operator: HO/NAT

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
			110.152*					102	100			
B-1	5.0	4:56p	113.214	1.0	1.31	1.31	85	102	100	1	N/A	60
2	10.0		116.699	1.4	1.84	1.84	83	105	98	1	N/A	63
3	15.0		120.421	1.6	2.09	2.09	88	111	99	1	N/A	60
4	20.0		124.281	1.65	~~1.78~~	2.18	87	117	100	1	N/A	60
5	25.0		128.209	1.70	2.26	2.26	86	120	101	1	N/A	61
6	30.0		132.151	1.70	2.26	2.26	87	124	103	1	N/A	62
7	35.0		136.244	1.80	2.41	2.41	86	127	105	1	N/A	61
8	40.0		140.319	1.80	2.42	2.41	86	129	106	1	N/A	62
9	45.0		144.281	1.70	2.28	2.28	86	129	107	1	N/A	62
10	50.0		148.284	1.75	2.35	2.35	86	128	108	1	N/A	61
11	55.0		152.249	1.70	2.28	2.28	86	128	108	1	N/A	60
12	60.0	5:56p	156.125	1.55	2.08	2.08	86	127	108	1	N/A	61

* no leak check done between traverse changes

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: 9/23/87

Sampling Location: Mist Eliminator - Outlet

Sample Type:

Run Number: ME-O-4

Sample Box Number: 4A

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers

Final Volume:	562.1 ml	567.0 ml	559.9 ml
Initial Volume:	549.9 ~~mlgr~~	564.3 ~~mlgr~~	559.3 ~~mlgr~~
Net Volume:	ml	ml	ml
Total H_2O:			

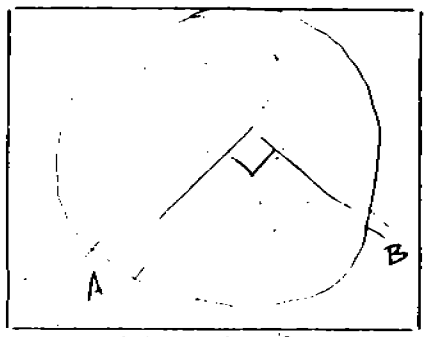
Silica Gel

Final Volume:	734.7 g	g	g
Initial Volume	719.0 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

FIELD DATA

Plant Roll Technology
Date 9/24/87
Sampling Location Mist Elim. Outlet
Sample Type MM13B
Run Number ME-O-5
Operator HJO-NAT
Ambient Temperature 58°
Barometric Pressure 29.15
Static Pressure (P_s) -0.03
Filter Number(s)
Pretest Leak Rate =0.002 cfm @ 12 in. Hg
Pretest Pitot Leak Check ✓
Pretest Orsat Leak Check
Read and Record all Data Every ___ Minutes



Schematic of Traverse Point Layout

Probe Length and Type 4" glass NO HEAT
Pitot Tube I.D. No.
Nozzle I.D. 0.178"
Assumed Moisture, % 1.0%
Temp. Readout S/N
Meter Box Number
Meter $\Delta H_@$ 2.163
C Factor
Meter Gamma 1.012
Heater Box Setting
Reference Δp HP41C
Post Test Leak Rate =0.003 cfm @ 13 in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	/ 940A	156.483									
A-1	5.0 /	159.609	1.3	1.62	1.62	80	71	71	1	N/A	60
2	10.0 /	162.064	1.45	1.82	1.82	79	76	70	1	N/A	56
3	15.0 /	166.439	1.45	1.84	1.84	78	83	72	1	N/A	56
4	20.0 /	170.149	1.55	1.98	1.98	79	90	74	1	N/A	56
5	25.0 /	173.731	1.55	2.01 ~~1.83~~	2.01 ~~1.83~~	79	96	77	1	N/A	56
6	30.0 /	177.329	1.50	1.94	1.94	79	101	80	1	N/A	58
7	35.0 /	181.029	1.55	2.02	2.02	80	104	82	1	N/A	58
8	40.0 /	184.814	1.60	2.10	2.10	80	108	86	1	N/A	58
9	45.0 /	188.741	1.70	2.24	2.24	80	111	89	1	N/A	59
10	50.0 /	192.700	1.75	2.31	2.31	80	113	91	1	N/A	59
11	55.0 /	196.701	1.80	2.38	2.38	80	114	93	1	N/A	59
12	60.0 / 1040	200.754	1.85	2.46	2.46	80	117	95	1	N/A	58
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Plant Name: Roll Technology

Test Date: 9/24/87

Run Number: ME-O-5

Operator: Hyc/NAT

Traverse Point Number	Sampling Time, (min) /	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Im-pinger Temp. °F
	/		200.754*									
B-1	5.0 /	11:01	204.00	0.46 1.20	1.58	1.58	80	100	97	1	N/A	60
2	10.0 /		207.449	1.35	1.78	1.78	82	106	98	1	N/A	60
3	15.0 /		211.151	1.55	2.04	2.04	83	110	98	1	N/A	60
4	20.0 /		214.981	1.60	2.12	2.12	83	116	100	1	N/A	60
5	25.0 /		218.819	1.60	2.13	2.13	83	120	101	1	N/A	60
6	30.0 /	start@	222.631	1.60	2.14	2.14	83	122	102	1	N/A	60
7	35.0 *//	12:02	226.781	1.70	2.29/2.23	2.29/2.23	80	125/100	103/98	1	N/A	58
8	40.0 /		230.439	1.70	2.24	2.24	80	127/102	104/99	1	N/A	60
9	45.0 /		234.372	1.75	2.30	2.30	83	105	98	1	N/A	60
10	50.0 /		238.200	1.65	2.18	2.18	83	113	99	1	N/A	60
11	55.0 /		241.941	1.60	2.13	2.13	83	117	100	1	N/A	60
12	60.0 /	12:27	245.637	1.45	1.93	1.93	83	120	101	1	N/A	60

* process down ~10 min

* no leak check was done between traverse changes

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE RECOVERY DATA

Plant: Boll Technology - EPA GLASS

Date: 9/24/87

Sampling Location: Mist Eliminator Outlet

Sample Type: MM13B

Run Number: ME-O-5

Sample Box Number: 4A

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

	E		663.1 A		566.5	
Impingers						
Final Volume:	472.8	ml	663.1 A	ml	566.5	ml
Initial Volume:	553.1	ml	566.6	ml	564.7	ml
Net Volume:		ml		ml		ml
Total H_2O:						
Silica Gel						
Final Volume:	743.1	g		g		g
Initial Volume	725.8	g		g		g
Net Volume		g		g		g
Total Moisture:						

Description of Impinger Catch:

FIELD DATA

Plant Roll Technology
Date 9/24/87
Sampling Location Mist Eliminator - Outlet
Sample Type MM13-B
Run Number ME-O-6
Operator HJO/NAT
Ambient Temperature
Barometric Pressure 29.11
Static Pressure (P_g) -0.03
Filter Number(s)
Pretest Leak Rate = 0.0 cfm @ 15 in. Hg
Pretest Pitot Leak Check ✓
Pretest Orsat Leak Check
Read and Record all Data Every 5.0 Minutes

Schematic of Traverse Point Layout

Probe Length and Type 4'
Pitot Tube I.D. No.
Nozzle I.D. 0.178
Assumed Moisture, % 1.0
Temp. Readout S/N
Meter Box Number MB-3
Meter $\Delta H_@$ 2.163
C Factor
Meter Gamma 1.012 γ
Heater Box Setting
Reference Δp HP41C
Post Test Leak Rate = 0.0 cfm @ 5 in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

246.337

Traverse Point Number	Sampling Time, (min) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_g) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	/	246.337					87	86			
A-1	5.0 / 2:25p	248.[illegible]	0.98	1.26	1.26	86	87	86	1	N/A	60
2	10.0 * / 2:41	252.581	1.45	1.86	1.86	87	95	90	1	N/A	60
3	15.0 * / 2:46	255.961	1.45	1.87	1.87	87	101	90	1.5	N/A	60
4	20.0 / ** 2:50	259.610	1.60	2.08	2.08	87	107	92	1.5	N/A	69
5	25.0 / * 2:55p	263.327	1.60	2.10	2.10	85	107	98	1.5	N/A	65
6	30.0 /	267.124	1.65	2.17	2.17	85	112	98	1.5	N/A	60
7	35.0 /	270.976	1.65	2.18	2.18	85	116	99	1.5	N/A	60
8	40.0 /	274.820	1.65	2.19	2.19	86	120	101	1.5	N/A	60
9	45.0 /	278.721	1.70	2.26	2.26	85	122	101	1.5	N/A	60
10	50.0 /	282.739	1.85	2.47	2.47	85	123	102	1.5	N/A	55
11	55.0 /	286.813	1.90	2.53	2.53	86	124	102	1.5	N/A	55
12	60.0 / 3:51	290.931	1.95	2.61	2.61	86	127	104	1.5	N/A	55
	/										
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* blew fuse ** lost power

SAMPLE RECOVERY DATA

Plant: Roll Technology

Date: 9/24/87

Sampling Location: Mist Eliminator - Outlet

Sample Type: MM13B

Run Number: ME - O - #6

Sample Box Number: Box 8-A

Clean-up Man:

Job Number:

Comments:

FRONT HALF

Filter Number:

Description of Filter:

MOISTURE

Impingers	#1	#2	#3
Final Volume:	584.0 ~~ml~~ gr	609.3 ~~ml~~ gr	585.4 ml gr
Initial Volume:	572.8 ~~ml~~	607.9 ~~ml~~	586.3 ~~ml~~
Net Volume:	~~ml~~	~~ml~~	~~ml~~
Total H_2O:			

Silica Gel	#4		
Final Volume:	739.9 g	g	g
Initial Volume	721.6 g	g	g
Net Volume	g	g	g
Total Moisture:			

Description of Impinger Catch:

Plant Name: Roll Technology

Run Number: MF-0-6

Test Date: 9/24/87

Operator: MO/NAT

Traverse Point Number	Sampling Time, (min) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
	/	290.931									
B-1	5.0 / 4:07p	294.445	1.45	1.92	1.92	86	112	108	1	N/A	65
2	10.0 /	298.075	1.50	1.99	1.99	87	119	107	1	N/A	60
3	15.0 /	301.771	1.50	2.01	2.01	87	125	108	1	N/A	60
4	20.0 /	305.421	1.60	1.97	1.97	87	130	109	1	N/A	60
5	25.0 /	309.254	1.60	2.16	2.16	87	132	111	1	N/A	60
6	30.0 /	313.100	1.60	2.17	2.17	87	135	112	1	N/A	60
7	35.0 /	317.09	1.70	2.31	2.31	87	137	113	1.5	N/A	60
8	40.0 /	321.099	1.70	2.33	2.33	85	140	116	1.5	N/A	60
9	45.0 /	325.104	1.70	2.33	2.33	86	141	117	1.5	N/A	65
10	50.0 /	329.112	1.65	2.27	2.27	86	142	119	1.5	N/A	65
11	55.0 /	333.065	1.60	2.20	2.20	85	142	120	1.5	N/A	65
12	60.0 /	336.913	1.50	2.07	2.07	85	142	121	1.5	N/A	65

SCREENING METHOD

FIELD SUMMARY SHEETS

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Inlet (Screening Method - During Test)

RUN	DATE	1 V_m Std.	2 DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	3 TOTAL	4 BACK HALF	5 FRONT + BACK TOTAL
1ITT1	22SEP87	3.732	11268				.292182		
1ITT2	22SEP87	3.619	11268				.267804		
1ICC1	22SEP87	3.844	11268				.381353		
1ICC2	22SEP87	4.05	11268				.297825		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
1TTT1	.00121	2.765	.1167	.0529		139.1%	+39.1%					
1TTT2	.00114	2.613	.1103	.0500		131.4%	+31.4%					
1ICC1	.00153	3.503	.1479	.0671		176.2%	+76.2%					
1ICC2	.00113	2.597	.1096	.0497		130.6%	+30.6%					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Before Test Pump Volume

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp. LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Inlet (Screening Method - After Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM
[illegible]	[illegible]/87	2.267	11268
IITT2	2/25/87	3.682	11268
IICC1	2/25/87	1.821	11268
IICC2	2/25/87	3.161	11268

FRONT HALF MILLIGRAMS					
PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF After Test	5 FRONT + BACK TOTAL
			.292182	-39.3%	
			.267804	+2%	
			.381353	-52.6%	
			.297825	-22%	

CONCENTRATIONS

FRONT HALF					BACK HALF				TOTAL			
RUN	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	Gr/DSCF	% Real Value	% High or Low	Kg/Hr	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
IITT1	.00199	4.551	.1921	.0871		228.9%	128.9%					
IITT2	.00113	2.569	.1084	.0492		129.2%	29.2%					
IICC1	.00323	7.395	.3121	.1416		272.0%	272.0%					
IICC2	.00145	3.327	.1404	.0637		167.4%	67.4%					
	[illegible]	[illegible]	[illegible]	[illegible]								
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Inlet (Screening Method - During Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	5 FRONT + BACK TOTAL
2ITT1	22SEP87	3.732	11779				.499975		
2ITT2	22SEP87	3.619	11779				1.211249		
2ICC1	22SEP87	3.844	11779				1.073034		
2ICCL2	22SEP87	4.050	11779				.539995		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
2ITT1	.00205	4.684	.2067	.0937		199.7%	+99.7%					
2ITT2	.00516	11.819	.5215	.2365		504.0%	+404.0%					
2ICC1	.00431	9.8577	.4349	.1973		420.4%	+320.4%					
2ICCL2	.00206	4.708	.2077	.0942		200.8%	+100.8%					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Before Test Pump Volume

SUMMARY OF EMISSIONS

PLANT Bell Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Cyclone Inlet (Screening Method - After Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	5 FRONT + BACK TOTAL
2ITT1	22SEP87	2.267	11779				.494975		
2ITT2	22SEP87	3.682	11779				1.211249		
2ICC1	22SEP87	1.821	11779				1.073034		
2ICC2	22SEP87	3.161	11779				.539995		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
2ITT1	.00337	7.7104	.3402	.1543		328.8%	228.8%					
2ITT2	.02509	11.6171	.5126	.2325		195.4%	395.4%					
2ICC1	.09909	20.3030	.9181	.4165		887.4%	787.4%					
2ICC2	.02264	6.0327	.2662	.1207		257.3%	157.3%					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C

SAMPLED SOURCE Scrubber Inlet (Screening Method - During Test)

RUN	DATE	1 V_m Std.	2 DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	3 TOTAL	4 BACK HALF	5 FRONT + BACK TOTAL
3ITT1	23SEP87	3.732	11027				.051403		
3ITT2	23SEP87	3.619	11027				.063516		
3ICC1	23SEP87	3.844	11027				.064742		
3ICCL2	23SEP87	4.050	11027				.094381		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
3ITT1	.00021	.4864	.0201	.0091		12.9%	-87.1%					
3ITT2	.00027	.6198	.0256	.0116		16.4%	-83.6%					
3ICC1	.00026	.5948	.0246	.0111		15.7%	-84.3%					
3ICCL2	.00036	.8230	.0340	.0154		21.8%	-78.2%					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Before Test Pump Volume

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Inlet (Screening Method - After Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	5 FRONT + BACK TOTAL
3ITT1	235-P87	2.267	11027				.051403		
3ITT2	235-P87	3.682	11027				.063516		
3ICC1	235-P87	1.821	11027				.064742		
3ICCL2	235-P87	3.161	11027				.094381		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
3ITT1	.00035	.8007	.0321	.0150		21.2%	-78.8%					
3ITT2	.00027	.6092	.0252	.0114		16.1%	-83.9%					
3ICC1	.00055	1.2555	.0519	.0235		33.2%	-66.8%					
3ICCL2	.00046	1.0544	.0436	.0198		27.9%	-72.1%					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Inlet (Screening Method - During Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	5 FRONT + BACK TOTAL
4ITT1	23SEP87	3.732	11034				.261103		
4ITT2	23SEP87	3.619	11034				.241882		
4ICC1	23SEP87	3.844	11034				.297725		
4ICC2	23SEP87	4.05	11034				.127031		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
4ITT1	.00108	2.4707	.1021	.0463		142.1%	+42.1%					
4ITT2	.00103	2.3603	.0976	.0443		135.7%	+35.7%					
4ICC1	.00120	2.7351	.1130	.0513		152.3%	+57.3%					
4ICC2	.00048	1.1077	.0458	.0208		63.7%	-36.3%					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Before Test Pump Volume

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Inlet (Screening Method - After Test)

RUN	DATE	1 V_m Std.	2 DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	3 TOTAL	4 BACK HALF	5 FRONT + BACK TOTAL
4ITT1	2350887	2.267	11034				.261103		
4ITT2	2350887	3.682	11034				.241882		
4ICC1	2350887	1.821	11034				.297725		
4ICC2	2350887	3.161	11034				.127031		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
4ITT1	.00178	4.067	.1681	.0763		233.9%	133.9%					
4ITT2	.00101	2.320	.0959	.0434		133.4%	33.4%					
4ICC1	.00252	5.774	.2386	.1082		332.0%	232.0%					
4ICC2	.00062	1.419	.0587	.0266		81.6%	-18.4%					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Inlet (Screening Method - During Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM
5ITT1	24SEP87	3.732	11191
5ITT2	24SEP87	3.619	11191
5ICC1	24SEP87	3.844	11191
5ICC2	24SEP87	4.050	11191

FRONT HALF MILLIGRAMS				(4)	5
PROBE	CYCLONE	FILTER	(3) TOTAL	BACK HALF	FRONT + BACK TOTAL
		.082938			
		.055335			
		.225992			
		.181688			

CONCENTRATIONS

FRONT HALF				
RUN	Gr/DSCF			Kg/Hr
5ITT1	.00034	.7848	.0329	.0149
5ITT2	.00024	.5400	.0226	.0103
5ICC1	.00091	2.0761	.0870	.0395
5ICC2	.00069	1.5842	.0664	.0301
	6	7	8	9

BACK HALF			
Gr/DSCF	% Real Value	% High or Low	Kg/Hr
	98.7%	-1.3%	
	67.9%	-32.1%	
	261.1%	+161.1%	
	199.3%	+99.3%	
10	17	18	19

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

Remarks: Before Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Inlet (Screening Method - After Test)

RUN	DATE	1 V_m Std.	2 DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	3 TOTAL	4 BACK HALF	5 FRONT + BACK TOTAL
5ITT1	24SEP87	2.267	11191				.032938		
5ITT2	24SEP87	3.682	11191				.055325		
5ICC1	24SEP87	1.821	11191				.225992		
5ICC2	24SEP87	3.161	11191				.181688		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
5ITT1	.00056	1.2920	.0542	.0246		162.5 %	62.5 %					
5ITT2	.00023	.5307	.0223	.0101		66.5 %	-33.2 %					
5ICC1	.00192	4.3826	.1837	.0833		551.3 %	451.3 %					
5ICC2	.00089	2.0298	.0851	.0386		273.0 %	173.0 %					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Scrubber Inlet (Screening Method – During Test)

RUN	DATE	1 V_m Std.	2 DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	3 TOTAL	4 BACK HALF	5 FRONT + BACK TOTAL
6ITT1	24SEP87	3.732	10361				.348409		
6ITT2	24SEP87	3.619	10361				.338029		
6ICC1	24SEP87	3.841	10361				.369474		
6ICCL2	24SEP87	4.050	10361				.211458		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% Rail Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
6ITT1	.00144	3.297	.1280	.0580		204.8%	+104.8%					
6ITT2	.00144	3.2985	.1280	.0581		204.9%	104.9%					
6ICC1	.00148	3.3943	.1317	.0598		210.8%	110.8%					
6ICCL2	.00081	1.8436	.0716	.0325		114.5%	14.5%					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Before Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Ball Technology Corp. LOCATION Greenville, S.C.

SAMPLED SOURCE Crusher Inlet (Screening Method — After Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS: PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	(5) FRONT + BACK TOTAL
6ITT1	2456287	2.267	10361				.348409		
6ITT2	2456287	3.682	10361				.338029		
6ITC1	2456287	1.821	10361				.369474		
6ITC2	2456287	3.161	10361				.211458		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
6ITT1	.00237	5.427	.2106	.0955		237.1%	237.1%					
6ITT2	.00142	3.242	.1258	.0571		201.4%	101.4%					
6ITC1	.00313	7.165	.2781	.1261		345.0%	345.0%					
6ITC2	.00103	2.362	.0917	.0416		146.7%	46.7%					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

OUTLET SUMMARIES

SUMMARY OF EMISSIONS

PLANT Hall Technology Inc LOCATION Greenville, S.C.

SAMPLED SOURCE Demister Outlet (Screening Method) (During Test)

RUN	DATE	1 V_m Std.	2 DSCFM
20TT1	[illegible]	3.717	1047
20TT2	[illegible]	3.+39	10427
20CC1	[illegible]	3.[illegible]	10421
20CC2	[illegible]	4.240	10421

FRONT HALF MILLIGRAMS				4	5
PROBE	CYCLONE	FILTER	3 TOTAL	BACK HALF	FRONT + BACK TOTAL
			.021341		
			.0203[illegible]		
			.027[illegible]		
			.0291+		

CONCENTRATIONS

FRONT HALF					BACK HALF				TOTAL			
RUN	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	Gr/DSCF	% Real Value	% High or Low	Kg/Hr	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
20TT1	.00009	.19[illegible]	.00[illegible]	.0035		146.6	+46.6					
20TT2	.00010	.2101	.0074	.0043		177.2	+77.2					
20CC1	.00012	.2645	.0103	.0047		195.2	+95.2					
20CC2	.00011	.24[illegible]	.0075	.0043		179.5	+79.5					
	.00006	.335	.0053	.0024								
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Before Test Pump Volume

SUMMARY OF EMISSIONS

PLANT Roll Technology Corporation LOCATION Greenville, S.C.

SAMPLED SOURCE Demister Outlet (Screening Method After Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	5 FRONT + BACK TOTAL
20TT1	22SEP87	5.594	10427				.021349		
20TT2	22SEP87	3.876	10427				.023386		
20CC1	22SEP87	3.524	10427				.027252		
20CC2	22SEP87	4.584	10427				.029894		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% of Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
20TT1	.00006	.1348	.0053	.0024		99.5%	-0.5%					
20TT2	.00009	.2131	.0083	.0038		157.3%	+57.3%					
20CC1	.00012	.2731	.0107	.0048		201.5%	101.5%					
20CC2	.00010	.2303	.0090	.0041		170.0%	70.0%					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Roll Technology Inc. LOCATION Greenville, S.C.

SAMPLED SOURCE Demister Outlet (Screening Method During Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	(5) FRONT + BACK TOTAL
30TT1	23SEP87	7.594	10958				.009564		
30TT2	23SEP87	6.878	10958				.008381		
30CC1	23SEP87	7.276	10958				.006904		
30CCL2	23SEP87	8.680	10958				.018424		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% REAL VALUE	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
30TT1	.00002	.0445	.0018	.0008		91.9	-8.1					
30TT2	.00002	.0430	.0018	.0008		88.8	-11.2					
30CC1	.00001	.0335	.0014	.0006		69.2	-30.8					
30CCL2	.00003	.0750	.0031	.0014		155.0	+55.0					
	.00002	.0484	[illegible]	[illegible]								
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Before Test Pump Volume

SUMMARY OF EMISSIONS

PLANT Roll Technology Corporation LOCATION Greenville, S.C.

SAMPLED SOURCE Demister Outlet (Screening Method After Test)

RUN	DATE	1 V_m Std.	2 DSCFM
30TT1	23SEP87	4.19(2)	10 958
30TT2	23SEP87	3.38(2)	10958
30CC1	23SEP87	3.65(2)	10958
30CC2	23SEP87	4.46(2)	10958

FRONT HALF MILLIGRAMS				4	5
PROBE	CYCLONE	FILTER	3 TOTAL	BACK HALF	FRONT + BACK TOTAL
			.009564		
			.008381		
			.006904		
			.018424		

CONCENTRATIONS

FRONT HALF					BACK HALF				TOTAL			
RUN	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	Gr/DSCF	% of Real Value	% High or Low	Kg/Hr	Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
30TT1	.00002	.0403	.0017	.0008		83.3%	-16.7%					
30TT2	.00002	.0438	.0018	.0008		90.5%	-9.5%					
30CC1	.00001	.0334	.0014	.0006		69.0%	-31.0%					
30CC2	.00003	.0729	.0030	.0014		150.6%	50.6%					
6	7	8	9		10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Roll Technology, Inc. LOCATION Greenville, S.C.

SAMPLED SOURCE Damister Outlet (Screening Method) (During Test)

RUN	DATE	1 V_m Std.	2 DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	3 TOTAL	4 BACK HALF	5 FRONT + BACK TOTAL
40TT1	235EP87	7.594	10788				.030347		
40TT2	235EP87	6.878	10788				.035356		
40CC1	235EP87	7.276	10788				.029486		
40CC2	235EP87	8.680	10788				.037181		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% REAL VALUE	% HIGH or LOW	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
40TT1	.00006	.1411	.0057	.0026		119.6	+19.6					
40TT2	.00008	.1815	.0073	.0033		153.8	+53.8					
40CC1	.00006	.1431	.0058	.0026		121.3	+21.3					
40CC2	.00007	.1513	.0061	.0028		128.2	+28.2					
	.00005	.1180	.0048	.0022								
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Before Test Pump Volume

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Demister Outlet (Screening Method After Test)

RUN	DATE	1 V_m Std.	2 DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	3 TOTAL	4 BACK HALF	5 FRONT + BACK TOTAL
40TT1	23SEP87	8.38	10788				.030347		
40TT2	23SEP87	6.76	10788				.035356		
40CC1	23SEP87	7.30	10788				.029486		
40CC2	23SEP87	8.92	10788				.037181		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% of Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr
40TT1	.00006	.1279	.0052	.0023		108.4 %	8.4 %					
40TT2	.00008	.1847	.0075	.0034		156.5 %	56.5 %					
40CC1	.00006	.1426	.0058	.0026		120.8 %	20.8 %					
40CC2	.00006	.1472	.0060	.0027		124.7 %	24.7 %					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Roll Technology, Inc. LOCATION Greenville, ~~N.C.~~ S.C.

SAMPLED SOURCE Demister Outlet (Screening Method) (During Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	5 FRONT + BACK TOTAL
50TT1	24SEP87	7.594	10680				.008344		
50TT2	24SEP87	6.878	10680				.009491		
50CC1	24SEP87	7.276	10680				.012274		
50CC2	24SEP87	8.680	10680				.015866		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% REAL VALUE	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
50TT1	.00002	.0388	.0016	.0007		71.3	- 28.7					
50TT2	.00002	.0488	.0020	.0009		89.7	- 10.3					
50CC1	.00003	.0596	.0024	.0011		109.6	+ 9.6					
50CC2	.00003	.0646	.0026	.0012		118.8	+ 18.8					
	.00002	.0544	.0022	.0010								
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Before Test Pump Volume

SUMMARY OF EMISSIONS

PLANT Roll Technology Corp LOCATION Greenville, S.C.

SAMPLED SOURCE Demister Outlet (Screening Method ~~Before~~ After Test)

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	(5) FRONT + BACK TOTAL
50TT1	24SEP87	8.38	10680				.008344		
50TT2	24SEP87	6.76	10680				.009496		
50CC1	24SEP87	7.30	10680				.012274		
50CC2	24SEP87	8.92	10680				.015866		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% of Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
50TT1	.00002	.0352	.0014	.0006		59.3	-40.7					
50TT2	.00002	.0496	.0020	.0009		83.5	-16.5					
50CC1	.00003	.0594	.0024	.0011		100.0	0.0					
50CC2	.00003	.0628	.0025	.0011		105.7	5.7					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

SUMMARY OF EMISSIONS

PLANT Roll Technology, Inc. LOCATION Greenville, S.C.

SAMPLED SOURCE Demister Outlet (Screening Method) (During Test)

RUN	DATE	1 V_m Std.	2 DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	3 TOTAL	4 BACK HALF	5 FRONT + BACK TOTAL
60TT1	24SEP87	7.594	10745				.020495		
60TT2	24SEP87	6.878	10745				.015110		
60CC1	24SEP87	7.276	10745				.023031		
60CCL2	24SEP87	8.680	10745				.027917		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% REAL VALUE	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
60TT1	.00004	.0953	.0038	.0017		189.1	+89.1					
60TT2	.00003	.0776	.0031	.0014		154.0	+ 54.0					
60CC1	.00005	.1118	.0045	.0020		221.8	+121.8					
60CCL2	.00005	.1136	.0046	.0021		225.4	+125.4					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Before Test Pump Volume

SUMMARY OF EMISSIONS

PLANT Roll Technology Corporation LOCATION Greenville S.C.

SAMPLED SOURCE Demister Outlet Screening Method (~~[illegible]~~) After Test

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	(3) TOTAL	(4) BACK HALF	5 FRONT + BACK TOTAL
60TT1	245EP87	8.38	10745				.020495		
60TT2	245EP87	6.76	10745				.015110		
60CC1	245EP87	7.30	10745				.023031		
60CC2	245EP87	8.92	10745				.027917		

CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	BACK HALF Gr/DSCF	% of Real Value	% High or Low	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
60TT1	.00004	.0864	.0035	.0016		171.4%	71.4%					
60TT2	.00003	.0789	.0032	.0014		156.5%	56.5%					
60CC1	.00005	.1114	.0045	.0020		221.0%	121.0%					
60CC2	.00005	.1105	.0045	.0020		219.2%	119.2%					
	.00002	.0914	.0020	.0009								
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: After Test Pump Volumes

ROLL TECH. GREENVILLE, S.C.

CC - CASSETTE CONE CCL - CASSETTE CONE LONG
TT - TEFLON TUBING (TAPERED) CALIBRATED ROTAMETERS

SCRUBBER INLET 9.22
(RUN SIMULTANEOUS WITH MM 13B)

SAMPLE	1-I CC-1	1-I CCL-2	1-I TT-1	1-I TT-2
FLOW	~1.5	~4.5	~3.5	~3.5

START 11:58
STOP 12:58
60 MIN

SAMPLE	2-I CC-1	2-I CCL-2	2-I TT-1	2-I TT-2
FLOW	~3.5	~4.5	~3.5	~4.5

START 17:57
STOP 18:07 (TRIPPED PANEL BREAKER)
RESTART 18:10
STOP 19:00
60 MIN

ROLL TECH GREENVILLE, S.C.

R - REUSE TEFLON TUBE

9-23

SCRUBBER INLET

SAMPLE	3-I-CC1	3-I-(R)CC2	3-I-TT1	3-I-TT2
FLOW	~3.5	~4.5	~4.0	~4.0

START 9:42
STOP 10:42
60 MIN

SAMPLE	4-ICC1	4-I(R)CC2	4-ITT1	4-I TT-2
FLOW	~3.5	~4.5	~4.0	~3.5

START 15:40
STOP 15:57 (TRIPPED PANEL BREAKER)
RESTART 15:59
STOP 16:42
60 MIN

ROLL TECH GREENVILLE, S.C.

SCRUBBER INLET 9-29

SAMPLE	S-I CC1	S-I CCL2	S-I TT1	S-I TT2
FLOW	~3.5	~4.0	~3.5	~3.5

START 9:42
STOP 10:42
60 MIN

SAMPLE	C-I CC1	C-I CCL2	C-I TT1 (R)	C-I TT2 (R)
FLOW	~3.5	~4.0	~3.5	~3.5

START 14:24
STOP 14:25 (BLOWN FUSE AT OUTLET)
RESTART 14:38
STOP 14:45 (TRIPPED BREAKER)
RESTART 14:47
STOP 14:50 (TRIPPED BREAKER) (PLANT APPLIANCE ADDED TO CIRCUIT, WAITED FOR BREAKER COOLDOWN)
RESTART 15:00
STOP 15:02 (TRIPPED BREAKER) (RELOCATED POWER CORDS)
RESTART 15:10
STOP 15:57
60 MIN

7-0 TT (W/O ROTAMETER)

A & B

9-29-87

START: 13:35

STOP: 14:25 (FUSE) 50 242

RESTART: 14:38 292

STOP 18:40

~292 MIN

CC - CASSETTE Cone CCL - CASSETTE cone long

TT - Teflon Tube (TAPered) R - REUSE TEFLON TUBE

Run - MIST ELIM. out let

9/22 Sample	20 CC-1 pump	20 CCL-2	20 TT-1	20 TT-2
Start: 5:0[illegible]				
flow:	4.0	3.5	4.5	4.5
End: 6:08				
60 min				

9/23 1st hour	30 CC 1	30 CCL	30 TT-1	30 TT-2
Start 9:44				
flow	2.25	4.0	4.5	4.5
end 10:44				
2nd hour				
Start 11:59				
flow	2.0	4.25	4.5	5.0
end 11:59				
120 min				
9/23 1st Start 3:50	40 CC1	40 CCL-R	40 TT-1	40 TT-2
flow	3.0	3.75	4.5	5.0
End 4:50				
2nd Start 4:56				
flow	2.75	4.0	4.15	5.0
end 5:56				
1st pump for 15 sec		120 MIN		

9/24

		SOCC1	SOCCL-R	SOTT-1	SOTT-2
1st hour	Start	9:40			
	flow	3.0	4.5	5.0	5.25
	end	10:40			
2 hour	start	11:00			
	flow	3.20	4.5	5.0	5.0
	End	11:40			
less	re-start	12:01			
	flow		4.5	5.0	5.0
	end	12:21			
		3.5			
		120 MIN			

9/24	~~start~~ [redacted]				
		GOCC1	GOCCL-R	GOTT1	GOTT2
	start	[redacted] 2:35pm	4.5	4.5	4.5
1st hour	flow	3.0			
	End	3:35 pm			
	re-start	~~[redacted]~~ [redacted] 4:08	4.5	4.5	4.5
2 hour	flow	3.0			
	End	~~[redacted]~~ 5:08			
		120 MIN			

APPENDIX C

LABRATORY DATA

SAMPLING TRAIN HEXAVALENT CHROMIUM ANALYTICAL RESULTS

Company Name ROLL TECHNOLOGIES EEI Ref # _____

Sampling Location _____

Analyst MJ K_c 122.7 λ max 540 Date Analyzed 9/22

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.1	A_1 0.040	5.0	-0.6
10	82.8	A_2 0.082	10.1	0.6
25	62.1	A_3 0.207	25.4	1.6
50	38.8	A_4 0.411	50.5	0.9
75	24.4	A_5 0.613	75.2	0.2
100	15.45	A_6 0.811	99.5	-0.5

$$K_c = 5 \frac{A_1 + 2A_2 + 3A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2}$$

$A = -\log(\% T/100)$ Calc = $K_c * A$ % RSD = $\frac{\text{Calc} - \text{Conc}}{\text{Conc}}$

	Sample Number	Sample Volume (mL)	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Mass of Cr^{+6} micrograms ($M_{Cr^{+6}}$) TOTAL µg PER SAMPLE	µg/mL
9/21	ME-O-P	850	80	—	52.1	.2832	369.155	0.4
9/21	ME-O-P-BK	300	80	—	99.6	.002	0.801	0.00
DUPE	ME-O-P	850	80	—	55.7	.254	331.325	0.39
	LOT-24 NaOH BLK	100	80	—	99.9	.000434	0.067	0.00
	SO-A-1	750	80	—	60.9	.215	247.757	0.33
	SO-B-1	8600	~~40~~ 20	—	76.5	0.116	428.242	0.71
	SI-1	1,000	10	—	38.1	0.419	5,142.051	5.14
K_c = 125.5	9-22 NaOH BLANK	300	80	—	99.8	0.00087	0.409	0.001
	ME-O-2	600	80	—	46.9	0.329	309.509	0.51
DUPE	ME-O-2	600	80	—	46.7	0.331	311.255	0.51

F = Dilution factor required to reduce absorbance to the range of calibration.

$M_{Cr^{+6}} = A * F * K_c *$ Sample Volume / Volume Analyzed

NOTE: Cr^{+6} results reported to the nearest microgram or four significant figures

ENTROPY

SAMPLING TRAIN HEXAVALENT CHROMIUM ANALYTICAL RESULTS

Company Name ROLL TECHNOLOGIES EEI Ref # _____

Sampling Location _____

Analyst MSG K_c 125.5 λ max 540 Date Analyzed 9/23

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.3	A_1 0.040	5.0	
10	82.9	A_2 0.081	10.2	
25	62.6	A_3 0.203	25.5	
50	39.5	A_4 0.403	50.6	
75	25.2	A_5 0.599	75.1	
100	16.13	A_6 0.792	99.4	

$$K_c = 5 \frac{A_1 + 2A_2 + 3A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2}$$

$A = -\log(\% T/100)$ Calc = $K_c * A$ % RSD = $\frac{\text{Calc} - \text{Conc}}{\text{Conc}}$

	Sample Number	Sample Volume (mL)	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Mass of Cr^{+6} micrograms ($M_{Cr^{+6}}$) TOTAL µg SAMPLE	µg/mL
	SO.A.2	900	80	—	34.2	0.466	657.897	0.731
	SO.B.2	800	80	—	30.5	0.516	647.204	0.809
	SI.2	1,000	5	—	56.3	0.249	6,262.239	6.262
DUPE	SI.2	1,000	5	—	56.2	0.250	6,281.618	6.282
	SO.A.3	850	80	—	72.4	0.140	187.030	0.220
	SO.B.3	850	80	—	69.3	0.159	212.372	0.250
	SI.3	1,005	5	—	41.3	0.384	9,687.852	9.640
	ME.0.3	1,015	80	—	84.6	0.073	115.647	0.114

F = Dilution factor required to reduce absorbance to the range of calibration.

$M_{Cr^{+6}} = A * F * K_c *$ Sample Volume / Volume Analyzed

NOTE: Cr^{+6} results reported to the nearest microgram or four significant figures

ENTROPY

SAMPLING TRAIN HEXAVALENT CHROMIUM ANALYTICAL RESULTS

Company Name Roll Technologies EEI Ref # _____

Sampling Location _____

Analyst MSG K_c 124.2 λ max 540 Date Analyzed 9/24

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.1	A_1 0.040	5.0	0.6
10	82.9	A_2 0.081	10.1	1.2
25	62.4	A_3 0.205	25.4	1.8
50	39.3	A_4 0.406	~~75.6~~ 50.4	0.8
75	24.6	A_5 0.609	~~9~~ 75.6	0.9
100	15.90	A_6 0.799	99.2	-0.8

$$K_c = 5 \frac{A_1 + 2A_2 + 3A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2}$$

$A = -\log(\% T/100)$ Calc = K_c * A % RSD = $\frac{\text{Calc} - \text{Conc}}{\text{Conc}}$

	Sample Number	Sample Volume (mL)	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Mass of Cr^{+6} micrograms ($M_{Cr^{+6}}$) TOT. ug SAMPLE	ug/ml
	SO.A.4	1,000	80	—	41.1	0.386	599.511	0.600
	SO.B.4	900	80	—	38.0	0.420	587.147	0.652
	ME.O.4	1,010	80	—	66.1	0.180	281.929	0.279
	SI.4	1,000	5	—	66.0	0.180	4,482.529	4.483
DUPE	SI.4	1,000	5	—	66.0	0.180	4,482.529	4.483
	LC. NaOH BLANK	100	80	—	100.0	~~0.21~~	0	
	DUP A	1,000	5	—	61.7	0.210	5,209.317	5.209
	DUP B	850	80	—	67.7	0.169	223.559	0.263
	SO.A.5	900	80	—	63.8	0.195	272.714	0.303
	SO.B.5	800	80	—	63.6	0.197	244.106	0.305
	ME.O.5	950	80	—	81.8	0.087	128.678	0.135
	SI.5	900	5	—	80.7	0.093	2,081.935	2.313

F = Dilution factor required to reduce absorbance to the range of calibration.

$M_{Cr^{+6}} = A * F * K_c$ * Sample Volume / Volume Analyzed

NOTE: Cr^{+6} results reported to the nearest microgram or four significant figures

ENTROPY

SAMPLING TRAIN HEXAVALENT CHROMIUM ANALYTICAL RESULTS

Company Name ROLL TECHNOLOGIES EEI Ref # _____

Sampling Location _____

Analyst MEF K_c 124.2 λ max 540 Date Analyzed 9/24

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.1	A_1 0.040	5.0	0.6
10	82.9	A_2 0.081	10.1	1.2
25	62.4	A_3 0.205	25.4	1.8
50	39.3	A_4 0.406	50.4	0.8
75	24.6	A_5 0.609	75.6	0.9
100	15.90	A_6 0.799	99.2	-0.8

$$K_c = 5 \frac{A_1 + 2A_2 + 3A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2}$$

$A = -\log(\% T/100)$ $Calc = K_c * A$ $\% RSD = \frac{Calc - Conc}{Conc}$

	Sample Number	Sample Volume (mL)	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Mass of Cr^{+6} micrograms ($M_{Cr^{+6}}$) TOTAL µg SAMPLE	µg/ml
	S·O·A·6	1,035	80	—	59.9	0.223	357.639	0.346 ~~0.223~~
	S·O·B·6	950	80	—	59.6	0.225	331.484	0.349
	NE·O·6	900	80	—	74.6	0.127	117.816	0.198
	SI·6	950	5	—	67.9	0.168	3,967.537	4.176
DUPE	SI.6	950	5	—	68.0	0.167	3,952.455	4.160
	NaOH BLANK	300	80	—	99.9	0.0004	0.202	0.001

F = Dilution factor required to reduce absorbance to the range of calibration.

$M_{Cr^{+6}} = A * F * K_c *$ Sample Volume / Volume Analyzed

NOTE: Cr^{+6} results reported to the nearest microgram or four significant figures

ENTROPY

SAMPLING TRAIN HEXAVALENT CHROMIUM ANALYTICAL RESULTS

Company Name ROLL TECHNOLOGIES EEI Ref # _____

Sampling Location _____

Analyst MEG K_c 124.2 λ max 540 Date Analyzed 9/24

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.1	A_1 0.040	5.0	0.6
10	82.9	A_2 0.081	10.1	1.2
25	62.4	A_3 0.205	25.4	1.8
50	39.3	A_4 0.406	50.4	0.8
75	24.6	A_5 0.609	75.6	0.9
100	15.90	A_6 0.799	99.2	-0.8

$$K_c = 5 \frac{A_1 + 2A_2 + 3A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2}$$

$A = -\log(\% T/100)$ Calc = K_c * A % RSD = $\frac{\text{Calc} - \text{Conc}}{\text{Conc}}$

Sample Number	Sample Volume (mL)	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Mass of Cr^{+6} micrograms ($M_{Cr^{+6}}$) TOT ug SAMPLE	µg/ml
5I.TT.1	100	5	—	92.6	0.033	82.938	0.829
5I.TT.2	100	5	—	95.0	0.022	55.335	0.553
5I.CC.1	100	5	—	81.1	0.091	225.992	2.260
5I.CCL.2	100	5	—	84.5	0.073	181.688	1.817
NaOH BLANK	100	80	—	~~84~~99.8	0.001	0.135	0.001
DUPE 5ICCL.2	100	5	—	84.6	0.073	180.412	1.804
50.TT.1	50	20	—	94.0	0.027	8.344	0.167
50.TT.2	50	20	—	93.2	0.031	9.496	0.190
50.CC.1	50	20	—	91.3	0.040	12.274	0.245
50.CCL.2	50	20	—	88.9	0.051	15.866	0.317

F = Dilution factor required to reduce absorbance to the range of calibration.

$M_{Cr^{+6}} = A * F * K_c$ * Sample Volume / Volume Analyzed

NOTE: Cr^{+6} results reported to the nearest microgram or four significant figures

ENTROPY

CONCENTRATION OF HEXAVALENT CHROMIUM IN SOLUTION

Company Name ROLL TECHNOLOGIES EEI Ref # _____

Sampling Location TANK

Analyst MEF K_c 125.5 λ max 540 Date Analyzed 9/23

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.3	A_1 0.040	5.0	
10	82.9	A_2 0.081	10.2	
25	62.6	A_3 0.203	25.5	
50	39.5	A_4 0.403	50.6	
75	25.2	A_5 0.599	75.1	
100	16.13	A_6 0.792	99.4	

$$K_c = 5\,\frac{A_1 + 2A_2 + 5A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2} \qquad A = -\log(\%\,T/100) \qquad Calc = K_c * A \qquad \%\,RSD = \frac{Calc - Conc}{Conc}$$

Sample Number	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Conc. of Cr^{+6} micrograms/mL ($C_{Cr^{+6}}$)
TANK # 1	5	~~400~~ 8000	53.3	0.273	54,873
TANK # 2	5	~~400~~ 8000	55.9	0.253	50,[illegible]20
TANK # 3	5	~~400~~ 8000	56.2	0.250	50,253
TANK # 7	5	~~400~~ 8000	52.2	0.282	56,692
SCRUBBER	5	2,500	32.8	0.484	30,064
SCRUBBER	5	2,500	41.6	0.381	23,901.8

6/24
Kc = 124.2

after run 6

2 → 100 → 2 → 100 = 50 X 50

F = Dilution factor required to reduce absorbance to the range of calibration.

$C_{Cr^{+6}}$ = * A * F * K_c / Volume Analyzed

NOTE: Cr^{+6} results reported to three significant figures

ENTROPY

SAMPLING TRAIN HEXAVALENT CHROMIUM ANALYTICAL RESULTS

Company Name ROLL TECHNOLOGIES EEI Ref # _____

Sampling Location _____

Analyst MEA K_c 124.2 λ max 540 Date Analyzed 9/24

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.1	A_1 0.040	5.0	0.6
10	82.9	A_2 0.081	10.1	1.2
25	62.4	A_3 0.205	25.4	1.8
50	39.3	A_4 0.406	50.4	0.8
75	24.6	A_5 0.609	75.6	0.9
100	15.90	A_6 0.799	99.2	-0.8

$$K_c = 5 \frac{A_1 + 2A_2 + 3A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2}$$

$A = -\log(\% T/100)$ Calc = K_c * A % RSD = $\frac{\text{Calc} - \text{Conc}}{\text{Conc}}$

Sample Number	Sample Volume (mL)	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Mass of Cr^{+6} micrograms ($M_{Cr^{+6}}$) TOTAL µg SAMPLE	µg/ml
6·I·TT·1	100	5	–	72.4	0.140	348.409	3.484
6·I·TT·2	100	5	–	73.1	0.136	338.029	3.380
6·I·CC·1	100	5	–	71.0	0.149	369.474	3.695
6·I·CC·2	100	5	–	82.2	0.085	211.458	2.115
6·O·TT·1	50	20	–	85.9	0.066	20.495	0.410
6·O·TT·2	50	20	–	89.4	0.049	15.110	0.302
6·O·CC·1	50	20	–	84.3	0.074	23.031	0.461
6·O·CC·2	50	20	–	81.3	0.090	27.917	0.558
7OTT1	100	10	–	66.9	0.175	216.821	2.168
7OTT2	100	20	–	89.4	0.049	30.219	0.302

EXTRA LONG SCREENING WITHOUT RCTCR

F = Dilution factor required to reduce absorbance to the range of calibration.

$M_{Cr^{+6}} = A * F * K_c *$ Sample Volume / Volume Analyzed

NOTE: Cr^{+6} results reported to the nearest microgram or four significant figures

ENTROPY

SAMPLING TRAIN HEXAVALENT CHROMIUM ANALYTICAL RESULTS

Company Name ROLL TECHNOLOGIES EEI Ref # _____

Sampling Location SCREENING

Analyst MEG K_c 125.5 λ max 540 Date Analyzed 9/23

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.3	A_1 0.040	5.0	
10	82.9	A_2 0.081	10.2	
25	62.6	A_3 0.203	25.5	
50	39.5	A_4 0.403	50.6	
75	25.2	A_5 0.599	75.1	
100	16.13	A_6 0.792	99.4	

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

$A = -\log(\% T/100)$ Calc = $K_c * A$ % RSD = $\frac{\text{Calc} - \text{Conc}}{\text{Conc}}$

Sample Number	Sample Volume (mL)	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Mass of Cr^{+6} micrograms ($M_{Cr^{+6}}$) TOTAL µg SAMPLE	µg/ml
4-I-TT-1	100	5	–	78.7	0.104	261.103	2.611
4-I-TT-2	100	5	–	80.1	0.096	241.882	2.419
4-ICC-1	100	5	–	76.1	0.119	297.725	2.977
4-ICCL-2	100	5	–	89.0	0.051	127.031	1.270
4-O-TT-1	50	25	–	75.7	0.121	30.347	0.607
4-O-TT-2	50	25	–	72.3	0.141	35.356	0.707
4-O-CC-1	50	25	–	76.3	0.117	29.486	0.590
4-O-CCL-2	50	25	–	71.1	0.148	37.181	0.744

F = Dilution factor required to reduce absorbance to the range of calibration.

$M_{Cr^{+6}} = A * F * K_c *$ Sample Volume / Volume Analyzed

NOTE: Cr^{+6} results reported to the nearest microgram or four significant figures

ENTROPY

SAMPLING TRAIN HEXAVALENT CHROMIUM ANALYTICAL RESULTS

Company Name ROLL TECHNOLOGIES EEI Ref # _____

Sampling Location SCREENING

Analyst MEG K_c 125.5 λ max 540 Date Analyzed 9/23

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.3	A_1 0.040	5.0	-0.8
10	82.9	A_2 0.081	10.2	2.2
25	62.6	A_3 0.203	25.5	2.1
50	39.5	A_4 0.403	50.6	1.2
75	25.2	A_5 0.599	75.1	0.2
100	16.13	A_6 0.792	99.4	-0.6

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

$A = -\log(\% T/100)$ Calc = K_c * A % RSD = $\frac{\text{Calc} - \text{Conc}}{\text{Conc}}$

Sample Number	Sample Volume (mL)	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Mass of Cr^{+6} micrograms ($M_{Cr^{+6}}$) TOTAL µg SAMPLE	µg/ml
3I·TT1	100	~~5~~ 10	–	91.0	0.041	51.403	0.514
3I·TT·2	100	~~5~~ 10	–	89.0	0.051	63.516	0.635
3I·CC·1	100	~~5~~ 10	–	88.8	0.052	64.742	0.647
3I·CCL·2	100	~~5~~ 10	–	84.1	0.075	94.381	0.944
DUPE 3I·CCL·2	100	10	–	84.1	0.075	94.381	0.944
30·TT1	50	25	–	91.6	0.038	9.564	0.191
3.0·TT·2	50	25	–	92.6	0.033	8.381	0.168
3·0·CCl	53	25	–	94.2	0.026	6.904	0.130
3·0·CCL·2	52	25	–	85.0	0.071	18.424	0.354

F = Dilution factor required to reduce absorbance to the range of calibration.

$M_{Cr^{+6}} = A * F * K_c$ * Sample Volume / Volume Analyzed

NOTE: Cr^{+6} results reported to the nearest microgram or four significant figures

ENTROPY

SAMPLING TRAIN HEXAVALENT CHROMIUM ANALYTICAL RESULTS

Company Name ROLL TECHNOLOGIES EEI Ref # _____

Sampling Location _____

Analyst MEG K_c 122.7 λ max 540 Date Analyzed 6/9/22

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.1	A_1 0.040	5.0	-0.6
10	82.8	A_2 0.082	10.1	0.6
25	62.1	A_3 0.207	25.4	1.6
50	38.8	A_4 0.411	50.5	0.9
75	24.4	A_5 0.613	75.2	0.2
100	15.45	A_6 0.811	99.5	-0.5

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

$A = -\log(\% T/100)$ Calc = $K_c * A$ % RSD = $\frac{\text{Calc} - \text{Conc}}{\text{Conc}}$

Sample Number	Sample Volume (mL)	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Mass of Cr^{+6} micrograms ($M_{Cr^{+6}}$) TOTAL µg SAMPLE	µg/mL
2·I·TT·1	100	10	–	39.5	0.403	494.975	4.950
2·I·TT·2	100	10	–	10.30	0.987	1,211.249	12.112
2·I·CC·1	100	10	–	13.35	0.875	1,073.034	10.730
2·I·CCL·2	100	10	–	36.3	0.440	539.995	5.400

9/22

F = Dilution factor required to reduce absorbance to the range of calibration.

$M_{Cr^{+6}} = A * F * K_c *$ Sample Volume / Volume Analyzed

NOTE: Cr^{+6} results reported to the nearest microgram or four significant figures

ENTROPY

SAMPLING TRAIN HEXAVALENT CHROMIUM ANALYTICAL RESULTS

Company Name ROLL TECHNOLOGIES EEI Ref # _____

Sampling Location SCRUBBER INLET (SCREENING)

Analyst MAG K_c 122.7 λ max 540 Date Analyzed 9/22

Concentration micrograms (Conc)	Percent Transmittance (% T)	Absorbance (A)	Calculated micrograms (Calc)	Percent Relative Standard Deviation (% RSD)
5	91.1	A_1 0.040	5.0	-0.6
10	82.8	A_2 0.082	10.1	0.6
25	62.1	A_3 0.207	25.4	1.6
50	38.8	A_4 0.411	50.5	0.9
75	24.4	A_5 0.613	75.2	0.2
100	15.45	A_6 0.811	99.5	-0.5

$$K_c = 5 \frac{A_1 + 2A_2 + 3A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2}$$

$A = -\log(\% T/100)$ $\quad$ Calc = K_c * A $\quad$ % RSD = $\frac{\text{Calc} - \text{Conc}}{\text{Conc}}$

Sample Number	Sample Volume (mL)	Volume Analyzed (mL)	Dilution Factor (F)	Percent Transmit. (% T)	Absorbance (A)	Mass of Cr^{+6} micrograms ($M_{Cr^{+6}}$) TOTAL µg/sample	µg/ml
TT-1	50	10	–	33.4	0.476	292.182	5.844
TT-2	50	10	–	36.6	0.437	267.804	5.356
CC-1	50	10	–	23.9	0.622	381.353	7.627
CCL-1	50	10	–	32.7	0.485	297.825	5.956
CCL-1 DUPE	50	10		32.8	0.484	297.011	5.904
2.0·TT·1	100	20	–	92.3	0.035	21.349	0.213
2.0·TT·2	50	20	–	83.9	0.076	23.386	0.468
2.0·CC·1	50	20	–	81.5	0.089	27.252	0.545
2.0·CCL·2	50	20	–	79.9	0.097	29.894	0.598

F = Dilution factor required to reduce absorbance to the range of calibration.

$M_{Cr^{+6}} = A * F * K_c$ * Sample Volume / Volume Analyzed

NOTE: Cr^{+6} results reported to the nearest microgram or four significant figures

I.D.'S HAD A FILTER CLEANED UP IN THE RINSE (NO REAGENT WAS USED IN THIS TRAIN)

PUMP 2

NOZZLE [3" TEFLON]

LONG CONE (PUMP 1)

-1 = PUMP 1
-2 = PUMP 2
CC = CASSETTE CONE
CCL = CASSETTE CONE LONG

ENTROPY

Oxford Laboratories, Inc.

Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 1-28-88
DATE REPORTED 1-29-88
88W9169

ENTROPY ENVIROMENTALIST INC
P.O. BOX 12291
RESEARCH TRIANGLE PK. , N.C. 27709-2291

P.O. # 020-88

ATTENTION: BRUCE HAWKS

SAMPLE DESCRIPTION: 7 0.1N NaOH IMPINGER REAGENT

1. SI.1 1000 ML
2. SI.2 1000 ML
3. SI.3 1005 ML
4. SI.4 1000 ML
5. SI.5 900 ML
6. SI.6 950 ML

RESULTS

	1	2	3	4	5	6
Chromium, as Cr, total ug	7500	7500	13600	5000	2250	4750

Oxford Laboratories, Inc.

Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 1-28-88
DATE REPORTED 1-29-88
88W9169

ENTROPY ENVIROMENTALIST INC
P.O. BOX 12291
RESEARCH TRIANGLE PK. , N.C. 27709-2291

P.O. # 020-88

ATTENTION: BRUCE HAWKS

SAMPLE DESCRIPTION: 7 0.1N NaOH IMPINGER REAGENT

7. NaOH BLANK

RESULTS

	7
Chromium, as Cr, ug/ml	<.055

Bruce A. Babson

BRUCE A. BABSON , CHEMIST

APPENDIX D

ANALYTICAL METHODS FOR

TOTAL CHROMIUM AND HEXAVALENT CHROMIUM

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

1. 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. 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. 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 pore 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. 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 § 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-diphenylcarbizide in 50 ml acetone. Store in a brown bottle. Discard when the solution becomes discolored.

5. 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 plus 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 at 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 each 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:

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

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. 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, 10ml, 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:

$$K_c = 5 \frac{A_1 + 2A_2 + 5A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2} \qquad \text{Eq. — -2}$$

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 ml) by more than __ percent (to be determined) for five of the six standards.

7. 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:

$$m = \frac{100\ K_c\ AF}{V_a} \qquad \text{Eq. } __ \text{-3}$$

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, Sections 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:

$$c_s = (10^{-6} g/\mu g)(m/V_{m(std)}) \qquad \text{Eq. -4}$$

7.5 Isokinetic Variation, Acceptable Results. Same as Method 5, Sections 6.11 and 6.12, respectively.

8. 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.

METHOD 3050

ACID DIGESTION OF SLUDGES

1.0 Scope and Application

1.1 Method 3050 is an acid digestion procedure used to prepare sludge-type and soil samples for analysis by flame or furnace atomic absorption spectroscopy (AAS) or by inductively coupled argon plasma spectroscopy (ICP). Samples prepared by Method 3050 may be analyzed by AAS or ICP for the following metals:

Antimony	Lead
Arsenic	Nickel
Barium	Selenium
Beryllium	Silver
Cadmium	Thallium
Chromium	Zinc
Copper	

1.2 Method 3050 may also be applicable to the analysis of other metals in sludge-type samples. However, prior to using this method for other metals, it must be evaluated using the specific metal and matrix.

2.0 Summary of Method

2.1 A dried and pulverized sample is digested in nitric acid and hydrogen peroxide. The digestate is then refluxed with either nitric acid or hydrochloric acid. Hydrochloric acid is used as the final reflux acid for the furnace analysis of Sb or the flame analysis of Sb, Ba, Be, Cd, Cr, Cu, Pb, Ni, and Zn. Nitric acid is employed as the final reflux acid for the furnace analysis of As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, Ag, Tl, and Zn or the flame analysis of Ag and Tl.

3.0 Interferences

3.1 Sludge samples can contain diverse matrix types, each of which may present its own analytical challenge. Spiked samples and any relevant standard reference material should be processed to aid in determining whether Method 3050 is applicable to a given waste. Nondestructive techniques such as neutron activation analysis may also be helpful in evaluating the applicability of this digestion method.

4.0 Apparatus and Materials

4.1 125-ml conical Phillips' beakers.

4.2 Watch glasses.

Revised 4/84

7.3 After the second reflux step has been completed and the sample has cooled, add 2 ml of Type II water and 3 ml of 30% hydrogen peroxide (H_2O_2). Return the beaker to the hot plate for warming to start the peroxide reaction. Care must be taken to ensure that losses do not occur due to excessively vigorous effervescence. Heat until effervescence subsides, and cool the beaker.

7.4 Continue to add 30% H_2O_2 in 1-ml aliquots with warming until the effervescence is minimal or until the general sample appearance is unchanged. (NOTE: Do not add more than a total of 10 ml 30% H_2O_2.)

7.5 If the sample is being prepared for the furnace analysis of Ag and Sb or direct aspiration analysis of Ag, Sb, Ba, Be, Cd, Cr, Cu, Pb, Ni, Tl, and Zn, add 5 ml of 1:1 HCl and 10 ml of Type II water, return the covered beaker to the hot plate, and heat for an additional 10 min. After cooling, filter through Whatman No. 42 filter paper (or equivalent) and dilute to 100 ml with Type II water (or centrifuge the sample). The diluted sample has an approximate acid concentration of 2.5% (v/v) HCl and 0.5% (v/v) HNO_3 and is now ready for analysis.

7.6 If the sample is being prepared for the furnace analysis of As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, Tl, and Zn, continue heating the acid-peroxide digestate until the volume has been reduced to approximately 2 ml, add 10 ml of Type II water, and warm the mixture. After cooling, filter through Whatman No. 42 filter paper (or equivalent) and dilute to 100 ml with Type II water (or centrifuge the sample). The diluted digestate solution contains approximately 2% (v/v) HNO_3. For analysis, withdraw aliquots of appropriate volume, add any required reagent or matrix modifier, and analyze by method of standard additions.

8.0 Quality Control

8.1 For each group of samples processed, procedural blanks (Type II water and reagents) should be carried throughout the entire sample-preparation and analytical process. These blanks will be useful in determining if samples are being contaminated.

8.2 Duplicate samples should be processed on a routine basis. Duplicate samples will be used to determine precision. The sample load will dictate the frequency, but 10% is recommended.

8.3 Spiked samples or standard reference materials should be employed to determine accuracy. A spiked sample should be included with each group of samples processed and whenever a new sample matrix is being analyzed.

8.4 The concentration of all calibration standards should be verified against a quality control check sample obtained from an outside source.

8.5 The method of standard addition shall be used for the analysis of all EP extracts and whenever a new sample matrix is being analyzed.

4.3 Drying ovens that can be maintained at 30° C.

4.4 Thermometer that covers range of 0° to 200° C.

4.5 Whatman No. 42 filter paper or equivalent.

5.0 Reagents

5.1 ASTM Type II water (ASTM D1193): Water should be monitored for impurities.

5.2 Concentrated nitric acid: Acid should be analyzed to determine level of impurities. If impurities are detected, all analyses should be blank corrected.

5.3 Concentrated hydrochloric acid: Acid should be analyzed to determine level of impurities. If impurities are detected, all analyses should be blank corrected.

5.4 Hydrogen peroxide (30%): Oxidant should be analyzed to determine level of impurities. If impurities are detected, all analyses should be blank corrected.

6.0 Sample Collection, Preservation, and Handling

6.1 All samples must have been collected using a sampling plan that addresses the considerations discussed in Section One of this manual.

6.2 All sample containers must be prewashed with detergents, acids, and distilled deionized water. Plastic and glass containers are both suitable.

6.3 Nonaqueous samples shall be refrigerated when possible, and analyzed as soon as possible.

7.0 Procedure

7.1 Weigh and transfer to a 125-ml conical Phillips' beaker a 1.0-g portion of sample which has been dried at 60° C, pulverized, and thoroughly mixed.

7.2 Add 10 ml of 1:1 nitric acid (HNO_3), mix the slurry, and cover with a watch glass. Heat the sample at 95° C and reflux for 10 min. Allow the sample to cool, add 5 ml of conc. HNO_3, replace the watch glass, and reflux for 30 min. Do not allow the volume to be reduced to less than 5 ml while maintaining a covering of solution over the bottom of the beaker.

APPENDIX E.

DRAFT
1708-12E3/CEP
11/6/87 2

AMPERE-HOUR CALCULATIONS
TEST RUN NO.: 1

Time, 24-h clock		Time interval, min		Current,	Ampere-hours	
Inlet	Outlet	Inlet	Outlet	amperes	Inlet	Outlet
			TANK NO. 1			
11:58	11:58					
12:00	12:00	2	2	800	26.7	26.7
12:10	12:10	10	10	800	133.3	133.3
12:25	12:25	15	15	800	200.0	200.0
12:40	12:40	15	15	800	200.0	200.0
12:55	12:55	15	15	800	200.0	200.0
13:00	13:00	5	5	800	66.7	66.7
TOTAL		62	62		826.7	826.7
			TANK NO. 2			
11:58	11:58					
12:00	12:00	2	2	1,800	60.0	60.0
12:10	12:10	10	10	1,800	300.0	300.0
12:25	12:25	15	15	1,800	450.0	450.0
12:40	12:40	15	15	1,600	400.0	400.0
12:55	12:55	15	15	1,700	425.0	425.0
13:00	13:00	5	5	1,700	141.7	141.7
SUBTOTAL		62	62		1,776.7	1,776.7
14:00	14:00					
14:10	14:10	10	10	4,000	666.7	666.7
14:25	14:25	15	15	4,000	1,000.0	1,000.0
14:40	14:40	15	15	4,000	1,000.0	1,000.0
14:52	14:52	12	12	4,000	800.0	800.0
SUBTOTAL		54	54		3,466.7	3,466.7
TOTAL		116	116		5,243.4	5,243.4
			TANK NO. 3			
12:05	12:05					
12:10	12:10	5	5	4,400	366.7	366.7
12:25	12:25	15	15	4,400	1,100.0	1,100.0
12:40	12:40	15	15	4,400	1,100.0	1,100.0
12:55	12:55	15	15	4,400	1,100.0	1,100.0
13:00	13:00	5	5	4,400	366.7	366.7
SUBTOTAL		55	55		4,033.4	4,033.4
13:25	13:25					
13:32	13:32	7	7	4,400	513.3	513.3
SUBTOTAL		7	7		513.3	513.3
13:58	13:58					
14:10	14:10	12	12	4,400	880	880
14:25	14:25	15	15	4,400	1,100	1,100
14:40	14:40	15	15	4,400	1,100	1,100
14:52	14:52	12	12	4,400	880	880
SUBTOTAL		54	54		3,960	3,960
TOTAL		116	116		8,506.7	8,506.7

(continued)

AMPERE-HOUR CALCULATIONS (continued)
TEST RUN NO. 1:

Time, 24-h clock		Time interval, min		Current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
			TANK NO. 7			
11:58	11:58					
12:00	12:00	2	2	1,000	33.3	33.3
12:10	12:10	10	10	1,000	166.7	166.7
12:25	12:25	15	15	1,000	250.0	250.0
12:40	12:40	15	15	1,000	250.0	250.0
12:55	12:55	15	15	1,000	250.0	250.0
13:00	13:00	5	5	1,000	83.3	83.3
SUBTOTAL		62	62		1,033.3	1,033.3
13:58	13:58					
14:10	14:10	12	12	2,200	440	440
14:25	14:25	15	15	2,200	550	550
14:40	14:40	15	15	2,200	550	550
14:52	14:52	12	12	2,200	440	440
SUBTOTAL		54	54		1,980	1,980
TOTAL		116	116		3,013.3	3,013.3

AMPERE-HOUR CALCULATIONS
TEST RUN NO.: 2

Time, 24-h clock Inlet	Time, 24-h clock Outlet	Time interval, min Inlet	Time interval, min Outlet	Current, amperes	Ampere-hours Inlet	Ampere-hours Outlet
			TANK NO. 1			
17:58	17:58					
18:00	18:00	2	2	3,000	100	100
SUBTOTAL		2	2		100	100
18:05	18:05					
18:15	18:15	10	10	3,000	500	500
18:30	18:30	15	15	3,000	750	750
19:45	19:45	15	15	3,000	750	750
19:05	19:05	20	20	3,000	1,000	1,000
SUBTOTAL		60	60		3,000	3,000
19:22	19:22					
19:30	19:30	8	8	3,000	400	400
19:45	19:45	15	15	3,000	750	750
20:00	20:00	15	15	3,000	750	750
20:15	20:15	15	15	3,000	750	750
20:25	20:25	10	10	3,000	500	500
SUBTOTAL		63	63		3,150	3,150
TOTAL		125	125		6,250	6,250
			TANK NO. 2			
17:58	17:58					
18:00	18:00	2	2	4,000	133.3	133.3
SUBTOTAL		2	2		133.3	133.3
18:05	18:05					
18:15	18:15	10	10	4,000	666.7	666.7
18:30	18:30	15	15	4,000	1,000	1,000
18:45	18:45	15	15	4,000	1,000	1,000
19:05	19:05	20	20	4,000	1,333.3	1,333.3
SUBTOTAL		60	60		4,000	4,000
19:22	19:22					
19:30	19:30	8	8	4,000	533.3	533.3
19:45	19:45	15	15	4,000	1,000	1,000
20:00	20:00	15	15	4,000	1,000	1,000
20:15	20:15	15	15	4,000	1,000	1,000
20:25	20:25	10	10	4,000	666.7	666.7
SUBTOTAL		63	63		4,200	4,200
TOTAL		125	125		8,333.3	8,333.3

(continued)

AMPERE-HOUR CALCULATIONS (continued)
TEST RUN NO.: 2

Time, 24-h clock Inlet	Time, 24-h clock Outlet	Time interval, min Inlet	Time interval, min Outlet	Current, amperes	Ampere-hours Inlet	Ampere-hours Outlet
			TANK NO. 3			
17:58	17:58					
18:00	18:00	2	2	4,400	146.7	146.7
SUBTOTAL		2	2		146.7	146.7
18:05	18:05					
18:15	18:15	10	10	4,400	733.3	733.3
18:30	18:30	15	15	4,400	1,100	1,100
18:45	18:45	15	15	4,400	1,100	1,100
19:05	19:05	20	20	4,400	1,466.7	1,466.7
SUBTOTAL		60	60		4,400	4,400
19:22	19:22					
19:30	19:30	8	8	4,400	586.7	586.7
19:45	19:45	15	15	4,400	1,100	1,100
20:00	20:00	15	15	4,400	1,100	1,100
20:15	20:15	15	15	4,400	1,100	1,100
20:25	20:25	10	10	4,400	733.3	733.3
SUBTOTAL		63	63		4,620	4,620
TOTAL		125	125		9,166.7	9,166.7
			TANK NO. 7			
17:58	17:58					
18:00	18:00	2	2	2,200	73.3	73.3
SUBTOTAL		2	2		73.3	73.3
18:05	18:05					
18:15	18:15	10	10	2,200	366.7	366.7
18:30	18:30	15	15	2,200	550	550
18:45	18:45	15	15	2,200	550	550
19:05	19:05	20	20	2,200	733.3	733.3
SUBTOTAL		60	60		2,200	2,200
19:22	19:22					
19:30	19:30	8	8	2,200	480	480
19:45	19:45	15	15	2,200	550	550
20:00	20:00	15	15	2,200	550	550
20:15	20:15	15	15	2,200	550	550
20:25	20:25	10	10	2,200	366.7	366.7
SUBTOTAL		63	63		2,496.7	2,496.7
TOTAL		125	125		4,770	4,770

AMPERE-HOUR CALCULATIONS
TEST RUN NO.: 3

Time, 24-h clock		Time interval, min		Current,	Ampere-hours	
Inlet	Outlet	Inlet	Outlet	amperes	Inlet	Outlet
			TANK NO. 1			
9:40	9:40					
9:55	9:55	15	15	900	225	225
10:10	10:10	15	15	900	225	225
10:25	10:25	15	15	900	225	225
SUBTOTAL		45	45		675	675
10:58	10:58					
11:05	11:05	7	7	2,600	303.3	303.3
11:20	11:20	15	15	2,700	675	675
11:35	11:35	15	15	2,600	650	650
11:55	11:55	20	20	2,600	866.7	866.7
SUBTOTAL		57	57		2,495	2,495
TOTAL		102	102		3,170	3,170
			TANK NO. 2			
9:40	9:40					
9:55	9:55	15	15	1,800	450	450
10:10	10:10	15	15	1,600	400	400
10:25	10:25	15	15	1,600	400	400
10:40	10:40	15	15	1,600	400	400
10:42	10:42	2	2	1,600	53.3	53.3
SUBTOTAL		62	62		1,703.3	1,703.3
10:58	10:58					
11:05	11:05	7	7	1,600	186.7	186.7
11:10	11:10	15	15	1,600	400	400
SUBTOTAL		22	22		586.7	586.7
11:40	11:40					
11:50	11:50	10	10	1,000	166.7	166.7
12:02	12:02	12	12	1,000	200	200
SUBTOTAL		22	22		366.7	366.7
TOTAL		106	106		2,656.7	2,656.7
			TANK NO. 3			
11:00	11:00					
11:05	11:05	5	5	4,400	366.7	366.7
11:20	11:20	15	15	4,400	1,100	1,100
11:35	11:35	15	15	4,400	1,100	1,100
11:50	11:50	15	15	4,400	1,100	1,100
12:02	12:02	12	12	4,400	880	880
TOTAL		62	62		4,546.7	4,546.7

(continued)

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AMPERE-HOUR CALCULATIONS (continued)
TEST RUN NO.: 3

Time, 24-h clock		Time interval, min		Current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
			TANK NO. 7			
10:00	10:00					
10:10	10:10	10	10	800	133.3	133.3
10:25	10:25	15	15	800	200	200
10:40	10:40	15	15	800	200	200
10:42	10:42	2	2	800	26.7	26.7
SUBTOTAL		42	42		560	560
10:58	10:58					
11:05	11:05	7	7	800	93.3	93.3
11:20	11:20	15	15	800	200	200
11:30	11:30	10	10	800	133.3	133.3
SUBTOTAL		32	32		426.6	426.6
TOTAL		74	74		986.6	986.6

AMPERE-HOUR CALCULATIONS
TEST RUN NO.: 4

Time, 24-h clock Inlet	Time, 24-h clock Outlet	Time interval, min Inlet	Time interval, min Outlet	Current, amperes	Ampere-hours Inlet	Ampere-hours Outlet
			TANK NO. 1			
16:25	16:25					
16:30	16:30	5	5	3,000	250	250
16:40	16:40	10	10	3,000	500	500
SUBTOTAL		15	15		750	750
16:57	16:57					
17:00	17:00	3	3	3,000	150	150
17:15	17:15	15	15	3,000	750	750
17:30	17:30	15	15	3,000	750	750
17:45	17:45	15	15	3,000	750	750
18:00	18:00	15	15	3,000	750	750
SUBTOTAL		63	63		3,150	3,150
TOTAL		78	78		3,900	3,900
			TANK NO. 2			
15:45	15:45					
15:50	15:50	5	5	3,000	250	250
15:58	15:58	8	8	3,000	400	400
SUBTOTAL		13	13		650	650
15:59	15:59					
16:00	16:00	1	1	3,000	50	50
16:15	16:15	15	15	3,000	750	750
16:30	16:30	15	15	3,000	750	750
16:40	16:40	10	10	3,100	516.7	516.7
SUBTOTAL		41	41		2,066.7	2,066.7
16:57	16:57					
17:00	17:00	3	3	3,100	155	155
17:15	17:15	15	15	3,000	750	750
17:30	17:30	15	15	3,000	750	750
17:45	17:45	15	15	3,000	750	750
18:00	18:00	15	15	3,000	750	750
SUBTOTAL		63	63		3,155	3,155
TOTAL		117	117		5,871.7	5,871.7
			TANK NO. 3			
15:39	15:39					
15:50	15:50	11	11	4,400	806.7	806.7
15:58	15:58	8	8	4,400	586.7	586.7
SUBTOTAL		19	19		1,393.4	1,393.4
15:59	15:59					
16:00	16:00	1	1	4,400	73.3	73.3
16:15	16:15	15	15	4,400	1,100	1,100
16:30	16:30	15	15	4,400	1,100	1,100
16:40	16:40	10	10	4,400	733.3	733.3
SUBTOTAL		41	41		3,006.6	3,006.6

(continued)

AMPERE-HOUR CALCULATIONS (continued)
TEST RUN NO.: 4

Time, 24-h clock		Time interval, min		Current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
			TANK 3 (continued)			
16:57	16:57					
17:00	17:00	3	3	4,400	220	220
17:15	17:15	15	15	4,400	1,100	1,100
17:30	17:30	15	15	4,400	1,100	1,100
17:45	17:45	15	15	4,400	1,100	1,100
18:00	18:00	15	15	4,400	1,100	1,100
SUBTOTAL		63	63		4,620	4,620
TOTAL		123	123		9,020	9,020
			TANK NO. 7			
16:25	16:25					
16:30	16:30	5	5	2,200	183.3	183.3
16:40	16:40	10	10	2,200	366.7	366.7
SUBTOTAL		15	15		550	550
16:57	16:57					
17:00	17:00	3	3	2,200	110	110
17:15	17:15	15	15	2,200	550	550
17:30	17:30	15	15	2,200	550	550
17:45	17:45	15	15	2,200	550	550
18:00	18:00	15	15	2,200	550	550
SUBTOTAL		63	63		2,310	2,310
TOTAL		78	78		2,860	2,860

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AMPERE-HOUR CALCULATIONS
TEST RUN NO.: 5

Time, 24-h clock Inlet	Time, 24-h clock Outlet	Time interval, min Inlet	Time interval, min Outlet	Current, amperes	Ampere-hours Inlet	Ampere-hours Outlet
			TANK NO. 1			
9:33	9:33					
9:34	9:34	1	1	1,800	30	30
SUBTOTAL		1	1		30	30
9:41	9:41					
9:50	9:50	9	9	1,800	270	270
10:05	10:05	15	15	1,800	450	450
10:15	10:15	10	10	1,800	300	300
10:30	10:30	15	15	1,800	450	450
10:40	10:40	10	10	1,800	300	300
SUBTOTAL		59	59		1,770	1,770
11:01	11:01					
11:05	11:05	4	4	1,800	120	120
11:20	11:20	15	15	1,800	450	450
11:30	11:30	10	10	1,800	300	300
SUBTOTAL		29	29		870	870
12:02	12:02					
12:05	12:05	3	3	1,200	60	60
12:15	12:15	10	10	1,200	200	200
12:27	12:27	12	12	1,200	240	240
SUBTOTAL		25	25		500	500
TOTAL		114	114		3,170	3,170
			TANK NO. 2			
9:33	9:33					
9:34	9:34	1	1	7,200	120	120
SUBTOTAL		1	1		120	120
9:41	9:41					
9:50	9:50	9	9	7,200	1,080	1,080
10:05	10:05	15	15	7,200	1,800	1,800
10:15	10:15	10	10	7,200	1,200	1,200
10:30	10:30	15	15	7,200	1,800	1,800
10:40	10:40	10	10	7,200	1,200	1,200
SUBTOTAL		59	59		7,080	7,080
11:01	11:01					
11:05	11:05	4	4	7,100	473	473
11:20	11:20	15	15	7,000	1,750	1,750
11:36	11:36	16	16	7,100	1,893	1,893
SUBTOTAL		35	35		4,116	4,116
12:02	12:02					
12:05	12:05	3	3	7,000	350	350
12:15	12:15	10	10	7,000	1,167	1,167
12:27	12:27	12	12	7,000	1,400	1,400
SUBTOTAL		25	25		2,917	2,917
TOTAL		120	120		14,233	14,233

(continued)

AMPERE-HOUR CALCULATIONS (continued)
TEST RUN NO.: 5

Time, 24-h clock Inlet	Time, 24-h clock Outlet	Time interval, min Inlet	Time interval, min Outlet	Current, amperes	Ampere-hours Inlet	Ampere-hours Outlet
			TANK NO. 7			
9:33	9:33					
9:34	9:34	1	1	1,800	30	30
SUBTOTAL		1	1		30	30
9:41	9:41					
9:50	9:50	9	9	1,800	270	270
10:05	10:05	15	15	1,800	450	450
10:15	10:15	10	10	1,800	300	300
10:30	10:30	15	15	1,800	450	450
10:40	10:40	10	10	1,800	300	300
SUBTOTAL		59	59		1,770	1,770
11:01	11:01					
11:05	11:05	4	4	1,800	120	120
11:20	11:20	15	15	1,800	450	450
11:30	11:30	10	10	1,800	300	300
SUBTOTAL		29	29		870	870
12:05	12:05					
12:15	12:15	10	10	1,800	300	300
12:27	12:27	12	12	1,800	360	360
SUBTOTAL		22	22		660	660
TOTAL		111	111		3,330	3,330

AMPERE-HOUR CALCULATIONS
TEST RUN NO.: 6

Time, 24-h clock		Time interval, min		Current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
			TANK NO. 1			
14:23	14:23					
14:24	14:24	1	1	2,800	47	47
SUBTOTAL		1	1		47	47
14:36	14:36					
14:40	14:40	4	4	2,800	186.7	186.7
SUBTOTAL		4	4		186.7	186.7
16:06	16:06					
16:10	16:10	4	4	2,800	187	187
16:25	16:25	15	15	2,800	700	700
16:40	16:40	15	15	2,800	700	700
16:55	16:55	15	15	2,800	700	700
17:06	17:06	11	11	2,800	513	513
SUBTOTAL		60	60		2,800	2,800
TOTAL		65	65		3,033.7	3,033.7
			TANK NO. 2			
14:23	14:23					
14:24	14:24	1	1	1,000	17	17
SUBTOTAL		1	1		17	17
14:36	14:36					
14:40	14:40	4	4	900	60	60
14:42	14:42	2	2	900	30	30
SUBTOTAL		6	6		90	90
14:58	14:58					
15:00	15:00	2	2	1,000	33	33
SUBTOTAL		2	2		33	33
15:08	15:08					
15:15	15:15	7	7	1,000	117	117
SUBTOTAL		7	7		117	117
16:00	16:00					
16:06	16:06	6	6	4,200	420	420
16:25	16:25	19	19	4,400	1,393	1,393
16:40	16:40	15	15	4,400	1,100	1,100
16:55	16:55	15	15	4,400	1,100	1,100
17:06	17:06	11	11	4,400	807	807
SUBTOTAL		66	66		4,820	4,820
TOTAL		82	82		5,077	5,077

(continued)

AMPERE-HOUR CALCULATIONS (continued)
TEST RUN NO.: 6

Time, 24-h clock		Time interval, min		Current, amperes	Ampere-hours	
Inlet	Outlet	Inlet	Outlet		Inlet	Outlet
			TANK NO. 3			
14:23	14:23					
14:24	14:24	1	1	4,400	73	73
SUBTOTAL		1	1		73	73
14:36	14:36					
14:40	14:40	4	4	4,400	293	293
14:42	14:42	2	2	4,400	147	147
SUBTOTAL		6	6		440	440
14:48	14:48					
15:00	15:00	2	2	4,400	147	147
SUBTOTAL		2	2		147	147
15:08	15:08					
15:15	15:15	7	7	4,400	513	513
15:30	15:30	15	15	4,400	1,100	1,100
15:45	15:45	15	15	4,400	1,100	1,100
15:53	15:53	8	8	4,400	587	587
SUBTOTAL		45	45		3,300	3,300
16:06	16:06					
16:10	16:10	4	4	4,400	293	293
16:25	16:25	15	15	4,000	1,000	1,000
16:40	16:40	15	15	4,000	1,000	1,000
16:55	16:55	15	15	4,000	1,000	1,000
17:06	17:06	11	11	4,000	733	733
SUBTOTAL		60	60		4,026	4,026
TOTAL		114	114		7,986	7,986
			TANK NO. 7			
14:46	14:36					
14:40	14:40	4	4	2,400	160	160
14:42	14:42	2	2	2,400	80	80
SUBTOTAL		6	6		240	240
14:58	14:58					
15:00	15:00	2	2	2,200	73	73
SUBTOTAL		2	2		73	73
15:08	15:08					
15:15	15:15	7	7	2,400	280	280
15:30	15:30	15	15	2,400	600	600
15:45	15:45	15	15	2,300	575	575
15:53	15:53	8	8	2,400	320	320
SUBTOTAL		45	45		1,775	1,775
16:06	16:06					
16:10	16:10	4	4	2,400	160	160
16:25	16:25	15	15	2,200	550	550
16:40	16:40	15	15	2,200	550	550
16:55	16:55	15	15	2,300	575	575
17:06	17:06	11	11	2,200	403	403
SUBTOTAL		60	60		2,238	2,238
TOTAL		113	113		4,326	4,326

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SOURCE SAMPLING PROGRAM PROCESS DATA SHEET

Place: Roll Technology Date: September 22, 1987 Run No.: 1

TEST START TIME
Inlet: 11:58
Outlet: 11:58

TEST END TIME
Inlet: 14:52
Outlet: 14:52

Time, 24-h clock	Tank No.	Temp., °F	Operating voltage, volts	Operating current, amperes	Job No.	Notes
11:40	1	129	5.4	800	876970-1	Testing started: 11:58
	2	122	7.0	1,800	876970-1	
	3	--	--	--		
	7	128	6.6	1,000	876970-1	
11:50	1	128	5.2	800		
	2	122	7.0	1,800		
	3	--	--	--		
	7	128	6.6	1,000		
12:00	1	129	5.4	800		
	2	123	7.0	1,800		
	3	--	--	--		
	7	129	6.6	1,000		
12:10	1	129	5.4	800		
	2	123	7.0	1,800		
	3	128	10.0	4,400	876996	
	7	129	6.6	1,000		
12:25	1	129	5.4	800		
	2	125	7.0	1,800		
	3	129	10.0	4,400		
	7	129	6.6	1,000		
12:40	1	129	5.4	800		
	2	126	6.8	1,600		
	3	129	10.2	4,400		
	7	129	6.6	1,000		
12:55	1	130	5.4	800		
	2	126	6.6	1,700		
	3	130	10.2	4,400		
	7	129	6.6	1,000		
13:10	1	129	5.4	800		Stopped testing: 13:00 to change ports
	2	127	6.6	1,700		
	3	130	10.2	4,400		
	7	--	--	--		
13:25	1	--	--	--		Started testing: 13:25
	2	127	6.6	1,700		
	3	130	10.2	4,400		
	7	--	--	--		
13:40	1	--	--	--		Stopped testing: 13:32 because of low current loading
	2	--	--	--		
	3	130	10.2	4,400		
	7	--	--	--		
14:00	1	--	--	--		Started testing: 13:58
	2	130	9.0	4,000	876825	
	3	130	10.2	4,400		
	7	123	7.6	2,200	876856	
14:10	1	--	--	--		
	2	128	9.0	4,000		
	3	130	10.0	4,400		
	7	125	7.6	2,200		
14:25	1	--	--	--		
	2	129	9.0	4,000		
	3	130	10.2	4,400		
	7	127	6.6	2,200		
14:40	1	--	--	--		
	2	130	9.0	4,000		
	3	130	10.2	4,400		
	7	128	6.6	2,200		
14:50	1	--	--	--		Stopped testing: 14:52
	2	130	9.0	4,000		
	3	130	10.2	4,400		
	7	129	7.6	2,200		

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SOURCE SAMPLING PROGRAM PROCESS DATA SHEET

Place: Roll Technology Date: September 22, 1987 Run No.: 2

TEST START TIME
Inlet: 17:58
Outlet: 17:58

TEST END TIME
Inlet: 20:25
Outlet: 20:25

Time, 24-h clock	Tank No.	Temp., °F	Operating voltage, volts	Operating current, amperes	Job No.	Notes
17:58	1	131	7.0	3,000	876622	Started testing: 17:58
	2	130	9.0	4,000	876825	Stopped testing: 18:00
	3	129	10.2	4,400	876996	power loss to meter
	7	130	7.6	2,200	876856	boxes
18:15	1	131	7.0	3,000		Started testing: 18:05
	2	129	9.0	4,000		
	3	130	10.2	4,400		
	7	130	7.6	2,200		
18:30	1	131	7.0	3,000		
	2	130	9.0	4,000		
	3	130	10.2	4,400		
	7	130	7.6	2,200		
18:45	1	130	7.0	3,000		
	2	130	9.0	4,000		
	3	129	10.2	4,400		
	7	130	7.6	2,200		
19:00	1	130	7.0	3,000		
	2	129	9.0	4,000		
	3	129	10.2	4,400		
	7	130	7.6	2,200		
19:15	1	131	7.0	3,000		Stopped testing: 19:05
	2	130	9.0	4,000		port change
	3	129	10.2	4,400		
	7	130	7.6	2,200		
19:30	1	131	7.0	3,000		Started testing: 19:22
	2	131	9.0	4,000		
	3	129	10.2	4,400		
	7	130	7.6	2,200		
19:45	1	130	7.0	3,000		
	2	130	9.0	4,000		
	3	130	10.2	4,400		
	7	130	7.6	2,200		
20:00	1	131	7.0	3,000		
	2	129	9.0	4,000		
	3	130	10.2	4,400		
	7	130	7.6	2,200		
20:15	1	130	7.0	3,000		
	2	130	9.0	4,000		
	3	129	10.2	4,400		
	7	130	7.6	2,200		
20:25	1	130	7.0	3,000		Stopped testing: 20:25
	2	131	9.0	4,000		
	3	129	10.2	4,400		
	7	130	7.6	2,200		

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SOURCE SAMPLING PROGRAM PROCESS DATA SHEET

Place: Roll Technology Date: September 23, 1987 Run No.: 3

TEST START TIME
Inlet: 9:40
Outlet: 9:40

TEST END TIME
Inlet: 12:02
Outlet: 12:02

Time, 24-h clock	Tank No.	Temp., °F	Operating voltage, volts	Operating current, amperes	Job No.	Notes
9:40	1	131	6.0	900	877018	Started testing: 9:40
	2	128	6.4	1,700	876970-1	
	3	--	--	--		
	7	--	--	--		
9:55	1	129	6.0	900		
	2	128	6.4	1,800		
	3	--	--	--		
	7	--	--	--		
10:10	1	129	6.0	900		
	2	128	6.2	1,600		
	3	--	--	--		
	7	127	6.4	800	876870-1	
10:25	1	129	6.0	900		
	2	128	6.2	1,600		
	3	--	--	--		
	7	127	6.4	800		
10:40	1	--	--	--		Stopped testing: 10:42
	2	127	6.2	1,600		port change
	3	--	--	--		
	7	127	6.4	800		
10:55	1	123	7.0	2,600	877018	
	2	128	6.2	1,600		
	3	--	--	--		
	7	128	6.4	800		
11:05	1	125	6.8	2,600		Started testing: 10:58
	2	129	6.2	1,600		
	3	128	9.8	4,400	876999-1	
	7	128	6.4	800		
11:20	1	129	6.6	2,700		
	2	--	--	--		
	3	129	9.6	4,400		
	7	129	6.4	800		
11:35	1	129	6.6	2,600		
	2	--	--	--		
	3	129	9.8	4,400		
	7	--	--	--		
11:50	1	129	6.6	2,600		
	2	128	5.6	1,000	876970-4	
	3	129	9.8	4,400		
	7	--	--	--		
12:00	1	--	--	--		Stopped testing: 12:02
	2	128	5.6	1,000		
	3	129	9.8	4,400		
	7	--	--	--		

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SOURCE SAMPLING PROGRAM PROCESS DATA SHEET

Place: Roll Technology Date: September 23, 1987 Run No.: 4

TEST START TIME
Inlet: 15:39
Outlet: 15:39

TEST END TIME
Inlet: 18:00
Outlet: 18:00

Time, 24-h clock	Tank No.	Temp., °F	Operating voltage, volts	Operating current, amperes	Job No.	Notes
15:50	1	--	--	--		
	2	129	9.6	3,000	876831-2	Started testing: 15:39
	3	130	10.0	4,400	876999-1	
	7	--	--	--		
16:00	1	--	--	--		
	2	129	9.6	3,000		Stopped testing: 15:58
	3	130	10.0	4,400		Started testing: 15:59
	7	--	--	--		
16:15	1	--	--	--		
	2	130	9.6	3,000		
	3	130	10.0	4,400		
	7	--	--	--		
16:30	1	130	6.8	3,000	876688	
	2	131	9.4	3,000		
	3	131	9.8	4,400		
	7	129	7.2	2,200	876909	
16:45	1	132	6.8	3,000		
	2	129	9.4	3,100		Stopped testing: 16:40
	3	131	9.8	4,400		
	7	129	7.2	2,200		
17:00	1	130	6.6	3,000		
	2	129	9.4	3,100		Started testing: 16:57
	3	131	10.0	4,400		
	7	130	7.2	2,200		
17:15	1	131	6.6	3,000		
	2	129	9.4	3,000		
	3	130	10.0	4,400		
	7	130	7.2	2,200		
17:30	1	132	6.6	3,000		
	2	129	9.4	3,000		
	3	131	10.0	4,400		
	7	130	7.2	2,200		
17:45	1	132	6.6	3,000		
	2	130	9.4	3,000		
	3	131	10.0	4,400		
	7	130	7.2	2,200		
18:00	1	132	6.6	3,000		
	2	130	9.4	3,000		Stopped testing: 18:00
	3	131	10.0	4,400		
	7	130	7.2	2,200		

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SOURCE SAMPLING PROGRAM PROCESS DATA SHEET

Place: Roll Technology Date: September 24, 1987 Run No.: 5

TEST START TIME
Inlet: 9:33
Outlet: 9:33

TEST END TIME
Inlet: 12:27
Outlet: 12:27

Time, 24-h clock	Tank No.	Temp., °F	Operating voltage, volts	Operating current, amperes	Job No.	Notes
9:35	1	129	7.0	1,800	872755-3	Started testing: 9:33
	2	129	7.6	7,200	876527	Stoppped testing: 9:34
	3	--	--	--		U-tube connector
	7	128	8.0	1,800	876755-3	broke-scrubber inlet
9:50	1	130	7.0	1,800		Started testing: 9:41
	2	129	7.4	7,200		
	3	--	--	--		
	7	129	8.0	1,800		
10:05	1	131	6.8	1,800		
	2	129	7.4	7,200		
	3	--	--	--		
	7	129	7.8	1,800		
10:15	1	130	6.8	1,800		
	2	130	7.5	7,200		
	3	--	--	--		
	7	129	8.0	1,800		
10:30	1	130	6.8	1,800		
	2	130	7.4	7,200		
	3	--	--	--		
	7	129	8.0	1,800		
10:40	1	130	6.8	1,800		Stopped testing: 10:40
	2	129	7.4	7,200		port change
	3	--	--	--		
	7	129	7.8	1,800		
11:05	1	130	6.8	1,800		Started testing: 11:01
	2	130	7.4	7,100		
	3	--	--	--		
	7	129	8.0	1,800		
11:20	1	130	6.8	1,800		
	2	130	7.4	7,000		
	3	--	--	--		
	7	129	7.8	1,800		
11:35	1	--	--	--		Stopped testing: 11:36
	2	130	7.4	7,100		low current loading
	3	--	--	--		
	7	--	--	--		
12:05	1	130	5.4	1,200	877005	Started testing: 12:02
	2	130	7.4	7,000		
	3	--	--	--		
	7	129	8.2	1,800	876755-3	
12:15	1	130	5.4	1,200		
	2	131	7.2	7,000		
	3	--	--	--		
	7	129	8.2	1,800		
12:25	1	129	5.4	1,200		Stopped testing: 12:27
	2	130	7.4	7,000		
	3	--	--	--		
	7	130	8.0	1,800		

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SOURCE SAMPLING PROGRAM PROCESS DATA SHEET

Place: Roll Technology Date: September 24, 1987 Run No.: 6

TEST START TIME
Inlet: 14:23
Outlet: 14:23

TEST END TIME
Inlet: 17:06
Outlet: 17:06

Time, 24-h clock	Tank No.	Temp., °F	Operating voltage, volts	Operating current, amperes	Job No.	Notes
14:25	1	131	7.2	2,800	877029	Started testing: 14:23
	2	129	6.8	1,000	877029	Stopped testing: 14:24
	3	131	12.2	4,400	876999-2	power lost to meter box
	7	--	--	--		
14:40	1	131	7.2	2,800		Started testing: 14:36
	2	129	7.0	900	877029	Stopped testing: 14:42
	3	131	12.2	4,400		power lost to meter box
	7	129	6.8	2,400	876909	
15:00	1	--	--	--		Started testing: 14:58
	2	129	6.8	1,000		Stopped testing: 15:00
	3	130	12.2	4,400		power lost to meter box
	7	130	6.8	2,200		
15:15	1	--	--	--		Started testing: 15:08
	2	129	7.0	1,000		
	3	130	12.2	4,400		
	7	130	6.8	2,400		
15:30	1	--	--	--		
	2	--	--	--		
	3	131	12.2	4,400		
	7	130	6.8	2,400		
15:45	1	--	--	--		
	3	129	6.8	4,200	876865	
	3	130	12.2	4,400		
	7	130	6.8	2,300		
16:10	1	130	7.4	2,800	876831-1	Stopped testing: 15:53
	2	130	8.2	4,400	876865	port change
	3	131	12.2	4,400		Started testing: 16:06
	7	130	6.8	2,400		
16:25	1	131	7.4	2,800		
	2	131	8.2	4,400		
	3	131	12.2	4,000		
	7	130	6.8	2,200		
16:40	1	129	7.2	2,800		
	2	129	8.2	4,400		
	3	131	12.2	4,000		
	7	130	6.8	2,200		
16:55	1	131	7.4	2,800		
	2	129	8.2	4,400		
	3	131	12.2	4,000		
	7	130	6.8	2,300		
17:05	1	130	7.4	2,800		Stopped testing: 17:06
	2	130	8.2	4,400		
	3	131	12.2	4,000		
	7	129	6.8	2,200		

SOURCE SAMPLING PROGRAM JOB DESCRIPTIONS

Place: Roll Technology Date: September 22, 1987 Run Nos.: 1 and 2

Job No.	Dimensions, in.xin. (circ.xlength)	Surface area, $in.^2$	Current required, amps	Tank No.	Plate time h (in-out)
876970-1	4x88.75	355	800	1	11:40-13:10 (1.5 h)
876970-1	4x88.75(2)	355(2)	1,600	2	11:25-13:25 (2 h)
876970-1	4x88.75	355	800	7	11:30-13:00 (1.5 h)
876996	35x54.5	1,907.5	4,000	3	12:05-08:05 (20 h)
876856	37.5x28	1,052	2,200	7	13:55-07:55 (18 h)
876825	31.2x80	2,499	4,000	2	14:00-06:00 (18 h)
876622	16.7x89	1,493	3,000	1	15:00-03:00 (12 h)

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SOURCE SAMPLING PROGRAM JOB DESCRIPTIONS

Place: Roll Technology Date: September 23, 1987 Run Nos.: 3 and 4

Job No.	Dimensions, in.xin. (circ.xlength)	Surface area, in.^{2}	Current required, amps	Tank No.	Plate time h (in-out)
876970-1	4x88.75	355	1,600	2	9:10-11:10 (2 h)
877018	6.5x51.5	334	700	1	9:25-10:25 (1 h)
876870-1	4.0x88.75	355	800	7	10:00-11:30 (1.5 h)
877018	14.0x90	1,260	2,500	1	10:55-11:55 (1 h)
876999-1	35x45 (Feeder)	--	4,000	3	11:00-7:00 (20 h)
876970-4	5.5x77	423	900	2	11:40-13:10 (2.5 h)
876831-2	24.9x60	1,497	3,000	2	15:45-6:45 (15 h)
876909	37.6x30	1,128	2,300	7	16:25-6:25 (14 h)
876688	24.9x64	1,596	3,000	1	16:25-7:25 (15 h)

SOURCE SAMPLING PROGRAM JOB DESCRIPTIONS

Place: Roll Technology Date: September 24, 1987 Run Nos.: 5 and 6

Job No.	Dimensions, in.xin. (circ.xlength)	Surface area, in.^{2}	Current required, amps	Tank No.	Plate time h (in-out)
876527	839x56	4,699	7,100	2	09:30-13:30 (4 h)
876755-3	18.8x43	810	1,700	7	09:30-11:30 (2 h)
872755-3	18.8x43	810	1,700	1	09:30-11:30 (2 h)
876755-3	18.8x43	810	1,700	7	12:05-14:05 (2 h)
877005	15.7x42	659	1,300	1	12:00-12:45 (0.75 min)
877029	14x96	1,344	2,800	1	13:40-14:40 (1 h)
876999-2	Plates	--	4,000	3	13:55-02:55 (15 h)
877029	8x46	368	800	2	14:15-15:15 (1 h)
876909	37.6x30	1,128	2,300	7	14:30-04:30 (14 h)
876831-1	21x66.5	1,399	2,800	1	15:55-06:55 (15 h)
876865	55.7x48	2,673	4,300	2	16:00-08:00 (16 h)

APPENDIX F
PROJECT PARTICIPANTS

PROJECT PARTICIPANTS

Ralph Prichard	Roll Technology Corporation
J. F. Tucker	Roll Technology Corporation
Richard Fraunfelder	Peer Associates
Nancy Jackson	Peer Associates
Tim Miller	Peer Associates
Helen Owens	Peer Associates
Andy Wiseman	Peer Associates
Jim Blau	Pacific Environmental Services
John Chehaske	Pacific Environmental Services
Mary Ellen Jackson	Entropy Environmentalists
Robin Barker	Midwest Research Institute
John Brown	U. S. Environmental Protection Agency
Frank Clay	U. S. Environmental Protection Agency
Andy Smith	U. S. Environmental Protection Agency
Mike Toney	U. S. Environmental Protection Agency