Background Report Reference

AP-42 Section Number: 12.20

Background Chapter: 4

Reference Number: 44

Title: Source Test Report of Ceco Filters Demonstration Unit Serving a Hard Chrome Plating Tank at Chrome Plating Company, 1748 Workman Street,Los Angeles,CA

PES

March 1989

SCREENING TEST

Source Test Report of a Ceco Filters Demonstration Unit Serving a Hard Chrome Plating Tank at Chromal Plating Company, 1748 Workman Street, Los Angeles, CA 90031

Conducted for the
Metal Finishing Association of Southern California
5000 Van Nuys Blvd
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3/1/89

Source Test Report of a Ceco Filters Demonstration Unit
Serving a Hard Chrome Plating Tank at
Chromal Plating Company, 1748 Workman Street,
Los Angeles, CA 90031

INTRODUCTION

Pacific Environmental Services, Inc. (PES) was contracted by the Metal Finishing Association of Southern California (MFASC), to perform a screening test on the reduction efficiency of a Ceco Filters, Inc demonstration unit used to collect hexavalent chromium emissions from a hard chrome plating operation. Set up and velocity determinations were conducted on February 11, and the source testing was done on February 13, 1989.

In order to evaluate the effectiveness of the Ceco unit, it was necessary to have a hard chrome plating tank that was outfitted with an emission collection system. Chromal Plating Co. in Los Angeles, Ca, was the site chosen for the testing. Ray Bokelman, General Manager of Chromal Plating, arranged for the hookup of the demonstration unit and the tank operation during source testing.

A slip stream was taken from the main emission collection exhaust to supply the Ceco Filters, Inc Unit. The location of the extraction was approximately 6 feet before the main scrubber of Chromal Plating as shown in Figures 1 and 2. The diameter of the main duct was 24" I.D. and the slip stream was 7" I.D. narrowing down to 6" I.D.

On February 13, three locations were chosen for sampling. The first sample, C-MI-I, was taken from the main exhaust before the slip stream extraction point. This was done in order to test the Isokinetics of the slip stream system. The second sample was taken from the slip stream 6' 10" before the inlet to the demonstration unit. This sample was used to determine the quantity of emissions in the gas stream before entering the Ceco unit. The third sample was taken from the stack outlet of the Ceco unit 38" from the bottom of the stack. This sample was used to determine the emission rate and subsequently the reduction efficiency of the Ceco unit for total and hexavalent chromium emissions. Continuous velocity measurements were made with a type "S" pitot tube at the main exhaust sample location and with standard pitot tubes 54" inches after the inlet sample location, and 21" after the outlet sample location. All sampling locations and velocity measurement locations are shown in Figures 1 and 2.

Table 1: Diagram of Slip Stream System and Sample Locations

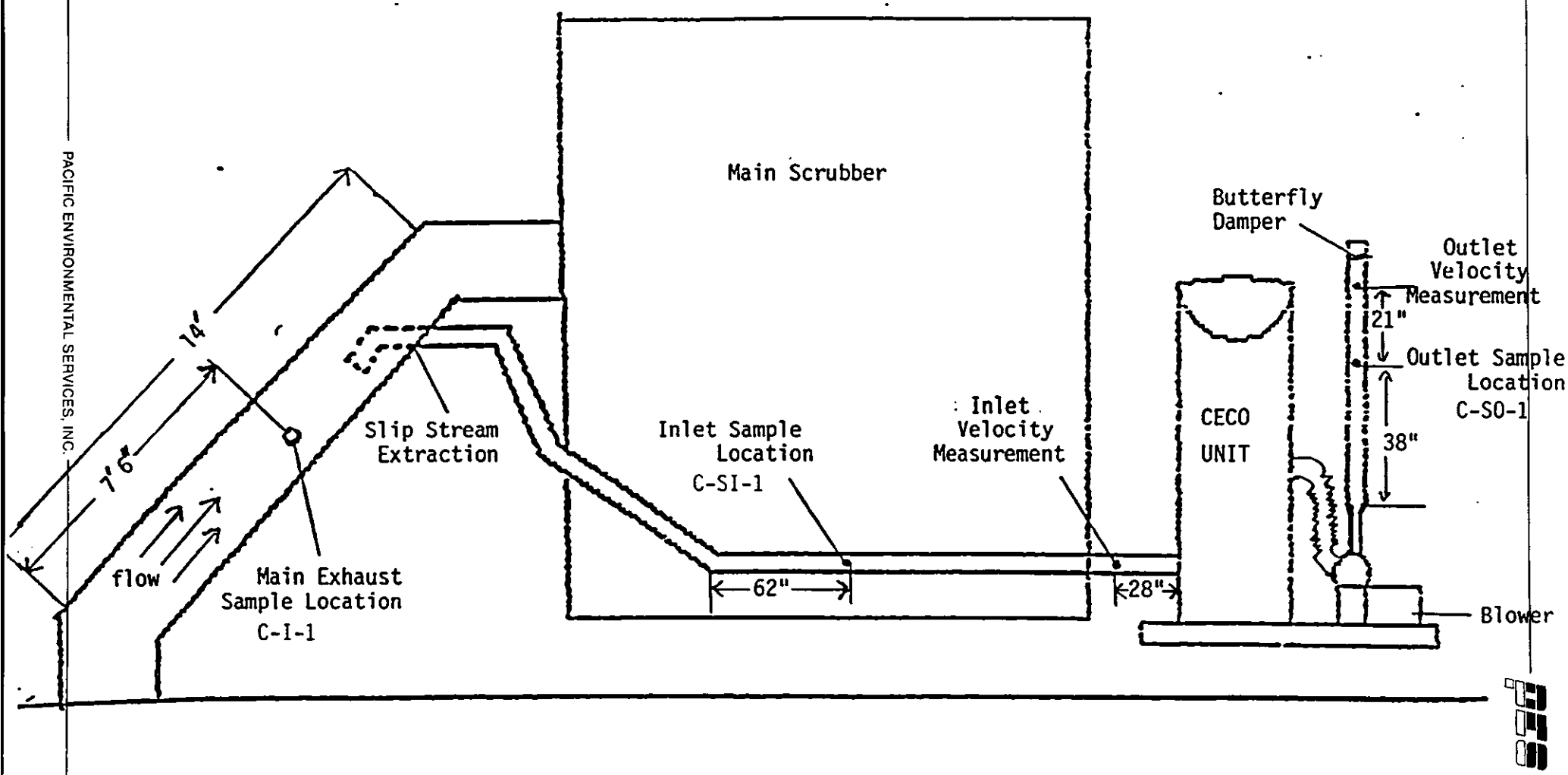
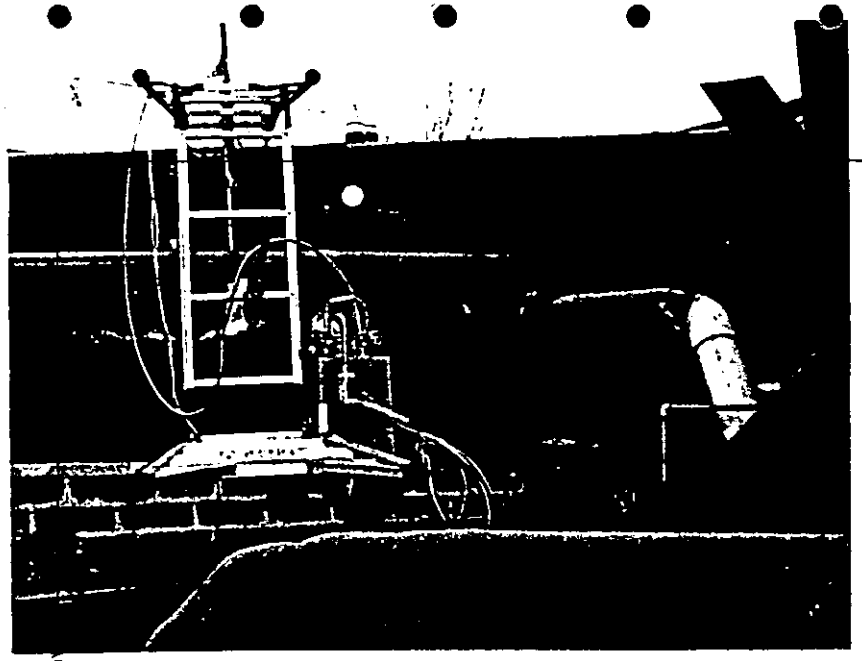
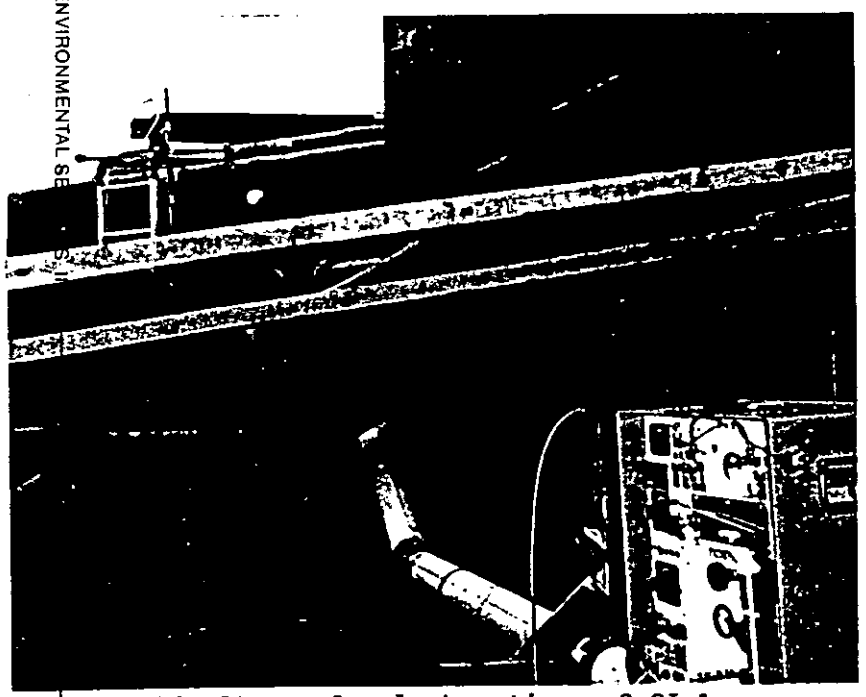


Figure 2: Sample Locations



Main Exhaust Sample Location: C-I-1



Slip Stream Sample Location: C-SI-1

Stack Outlet Sample Location: C-SO-1

EQUIPMENT AND PROCESS DESCRIPTION

Chromal Plating Company, 1748 Workman Street, Los Angeles, CA 90031, is engaged in the business of hard chrome plating for the aircraft and a wide variety of other industries. During the test, the Ceco unit served hard chrome plating tank No. 1. The dimensions of tank No. 1 were 7' x 6' x 8'. The chrome concentration of Tank No. 1 during the test was 30% Chromic Acid. During the test the tank was covered 100% by 3/4" polyballs and the mixing air was turned off. The temperature of the tank was maintained at 120 Fahrenheit, the voltage averaged 4.5 volts, and the amperage averaged 853 amps.

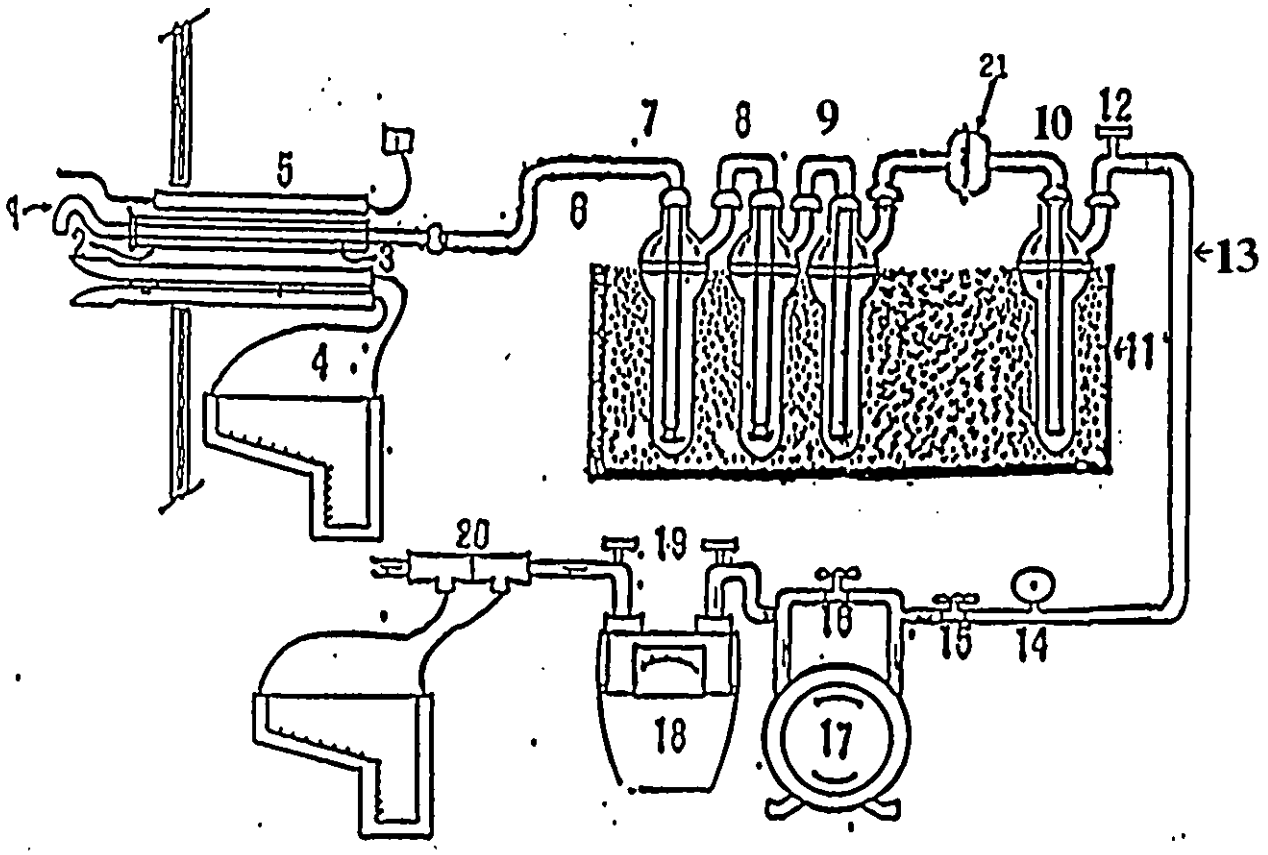
The Ceco chromic acid removal system utilized several control mechanisms. These included particle settling, inertial impaction, direct interception, particle size control, condensation, and Brownian diffusion. The Ceco unit weighed about 3000 pounds when wetted. The blower motor was 3 HP, and could handle flow rates up to 500 ACFM.

TESTING METHODOLOGY

The samples at each location were extracted with modified CARB method 425 source testing trains as described in a 1/20/89 CARB protocol (Figure 3). The source sampling trains consisted of a 0.234" - 0.310" I.D. glass nozzle, a glass probe, two impingers each with 100 ml of 0.1N sodium hydroxide, an empty impinger, an 89mm teflon coated glass fiber filter placed after the empty impinger, an impinger filled with silica gel, an umbilical cord connected to a vacuum pump, a dry gas meter, and a calibrated orifice connected to an inclined manometer.

Sampling at the three ports was conducted simultaneously for a period of 8 hours; however after 6 hours and 13 minutes the impinger with silica gel imploded so that sample was cut short immediately. Sampling was done by traversing at each location. Velocity and temperature of the emission streams were measured and recorded every 20 minutes for the main exhaust, every hour for the slip stream sample, and every 30 minutes for the outlet sample during the test. The meter temperature and the volume of the gas through the meter also were measured and recorded at the same intervals for each location. Applied voltage, bath temperature, and amperage applied to the chrome plating tank was also recorded. All information was recorded on field data sheets (Appendix).

Laboratory analyses were conducted by Thermo Analytical Laboratory in Monrovia, CA. Total chrome and hexavalent chrome concentrations were determined for the three stack samples, a



1. Glass or stainless steel sampling nozzle
2. Stainless steel probe sheath
3. Stainless steel, glass, or Teflon-lined probe
4. Type S pitot tube and manometer for ΔP readings
5. Stack temperature sensor
6. 15 ft. teflon probe line with ball and socket connectors
7. Greenburg-Smith impinger with 100 ml. of .1 N NaOH solution
8. Greenburg-Smith impinger with 100 ml. of .1 N NaOH solution
9. Modified Greenburg-Smith impinger - dry
10. Modified Greenburg-Smith impinger filled with 200 grams of silica gel
11. Impinger case filled with ice
12. Impinger exit gas temperature sensor
13. Umbilical line to meter box
14. Vacuum gauge
15. Coarse adjustment valve
16. By-pass valve to adjust ΔH
17. Leak free vacuum pump
18. Dry gas meter
19. Dry gas meter inlet and outlet temperature sensors
20. Orifice meter with manometer for ΔH readings
21. Filter Holder with teflon-lined glass fiber filter.

FIGURE 3
Diagram Of Sampling Train

blank, and the plating bath solution. Analyses for total chrome used atomic absorption spectrophotometry and analyses for hexavalent chrome used diphenylcarbazide colorimetric techniques.

RESULTS OF TESTING

After running 6 hours and 13 minutes, sampling was discontinued at the main exhaust port because of damage to the silica gel impinger. The bottom of the impinger had broken off and ice water was sucked into the pump. The inlet and outlet samples were not affected and testing continued at these two points for the full eight hours.

Flow rates in the main exhaust stream and the extraction duct were intended to provide near isokinetic velocities. From the measured flow rates the two velocities were calculated as follows.

24" duct	6678 dscfm	34.9 fps
7.2" duct	616 dscfm	36.3 fps

The main exhaust gas stream showed 0.00429 mg/scf for total chrome and 0.00346 mg/scf for hexavalent chrome. The slip stream extraction showed 0.00281 mg/scf for total chrome and 0.00217 mg/scf for hexavalent chrome.

Calculations were made from the field data sheets to determine sample volume, molecular weight, velocities, flow rates, and isokinetic testing for the gas at each sample location. Stack gas volumes were calculated from the velocity measurements taken simultaneously during sample extraction. Results are shown on the emission test calculation sheets (Appendix).

The inlet loading to the Ceco demonstration unit was 103.93 mg/hour for total chrome and 80.2 mg/hour for hexavalent chrome. The outlet emissions were 3.55 mg/hour for total chrome and 1.43 mg/hour for hexavalent chrome. In order to express the efficiency in mg/amp-hour the total gas flow needed to be used and the results divided by the amp-hours. The control efficiency for total chrome was calculated at 97.0% and for hexavalent chrome was calculated at 98.4% (Table 1).

It should be noted that the main purpose of the screening test was to determine whether the sampling system was set up properly and whether the demonstration unit was functioning at full capacity. On February 15, 1989, Mr. John Watkins, a Ceco Filters, Inc representative, removed the observation port on top of the unit

and discovered that some of the filter holders within the unit had become loose and disaligned and a water line had been cracked during shipping. Mr. Watkins repaired the unit and hosed down the effluent side of the filter and stack with tap water. The unit was restarted and operated 3 or 4 days at design conditions before the CARB tests which started on 2/22/89.

Table 1: Control Efficiency of the Ceco Filter, Inc Demonstration Unit. SCREENING TEST

Sample Run Number	Sample Volume ml	Conc. Cr T ug/l	Conc. Cr 6 ug/l	Cr T ug	Cr 6 ug	Sample Meter Vol dscf	Emissions Cr T ug/scf	Emissions Cr 6 ug/scf	Flow Rate dscfm	Actual Emissions Cr T ug/hour	Actual Emissions Cr 6 ug/hour
C-MI-1	570	2.81	2.27	1.6017	1.2939	373.578	0.00429	0.00346	6678	1717.90	1387.77
C-SI-1	926	1.27	0.98	1.1760	0.9075	418.213	0.00281	0.00217	616	103.93	80.2
C-SO-1	880	0.0571	0.023	0.0502	0.0202	593.164	0.00008	0.00003	698	3.55	1.43

Sample Run Number	Adjusted Total Flow Rate dscfm	Total Emissions CrT ug/hour	Total Emissions Cr6 ug/hour	Average Asp-hours	Emissions Cr T ug/asp-hour	Emissions Cr 6 ug/asp-hour	Control Efficiency Cr T %	Control Efficiency Cr 6 %
C-MI-1	6678	1717.899	1387.769	853	2.0139	1.6269		
C-SI-1	6678	1126.717	869.435	853	1.3209	1.0193		
C-SO-1	6678	33.96	13.68	853	0.0398	0.016	97.0	98.4

Note: The filters on all three test trains contained no more Cr 6 than the blanks, so results are not shown.
The laboratory report is appended

APPENDICES

PES

EMISSION TEST CALCULATIONS

Definition of Symbols

A = cross-sectional area of stack, ft^2

A_n = Cross-sectional area of Nozzle, ft^2

B_{ws} = Water vapor in gas stream, proportional by volume

C_p = Pilot tube coefficient

I = Percent of Isokinetic Sampling

M_d = dry molecular weight, lb/lb-mole

M_s = Molecular weight of stack gas, lb/lb-mole

P_{bar} = Barometric Pressure at the sampling site, in Hg

P_s = Stack gas pressure, in. Hg

Q_s = Stack volumetric flow rate, actual condition acfm

$Q_{(std)}$ = stack volumetric flow rate, actual conditions dscfm

T_m = Average dry gas meter temperature, R = 460 ° + F°

T_s = Average stack gas temperature, °R = 460° + F°

V_{lc} = Total volume of liquid collected in impingers and silica gel, ml

V_m = Volume of gas sample as measured by dry gas meter, dscf

$V_{m(std)}$ = V_m corrected to standard conditions, dscf

$V_{w(std)}$ = Volume of water vapor in gas sample corrected to standard conditions, scf

V_s = Stack gas velocity, ft/sec

Y = Dry gas meter calibration factor

ΔH = Average pressure differential across the orifice meter, in. H_2O

θ = Total Sampling Time, min.

13.6 = Specific gravity of Mercury

PACIFIC ENVIRONMENTAL SERVICES

Plant: Chroma/ - Ceco Unit
Date: 2-13-89
Source/Sample Number: C-MI-1

1. $V_{m(std)} = 17.64\ V_m\ Y \left[\frac{P_{bar} + (\Delta H/13.6)}{T_m}\right]$

$V_{m(std)} = 17.64(368.115)(1.003)\left[\frac{(20.64)+(3.53/13.6)}{(538.7)}\right]$

$V_{m(std)} =$ 373.578 dscf

2. Volume Water Vapor Collected, Standard Conditions

$V_{lc} =$ ✓ condensate from impingers and Silica Gel

$V_{W(std)} = .04707\ V_{lc} =$ ✓ scf

$V_{W(std)} =$ ✓ scf

3. Percent Moisture, by volume

$B_{Ws} = \frac{V_{W(std)}}{V_{W\ std} + V_{m\ (std)}} = \frac{(\ \checkmark\ )}{(\ \checkmark\ )+(\ \checkmark\ )} =$ 0.006

$B_{Ws} =$ 0.6 % obtained from Sample C-SI-1

4. Molecular Weight, Stack gas

Dry Molecular Wight

$M_d = 0.440\ (\%\ CO_2) + 0.320\ (\%\ O_2) + 0.280\ (\%\ N_2 + \%\ CO)$

$M_d = 0.440(\quad) + 0.320(\quad) + 0.280(\quad)$

$M_d =$ 29.0 lb/lb-mole

$M_s = M_d + B_{Ws}(18-M_d) = (29.6) + (0.006)(18-29.0)$

$M_s =$ 28.93 lb/lb-mole

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Plant: Chromal Coco Unit
Date: 2-13-89
Source/Sample Number: C-MI-1

5. Stack Gas Velocity Average

$$V_{s(avg)} = 85.49\ C_p \left(\sqrt{\Delta P}\right)_{avg} \sqrt{\frac{T_s}{P_s M_s}}$$

$$V_{s(avg)} = 85.49(0.84)(0.6294)\sqrt{\frac{(528.8)}{(30.57)(28.83)}}$$

$V_{s(avg)}$ = 34.95 ft/sec.

6. Stack Volumetric Flow Rate, Actual Conditions (Stack Temperature and Pressure)

$$Q_s = 60\ V_s\ A = 60\ (34.95)(3.14)$$

Q_s = 6588 acfm

7. Stack volumetric flow rate, standard conditions (68° F, 29.92 Hg)

$$Q_{(std)} = 17.64\ Q_s\ (1-B_{ws})\ \frac{P_s}{T_s} =$$

$$Q_{(std)} = 17.64(6588)(1-0.006)\frac{(30.67)}{(528.8)}$$

Q_{std} = 6678 dscfm

8. Isokinetic Variation

$$\%I = K\ \frac{T_s\ V_{m(std)}}{P_s\ V_s\ A_n\ \theta\ (1-B_{ws})}$$

$$= 0.0945\ \frac{(528.8)(373.58)}{(30.57)(34.95)(.00524)(373)(1-0.006)}$$

%I = 89.9 %

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Plant: Chronal - Coco Unit
Date: 2-13-89
Source/Sample Number: C-ST-1

1. $V_{m(std)} = 17.64\ V_m \cdot Y \left[\frac{P_{bar} + (\Delta H / 13.6)}{T_m}\right]$

$V_{m(std)} = 17.64(406.62)(0.993)\left[\frac{(30.64) + (2.94/13.6)}{(524.8)}\right]$

$V_{m(std)} =$ 418.213 dscf

2. Volume Water Vapor Collected, Standard Conditions

$V_{lc} =$ 51.6 condensate from impingers and Silica Gel

$V_{W(std)} = .04707\ V_{lc} =$ 2.43 scf

$V_{W(std)} =$ 2.43 scf

3. Percent Moisture, by volume

$B_{ws} = \frac{V_{W(std)}}{V_{W\ std} + V_{m\ (std)}} = \frac{(2.43)}{(2.43)+(418.213)} =$ 0.006

$B_{ws} =$ 0.6 %

4. Molecular Weight, Stack gas

Dry Molecular Wight

$M_d = 0.440\ (\%\ CO_2) + 0.320\ (\%\ O_2) + 0.280\ (\%\ N_2 + \%\ CO)$

$M_d = 0.440(\quad) + 0.320(\quad) + 0.280(\quad)$

$M_d =$ 29.0 lb/lb-mole

$M_s = M_d + B_{ws}(18 - M_d) = (29.0) + (0.006)(18 - 29.0)$

$M_s =$ 28.93 lb/lb-mole

PES

Plant: Chromal Coco Unit
Date: 2-13-89
Source/Sample Number: C-SI-1

5. Stack Gas Velocity Average

$$V_{s(avg)} = 85.49\ C_p\ (\sqrt{\Delta P})_{avg} \sqrt{\frac{T_s}{P_s M_s}}$$

$$V_{s(avg)} = 85.49(0.99)(0.7852)\sqrt{\frac{(523)}{(30.46)(28.83)}}$$

$V_{s(avg)}$ = 51.2 ft/sec.

6. Stack Volumetric Flow Rate, Actual Conditions (Stack Temperature and Pressure)

$$Q_s = 60\ V_s\ A = 60\ (51.2)\left(\frac{3\pi}{5\pi}\right)$$

Q_s = ~~2443~~ 603 acfm

7. Stack volumetric flow rate, standard conditions (68° F, 29.92 Hg)

$$Q_{(std)} = 17.64\ Q_s\ (1-B_{ws})\ \frac{P_s}{T_s} =$$

$$Q_{(std)} = 17.64(603)(1-0.006)\frac{(30.46)}{(523)}$$

Q_{std} = 616 dscfm

8. Isokinetic Variation

$$\%I = K\ \frac{T_s\ V_{m(std)}}{P_s\ V_s\ A_n\ \theta\ (1-B_{ws})}$$

$$= 0.0945\ \frac{(523)(418.213)}{(30.46)(51.2)(.00247)(480)(1-0.006)}$$

%I = 94.9 %

PES

Plant: Chromal - Ceco - Unit
Date: 2-13-89
Source/Sample Number: C-50-1

1. $V_{m(std)} = 17.64\ V_m \cdot Y \left[\frac{P_{bar} + (\Delta H/13.6)}{T_m}\right]$

$V_{m(std)} = 17.64(585.686)(.9967)\left[\frac{(30.64) + (5.01/13.6)}{(538.3)}\right]$

$V_{m(std)} =$ 593.164 dscf

2. Volume Water Vapor Collected, Standard Conditions

$V_{lc} =$ 83.6 condensate from impingers and Silica Gel

$V_{W(std)} = .04707\ V_{lc} =$ 3.95 scf

$V_{W(std)} =$ 3.94 scf

3. Percent Moisture, by volume

$B_{ws} = \frac{V_{W(std)}}{V_{W\ std} + V_{m\ (std)}} = \frac{(3.94)}{(3.94)+(593.164)} =$ 0.0066

$B_{ws} =$ 0.66 %

4. Molecular Weight, Stack gas

Dry Molecular Wight

$M_d = 0.440\ (\%\ CO_2) + 0.320\ (\%\ O_2) + 0.280\ (\%\ N_2 + \%\ CO)$

$M_d = 0.440(\quad) + 0.320(\quad) + 0.280(\quad)$

$M_d =$ 29.0 lb/lb-mole

$M_s = M_d + B_{ws}(18 - M_d) = (29.0) + (0.0066)(18 - 29.0)$

$M_s =$ 28.93 lb/lb-mole

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Plant: Chromal Ceco - Unit
Date: 2-13-89
Source/Sample Number: C-SO-1

5. Stack Gas Velocity Average

$$V_{s(avg)} = 85.49\ C_p\ (\sqrt{\Delta P})_{avg} \sqrt{\frac{T_s}{P_s M_s}}$$

$$V_{s(avg)} = 85.49(0.84)(1.0527)\sqrt{\frac{(531.7)}{(30.79)(28.93)}}$$

$V_{s(avg)}$ = 58.4 ft/sec.

6. Stack Volumetric Flow Rate, Actual Conditions (Stack Temperature and Pressure)

$$Q_s = 60\ V_s\ A = 60\ (58.4)\left(\frac{30.79}{29.92}\right)$$

Q_s = 688 acfm

7. Stack volumetric flow rate, standard conditions (68° F, 29.92 Hg)

$$Q_{(std)} = 17.64\ Q_s\ (1-B_{ws})\ \frac{P_s}{T_s} =$$

$$Q_{(std)} = 17.64(688)(1-0.0066)\frac{(30.79)}{(531.7)}$$

Q_{std} = 698 dscfm

8. Isokinetic Variation

$$\%I = K\ \frac{T_s\ V_{m(std)}}{P_s\ V_s\ A_n\ \theta\ (1-B_{ws})}$$

$$= 0.0945\ \frac{(531.7)(593.14)}{(30.79)(58.4)(0.00349)(480)(1-0.0066)}$$

%I = 100.7 %

CHROME PLATING PROCESS DATA
METAL FINISHING ASSOCIATION OF SOUTHERN CALIFORNIA

PLATING SHOP Chromal
TEST DATE 2-13-89
TANK NUMBER 1
LENGTH 6'9" INCHES
WIDTH 6' INCHES
DEPTH 8' INCHES
ADDITIVE NO (ANTI-MIST)
FREEBOARD _____ INCHES
POLYBALLS 100% INCH DIA, 3/4 PERCENT COVERAGE
HOOD TYPE _____
MIX AIR NO (AGITATION)
ACID STRENGTH _____ OUNCES CHROMIC ACID/GALLON OF SOLUTION 30% Chromic Acid

BATH TEMPERATURE 120° F
CONTROLS _____

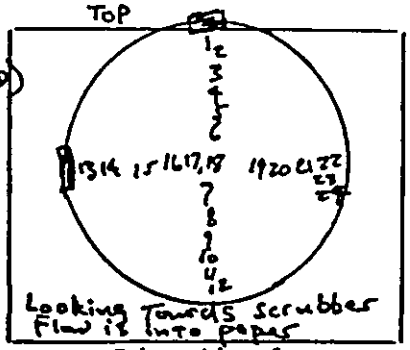
RECTIFIER _____
CAL DATE _____

TIME	DC VOLTS	AMPS	DC VOLTS	AMPS	DC VOLTS	AMPS
11:07	4.5	214269				
14:12	4.3	219620				
17:39	4.6	219845				
AVERAGE AMP-HOURS = 853						

0.20" H2O

FIELD DATA

Plant Chromal Ceco Unit
Date 2-13-89
Sampling Location Main Inlet (24" ID)
Sample Type Chrome
Run Number C-MI-1
Operator Simon, Purcell, Parks
Ambient Temperature 60° F average
Barometric Pressure 30.62
Static Pressure (P_s) -0.9" water
Filter Number(s) C-MI-F
Pretest Leak Rate = 0.009 cfm @ 12 in. Hg
Pretest Pitot Leak Check ✓
Pretest Orsat Leak Check ✓ N.A.
Read and Record all Data Every 20 Minutes



Schematic of Traverse Point Layout

Probe Length and Type 3' glass
Pitot Tube I.D. No. Type S
Nozzle I.D. 0.31, 0.32, 0.30
Assumed Moisture, % 1.0
Temp. Readout S/N —
Meter Box Number Nutech 2A
Meter $\Delta H_@$ 1.92
C Factor 1.10
Meter Gamma 1.003
Heater Box Setting —
Reference Δp 0.20
Post Test Leak Rate = — cfm @ — in. Hg
Post Test Pitot Leak Check OK. ✓
Post Test Orsat Leak Check N.A.

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
1	0	/ 0950	0[illegible].042	0.40	2.40	2.4	68			6.5		
1	20	/ 0910	081.7	0.36	2.2	2.2	70	65	55	6.0		60
2	40	/ 0930	097.1	0.40	3.6	3.6	70	68	58	7.5		59
3	60	/ 0950	136.9	0.42	3.85	3.85	68	71	60	8.0		63
4	80	/ 1010	136.9	0.40	3.60	3.6	67	73	62	7.0		55
5	100	/ 1030	156.9	0.36	3.70	3.85	68	75	64	7.0		56
6	120	/ 1050	177.5	0.40	3.70	3.70	68	81	69	7.5		59
7	140	/ 1110	191.4	0.40	3.7	3.7	67	83	70	7.5		55
8	160	/ 1130	216.5	0.40	3.70	3.7	69	88	75	7.5		55
9	180	/ 1150	237.3	0.40	3.70	3.7	68	90	76	7.5		54
10	200	/ 1210	MISSED	0.40	3.70	3.7	73	100	82	7.5		53
11	220	/ 1230	277.8	0.40	3.70	3.7	72	100	82	7.5		50
12	240	/ 1250	298.9	0.41	3.80	3.8	67	95	81	7.5		52
13	260	/ 1320	[illegible]	0.39	3.6	3.6	70	98	86	7.5		50
14	280	/ 1340	338.7	0.40	3.70	3.7	69	94	79	7.5		48
15	300	/ 1400	359.5	0.39	3.6	3.6	70	96	78	7.0		47
16	320	/ 1420	379.1	0.39	3.6	3.6	68	87	74	7.5		45
17	340	/ 1440	399.5	0.40	3.7	3.7	69	91	76	7.5		45
18	360	/ 1500	420.5	0.41	3.9	3.9	66	84	73	8.0		44
19	[illegible]	1520	433.[illegible]	Pump Died - END of TEST				81	75	18.0		44
20	400	/ [illegible]										
21	420	/	368.115		3.53		68.8				4	52.1
22	440	/		.629		5	68.8	78	70			
23	460	/									5	12.1
24	480	/						538	[illegible]			

SWITCH - START @ 12:55 1300

1513

reset nomographs

PACIFIC ENVIRONMENTAL SERVICES, INC.

PES

SAMPLE RECOVERY DATA

Plant: Chromal Plating Co. → Caco Unit

Date: 2-13-89

Sampling Location: Main Inlet

Sample Type: Chrome + Hexavalent Chrome

Run Number: C-MI-1

Sample Box Number: 1B ~~C-MI-1~~

Clean-up Man: Simon/Arks

Job Number: 3625

Comments:

FRONT HALF

Filter Number: C-MI-F

Description of Filter:

MOISTURE

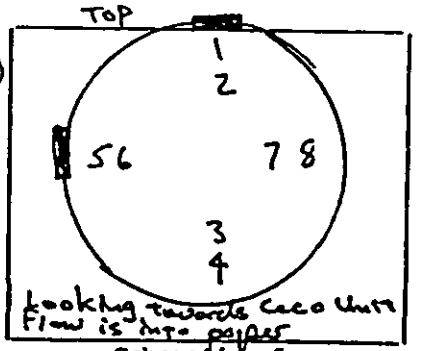
	#1		#2		#3	
Impingers						
Final Volume:	106	ml	165	ml	1	ml
Initial Volume:	100	ml	100	ml	0	ml
Net Volume:		ml		ml		ml
Total H_2O:						
Silica Gel + Impinger						
Tare Wt. Final Volume:		g		g		g
+ Initial Volume	101.3	g		g		g
Net Volume		g		g		g
Total Moisture:						

Description of Impinger Catch:

Note: Botton of Impinger Broke. No final silica gel weight was obtainable. MJB.

FIELD DATA

Plant Chromal (Ceco Unit)
Date 2-13-89
Sampling Location Inlet (6" slipstream)
Sample Type Chrome
Run Number C-ST-1
Operator Simon, Purcell, Parks
Ambient Temperature 60°F, overcast
Barometric Pressure 30.64
Static Pressure (P_s) -2.5"
Filter Number(s) C-ST-F
Pretest Leak Rate = 0.01 cfm @ 10 in. Hg
Pretest Pitot Leak Check ✓
Pretest Orsat Leak Check
Read and Record all Data Every 60 Minutes



Schematic of Traverse Point Layout

Probe Length and Type 1' glass
Pitot Tube I.D. No. 1' Standard
Nozzle I.D. 0.29, 0.29, 0.30 for #1; 0.235, 0.226, 0.237 for #2
Assumed Moisture, % 1.0
Temp. Readout S/N —
Meter Box Number Joy
Meter $\Delta H_@$ 1.735
C Factor None on this Nomograph
Meter Gamma 0.993
Heater Box Setting —
Reference Δp 0.56
Post Test Leak Rate = 0.02 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	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
				#1	#2						#3
1	0 / 0858	655.414	(0.70) .97	5.5	3.5		59	—			50
1	20 / 0918	672.857	STOP TEST TO CHANGE TO SMALLER NOZZLE (Pump couldn't pull large ΔH)								
1	20 / 0925	672.860	(0.63) 0.90	3.40	3.0	64	60		9.0		50
2	60 / 1005	708.1	1.51 1.12	3.40	2.50	64	60		9.5		51
3	120 / 1105	755.7	.64	2.60	2.60	64	66		10.0		49
4	180 / 1205	806.2	0.90	1.65	1.65	64	69		7.0		48
4	240 / 1305	848.178	END OF 1st HALF OF TEST - STOP								
—	— / 1309	—	—	—	—	—	—	—	—	—	—
5	240 / 1308	848.178	0.69	2.80	2.80	66	69		12.0		46
6	300 / 1408	901.1	0.78	3.20	2.10	64	68		12.0		45
7	360 / 1508	957.1	0.63	2.70	2.80	60	66		8.0		42
8	420 / 1608	010.3	0.90	1.75	2.85	58	60		7.0		40
8	480 / 1708	061.457	END OF TEST								
	/										
	/										
	/				2.94		64.8				
	/										
	/										
	/										
	/										
	/										
	/										
	/										

ΔP_r = .23 (reset nomograph) ΔP_r = .56
Use plastic nomograph ΔP_r = 0.56 Still
START AT 1308

PACIFIC ENVIRONMENTAL SERVICES, INC.

PES

SAMPLE RECOVERY DATA

Plant: Chromal Coco Unit

Date: 2-13-89

Sampling Location: ~~After~~ Slip Stream Inlet

Sample Type: Chrome & Hexavalent Chrome

Run Number: C-SI-1

Sample Box Number: 23 - C-SI-1

Clean-up Man: Parks / Simon

Job Number: 3625

Comments:

FRONT HALF

Filter Number: C-SI-F

Description of Filter:

MOISTURE

	#1		#2		#3	
Impingers Final Volume:	105	ml	100	ml	3	ml
Initial Volume:	100	ml	100	ml	0	ml
Net Volume:		ml		ml		ml
Total H_2O:					8 ml	

Silica Gel + Impinger

Tare Wt. + Final Volume: 168.0 g

Tare Wt. + Initial Volume: 124.4 g

Net Volume: 43.6 g

Tare Wt. +	g	X	X
	g	X	X
	g	X	X

Total Moisture: Total 51.6 ml

Description of Impinger Catch:

PES

SAMPLE RECOVERY DATA

Plant: Chromal - Ceco Unit

Date: 11-13-89

Sampling Location: Stack Outlet

Sample Type: Chrome

Run Number: C-50-1

Sample Box Number: 3B - 501

Clean-up Man: Simon / Parks

Job Number: 3625

Comments:

FRONT HALF

Filter Number: C-50-F

Description of Filter:

MOISTURE

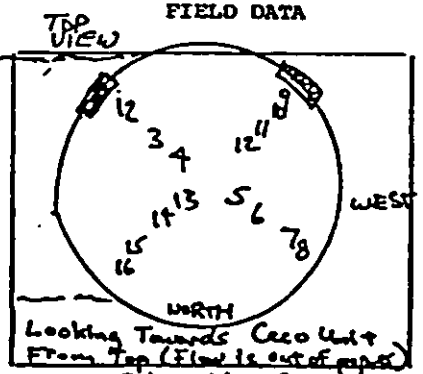
	#1		#2		#3	
Impingers Final Volume:	123	ml	108	ml	2	ml
Initial Volume:	100	ml	100	ml	0	ml
Net Volume:	23	ml	8	ml	2	ml
Total H_2O:					Tot 25 ml	
Silica Gel + Impinger Tare Wt + Final Volume:	191.8	g		g		g
Initial Volume	133.2	g		g		g
Net Volume	58.6	g		g	Total	g
Total Moisture:					83.6	

Description of Impinger Catch:

Tank [illegible] throughout test.

FIELD DATA

Plant Chromel (Ceco)
Date 2-13-89
Sampling Location Stack Outlet
Sample Type Chrome
Run Number C-50-1
Operator Simon, Purcell, Parks
Ambient Temperature 60 F, overcast
Barometric Pressure 30.64
Static Pressure (P_g) -2.10
Filter Number(s) C-50-F
Pretest Leak Rate = 0.003 cfm @ 12 in. Hg
Pretest Pitot Leak Check ✓
Pretest Orsat Leak Check N.A.
Read and Record all Data Every 30 Minutes



Schematic of Traverse Point Layout

Probe Length and Type 1.5' glass
Pitot Tube I.D. No. Standard (multiply by 1.89 to convert to "S")
Nozzle I.D. .291, .288, .295 for first nozzle, .291, .288, .299 for 2nd one.
Assumed Moisture, % 2.0
Temp. Readout S/N —
Meter Box Number NUTECH 2A
Meter $\Delta H_@$ 1.93
C Factor 1.15
Meter Gamma 0.9967
Heater Box Setting N.A.
Reference Δp 0.40
Post Test Leak Rate = 0.011 cfm @ 15 in. Hg
Post Test Pitot Leak Check ✓
Post Test Orsat Leak Check N.A.

	Traverse Point Number	Sampling Time, (min) / Clock Time /(24-hour clock)	Gas Meter Reading (V_m) ft^3	Corrected Velocity Head (ΔP_g) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F (#5)	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F (#6)	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F (#7)	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F (#4)	
0	1	0 / 0910	932.047	1.00	9.00	7.0							$\Delta P_r = 2.20$
30	2	30 / 0940	967.7	1.00	9.00	7.5	71	65	70	12.5		56	
40	2	40 / 0950	985.0	STOP	TEST-	SWITCHED TO	SMALLER	NOZZLE		(Pump Couldn't pull		target ΔH)	Reset Nomograph. $\Delta P_r = 0.40$
90	2	90 / 0953	985.0	1.00	4.5	5.0	71	64 73	M 57 3 67	10.0		57	
60	3	60 / 1013	007.7	1.00	4.6	4.80	73	77	66	10.0		59	
120	4	120 / 1043	NOT TAKEN	1.2	5.5	5.4	71	82	71	10.0		60	
150	5	150 / 11:23	098.00	1.1	5.0	5.0	74	85	78	9.0		56	
180	6	180 / 11:43	115.8	1.14	5.2	5.3	72	84	75	9.0		55	Rain
210	7	210 / 12:13	156.3	1.15	5.4	5.4	69	86	76	9.0		60	
240	8	240 / 12:43	190.0	1.15	5.4	5.4	75	87	78	9.5		53	
240	8	240 / 13:13	226.988	— END OF	1st HALF -	STOP	—	—	—	—	—	—	
240	9	240 / 13:26	226.988	1.04	4.6	4.6	83	81	76	9.0		46	
270	10	270 / 13:56	262.3	1.04	4.6	4.6	89	84	75	8.0		47	
300	11	300 / 1426	298.2			4.6	75	84	74	9.0		44	
330	12	330 / 1456	333.2	1.37	6.00	FES	68	83	74	10.		41	
360	13	360 / 1526	372.4	1.29	5.8	5.8	68	77	70	10.5		38	
390	14	390 / 1556	411.8	1.18	5.35	5.35	65	75	67	9.8		39	
420	15	420 / 1626	450.0	1.03	4.85	4.85	65	77	67	9.0		41	
450	16	450 / 1656	489.2	1.03	4.85	4.85	64	72	68	9.0		40	
480	1 Clp	480 / 1726	527.73										
		/											
		/											
		/											
		/											

PACIFIC ENVIRONMENTAL SERVICES, INC.

Received: 02/14/89 02/22/89 10:35:15

REPORT TO: Pacific Environmental Service
150 E. Foothill Blvd.
Arcadia, CA 91006

ATTEN: Mr. Dean High

CLIENT: PACIFIC ENVI SAMPLES: 9
COMPANY: Pacific Environmental Service
FACILITY:

WORK ID: #3625
TAKEN: By Pacific Enviro Staff
TRANS: By Pacific Enviro Staff
TYPE: Liquids
P.O. #: # 3625
INVOICE: under separate cover

PREPARED BY: Thermo Analytical, Inc.
160 Taylor Street
Monrovia, CA 91016

ATTEN:
PHONE: 818-357-3247

Robert S. Ferguson
CERTIFIED BY

CONTACT: RSF

This report is for the sole and exclusive use of the client to whom it is addressed and represents only those samples herein described. Samples not destroyed in testing are retained a maximum of 30 days unless otherwise requested.

Information reported by telephone to Scott on 2/21/89.

SAMPLE IDENTIFICATION

01	C-FB
02	C-SI-TB
03	C-SO-1
04	C-SO-F
05	C-MI-1
06	C-MI-F
07	C-SI-1
08	C-SI-F
09	C-RB

TEST CODES and NAMES used on this report

CRHEXS	Hexavalent Chromium
CRHGAA	Chromium - Air
CR HEX	Hexavalent Chromium
CR L	Chromium - Liquids
WC	General Chemical Testing

PACIFIC ENVIRONMENTAL SERVICES

SAMPLE ID C-FB SAMPLE # 01 FRACTIONS: A
Date & Time Collected 02/13/89 Category

CRHEXS <0.5 ugms/Filter CRHGAA 0.34 Total ug

SAMPLE ID C-SI-TB SAMPLE # 02 FRACTIONS: A
Date & Time Collected 02/13/89 Category

CR_HEX 0.026 mg/L CR_L 0.0308 mg/L WC 223 mls

SAMPLE ID C-SO-1 SAMPLE # 03 FRACTIONS: A
Date & Time Collected 02/13/89 Category

CR_HEX 0.023 mg/L CR_L 0.0571 mg/L WC 880 mls

SAMPLE ID C-SO-F SAMPLE # 04 FRACTIONS: A
Date & Time Collected 02/13/89 Category

CRHEXS <0.5 ugms/Filter CRHGAA 0.32 Total ug

SAMPLE ID C-MI-1 SAMPLE # 05 FRACTIONS: A
Date & Time Collected 02/13/89 Category

CR_HEX 2.27 mg/L CR_L 2.81 mg/L WC 570 mls

SAMPLE ID C-MI-F SAMPLE # 06 FRACTIONS: A
Date & Time Collected 02/13/89 Category

CRHEXS <0.5 ugms/Filter CRHGAA 0.66 Total ug

SAMPLE ID C-SI-1 SAMPLE # 07 FRACTIONS: A
Date & Time Collected 02/13/89 Category

CR_HEX 0.98 mg/L CR_L 1.27 mg/L WC 926 mls

SAMPLE ID C-SI-F SAMPLE # 08 FRACTIONS: A
Date & Time Collected 02/13/89 Category

CRHEXS <0.5 ugms/Filter CRHGAA 1.14 Total ug

Received: 02/14/89 Results by Sample

SAMPLE ID C-RB SAMPLE # 09 FRACTIONS: A

Date & Time Collected 02/13/89 Category

CR_HEX	CR_L	WC
<0.003 mg/L	0.0027 mg/L	145 mls

Pacific Environmental Service

Five liquids and four filters were analyzed for hexavalent and total chromium content, according to EPA method 425. The volumes of the liquids were measured.

Please see the enclosed tables for the results.