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.

Background Report Reference

AP-42 Section Number: 12.20

Background Chapter: 4

Reference Number: 41

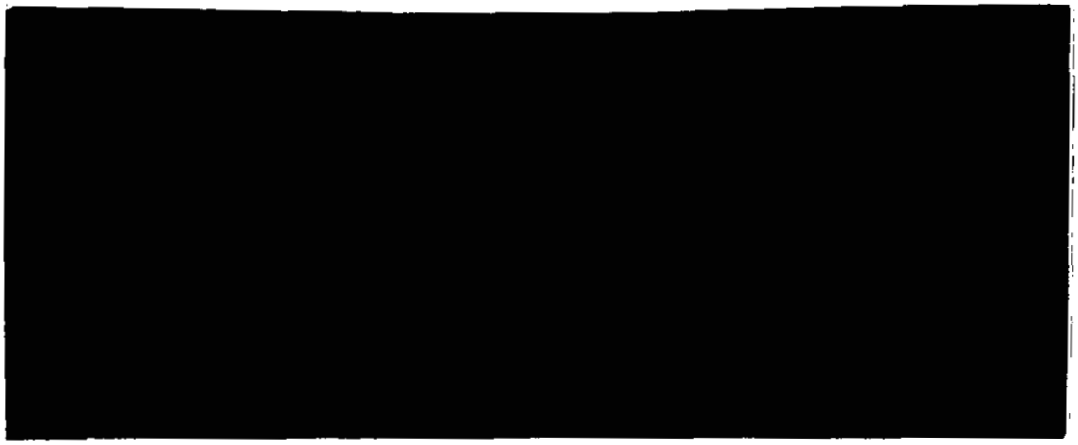
Title: Source Test Report of a CM&E Demonstration Unit Serving a Hard Chromic Plating Tank at Electrolyzing Inc., 1947 Hooper Avenue, Los Angeles, CA 90011

PES

January 1989

ELECTROPLATING

REF. 4-41



PACIFIC ENVIRONMENTAL SERVICES, INC.

WASHINGTON, D.C. • RESEARCH TRIANGLE PARK, NC • LOS ANGELES, CA

Source Test Report of a CM&E Demonstration Unit Serving a Hard Chrome Plating Tank at Electrolizing Inc., 1947 Hooper Avenue Los Angeles, CA 90011

Conducted for the
Metal Finishing Association of Southern California
5000 Van Nuys Blvd
Sherman Oaks, CA 91403

Prepared by
Pacific Environmental Services, Inc.
150 E. Foothill Blvd
Arcadia, CA 91006
1/25/89

Source Test Report of a CM&E Demonstration Unit
Serving a Hard Chrome Plating Tank at
Electrolizing Inc., 1947 Hooper Avenue
Los Angeles, CA 90011

INTRODUCTION

Pacific Environmental Services, Inc. (PES) was contracted by the Metal Finishing Association of Southern California (MFASC), to perform a screening test on the control efficiency of a CM&E demonstration unit used to collect hexavalent chromium emissions from a hard chrome plating operation. Set up and velocity determinations were conducted on January 18, and the source testing was done on January 19, 1989.

In order to evaluate the effectiveness of the CM&E unit, it was necessary to have a hard chrome plating tank that was outfitted with an emission collection system. Electrolizing Inc. in Los Angeles, CA, was the site chosen for the testing. Susan Grant, General Manager of Electrolizing Inc., arranged for the hookup of the demonstration unit and the tank operation during source testing.

The exhaust was taken from hard chrome plating tank No. 10 to supply the CM&E unit. The plating tank was covered by a prefabricated dome enclosure and a flexible hose was attached to the enclosure outlet above the tank. The flexible hose ran across ceiling joints then vertically to the roof, then across the roof and down to the inlet of the CM&E unit (Figure 1). The length of the hose and pipe was approximately 100 feet between the tank and the control unit. The outlet of the tank, the inlet to the CM&E unit, and the outlet of the CM&E unit were all 6" I.D..

On January 18th, velocity traverses were taken at 10 different ports to determine the velocities of the emission system. Two traverses were near the tank exhaust, four traverses were made on the inlet near the unit and four on the outlet (Figure 2). The preliminary velocity traverses above the tank measured 9.4 ft/sec, at the inlet to the CM&E unit it was 8.7 ft/sec, and at the outlet it was 9.8 ft/sec.

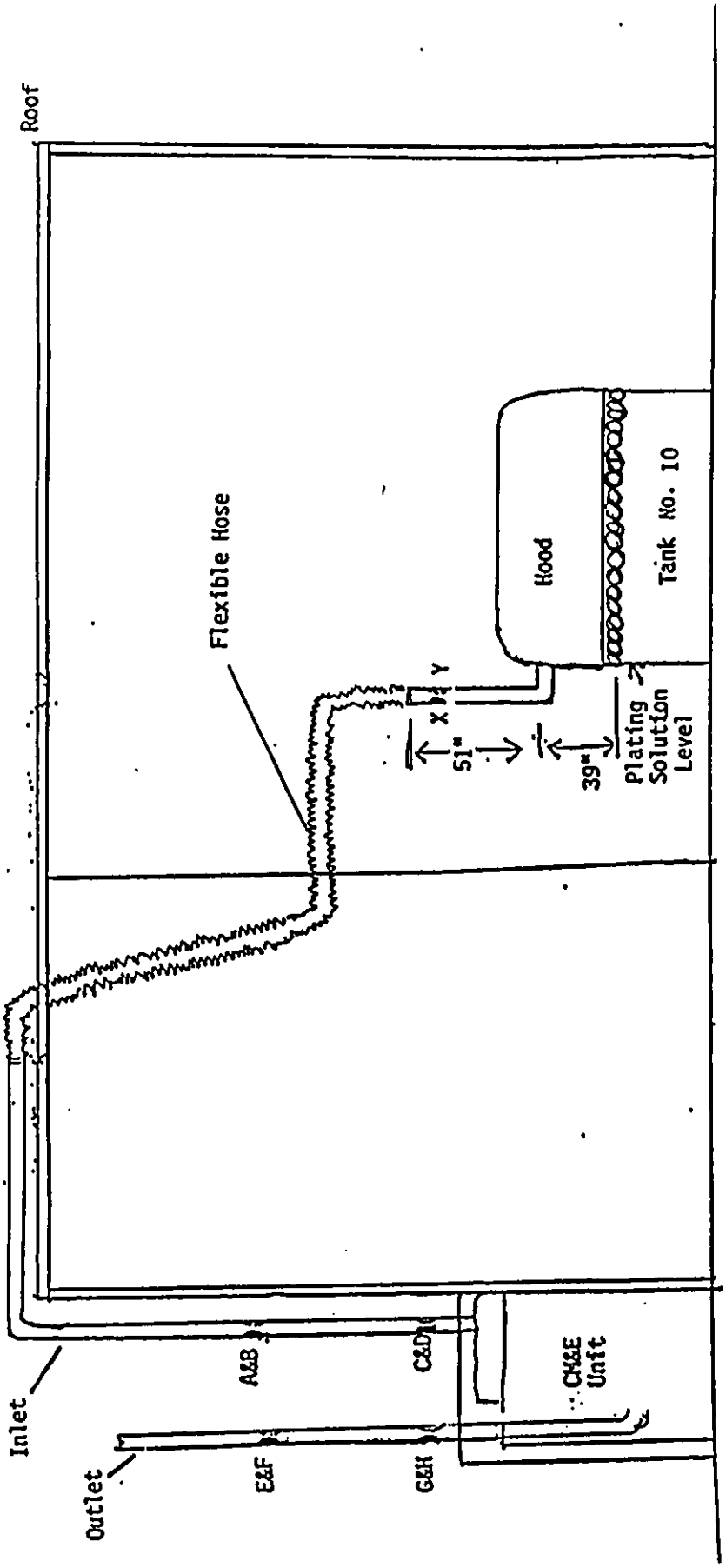


Figure 1: Diagram of the Exhaust Line From Plating Tank No. 10 to the CM&E Demonstration Unit.

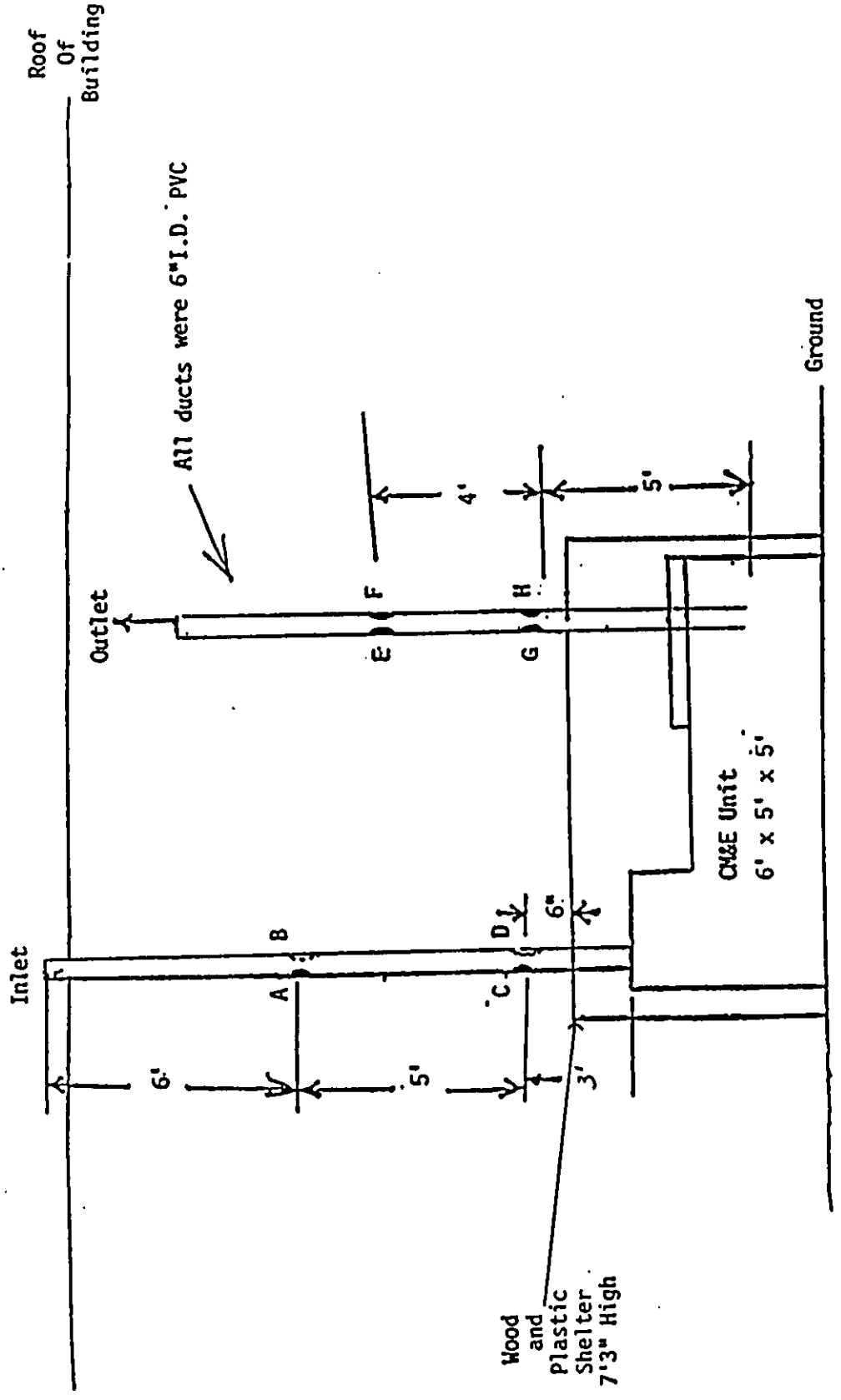


Figure 2: Diagram of Testing Ports for the CM&E Unit

On January 19th, two locations were chosen for sampling. The first sample, CME-I, was taken from the inlet to the unit at sampling port A. This sample was used to determine the quantity of emissions in the gas stream before entering the CM&E unit. The second sample, CME-O, was taken from the outlet of the CM&E unit at sampling port G, in order to determine the emission rate and subsequently the reduction efficiency of the CM&E unit for hexavalent chromium emissions. Continuous velocity measurements were observed in ports C and F.

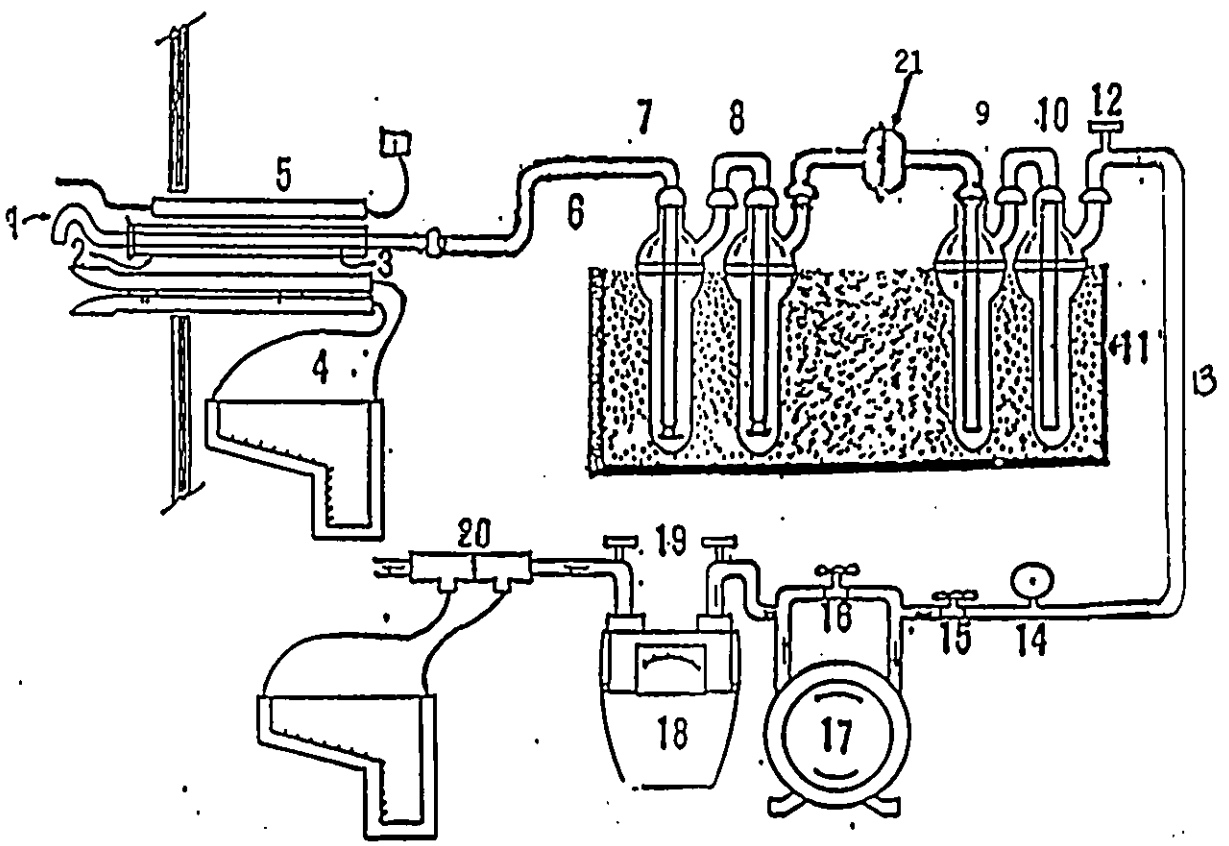
EQUIPMENT AND PROCESS DESCRIPTION

Electrolizing Inc., 1947 Hooper Avenue, Los Angeles, CA 90011 , is engaged in the business of hard chrome plating for the aircraft and various other industries. During the test, the CM&E unit served hooded hard chrome plating tank No. 10. The dimensions of the tank were approximately 3.5′ x 8′ x 3′deep. The tank had a 3" freeboard and had a 3/4" polyball coverage of 150%. During the test the temperature of the tank was maintained at 140 F, the voltage averaged 6.5 volts, and the amperage averaged 1065 amps. The concentration of chrome in the tank was 143,500 mg/l for total chrome and 140,000 mg/l for hexavalent chrome.

The CM&E demonstration unit was approximately 6′ x 5′ x 5′. It was mounted on a trailer that was 5′ x 9′ and weighed 1300 pounds. The full name of the unit is the SVS/MECA, which stands for its two stages, the Smart Ventilation System and the Multipurpose Emission Control Assembly. The power requirements were 230 V at 20 amps or 460 V at 10 amps. The demonstration unit was sized for application on tanks 20 sq.ft. or smaller.

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 0.52" I.D. glass nozzle, a teflon lined stainless steel probe, two impingers each with 100 ml of 0.1N sodium hydroxide, an 89mm teflon coated glass fiber filter placed after the second wet impinger, an empty impinger, an impinger filled with silica gel, a vacuum pump, a dry gas meter, and a calibrated orifice connected to an inclined manometer.



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

Sampling at the two ports was conducted simultaneously at a single stack velocity location for a period of just over five hours. Velocity and temperature of the emission streams were measured and recorded every 30 minutes during the test. The meter temperature and the volume of gas through the meter also were measured every 30 minutes during the test. Applied voltage and amperage to the chrome plating tanks and plating bath temperature was recorded by CM&E personnel. All information was recorded on field data sheets (Appendix).

Laboratory analyses were conducted by Thermo Analytical Laboratory in Monrovia, CA. Total chrome concentration and hexavalent chrome concentration were determined for the two stack samples, a blank, and the plating bath solution. Chrome analyses and pH were measured for the scrubbing solution of the CM&E unit. Analyses for total chrome used atomic absorption spectrophotometry and analyses for hexavalent chrome used diphenylcarbazide colorimetric techniques.

RESULTS OF TESTING

After running 5 hours and 7 minutes the test was stopped immediately when water was observed in the silica gel impinger on the outlet train. The bottom of the impinger had broken off and allowed water to be sucked into the impinger. A post sampling leak check of the sample collection system passed at 6" Hg vacuum so we believe that the test results were not seriously effected. A leak in the silica gel impinger would allow the pump to suck ambient air, thus providing a lower concentration of chrome than would be correct. Results of the test should not be used quantitatively but can be used to indicate the general concentration of chrome in the inlet and outlet ducts.

Because of the above difficulty, no moisture determination could be made on the outlet train. It was decided to estimate moisture on both the inlet and outlet assuming saturated air at the measured stack temperature and pressure. The estimate was 2% moisture content.

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 during sample extraction. The isokinetic sampling rates were 94.9% for the inlet and 98.4% for the outlet. Results are shown on the emission test calculation sheets (Appendix).

The inlet loading to the CM&E unit was 0.4579 mg/amp-hour for total chrome and 0.3271 mg/amp-hour for hexavalent chrome. The outlet was 0.0091 mg/amp-hour for total chrome and 0.0059 for hexavalent chrome. The control efficiency for total chrome was calculated at 98.02% and for hexavalent chrome was calculated at 98.19% (Tables 1 and 2).

TABLE 1: CONTROL EFFICIENCY OF THE CH&E PVS/MECA DEMONSTRATION UNIT ON TOTAL CHROME EMISSIONS.

CHE-I Sample liquid from the impingers in the inlet sample train.
CHE-FI Sample caught on the filter in the inlet sample train.
CHE-O Sample liquid from the impingers in the outlet sample train.
CHE-FO Sample caught on the filter in the outlet sample train.

SAMPLE RUN NUMBER	SAMPLE VOLUME (ml)	Conc. Cr T (mg/l)	Impinger Catch Cr T (mg)	Filter Catch Cr T (mg)	Total Catch Cr T (mg)	SAMPLE METER VOL (dscf)	EMISSIONS Cr T (mg/scf)	STACK FLOW RATE (dscfm)	ACTUAL EMISSIONS Cr T (mg/hour)	AVERAGE AMP-HOURS	EMISSIONS Cr T (mg/amp-hour)	CONTROL EFFICIENCY Cr T %
Inlet					17.7215	233.004	0.0761	106.87	487.69	1065	0.4579	
CHE-I	545	32.2	17.549									
CHE-FI				0.1725								
Outlet					0.3655	275.343	0.00133	121.31	9.66	1065	0.0091	98.02
CHE-O	650	0.46	0.299									
CHE-FO				0.0665								

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TABLE 2: CONTROL EFFICIENCY OF THE CM&E PVS/MECA DEMONSTRATION UNIT ON HEXAVALENT CHROME EMISSIONS.

CME-I Sample liquid from the impingers in the inlet sample train.
CME-FI Sample caught on the filter in the inlet sample train.
CME-O Sample liquid from the impingers in the outlet sample train.
CME-FO Sample caught on the filter in the outlet sample train.

SAMPLE RUN NUMBER	SAMPLE VOLUME (ml)	Conc. Cr 6 (mg/l)	Impinger Catch Cr 6 (mg)	Filter Catch Cr 6 (mg)	Total Catch Cr 6 (mg)	SAMPLE METER VOL (dscf)	EMISSIONS Cr 6 (mg/scf)	STACK FLOW RATE (dscfm)	ACTUAL EMISSIONS Cr 6 (mg/hour)	AVERAGE AMP-HOURS	EMISSIONS Cr 6 (mg/amp-hour)	CONTROL EFFICIENCY Cr 6 %
Inlet					12.6582	233.004	0.0543	106.87	348.35	1065	0.3271	
CME-I	545	23	12.535									
CME-FI				0.1232								
Outlet					0.2384	275.343	0.0009	121.31	6.30	1065	0.0059	98.19
CME-O	650	0.3	0.195									
CME-FO				0.0434								

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PES

Plant: Electrolizing Inc
Date: 1-19-1989
Source/Sample Number: CNE-I

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

$V_{m(std)} = 17.64(243.005)(1.003)\left[\frac{(29.90) + (2.045/13.6)}{(554.5)}\right]$

$V_{m(std)} =$ 233.004 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

$B_{Ws} = \frac{V_{W(std)}}{V_{W\ std} + V_{m\ (std)}} = \frac{(\quad)}{(\quad)+(\quad)} =$ 0.020 = maximum saturation content

$B_{Ws} =$ 0.020

4. Molecular Weight, Stack gas

Dry Molecular Weight

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

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

$M_d =$ 29.0 lb/lb-mole [40 CFR, Part 60, Method 2, App A, section 3.6]

$M_s = M_d + B_{Ws}(18 - M_d) = (29.0) + (0.020)(18 - 29.0)$

$M_s =$ 28.78 lb/lb-mole

PES

Plant: Electrolizing Inc.
Date: 1-19-1989
Source/Sample Number: CME-I

5. Stack Gas Velocity Average

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

$$V_{s(avg)} = 85.49(0.84)(0.1656)\sqrt{\frac{(533.6)}{(29.88)(28.78)}}$$

$V_{s(avg)}$ = 9.37 ft/sec.

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

$$Q_s = 60\ V_s\ A = 60\ (9.37)(0.1963)$$

Q_s = 110.39 acfm

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

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

$$Q_{(std)} = 17.64(110.39)(1-0.02)\frac{(29.88)}{(533.6)}$$

Q_{std} = 106.870 dscfm

8. Isokinetic Variation

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

$$= 0.0945\ \frac{(533.6)(233.004)}{(29.88)(9.37)(.00475)(307)(1-0.020)}$$

%I = 94.9 %

PES

Plant: Electrolizing Inc.
Date: 1-19-1999
Source/Sample Number: CME-0

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

$V_{m(std)} = 17.64(284.897)(0.993)\left[\frac{(29.90) + (2.614/13.6)}{(545.4)}\right]$

$V_{m(std)} =$ 275.343 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

$B_{ws} = \frac{V_{w(std)}}{V_{w\ std} + V_{m\ (std)}} = \frac{(\ -\ )}{(\ -\ )+(\ -\ )} =$ 0.020 max saturation level.

$B_{ws} =$ 0.020

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 (40 CFR, Section 60, Method 2, App A, sect 3.6)

$M_s = M_d + B_{ws}(18 - M_d) = (29.0) + (0.020)(18 - 29.0)$

$M_s =$ 28.78 lb/lb-mole

PES

Plant: Electrolizing Inc.
Date: 1-19-1989
Source/Sample Number: CME-O

5. Stack Gas Velocity Average

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

$V_{s(avg)} = 85.49(0.84)(0.1903)\sqrt{\frac{(546.5)}{(29.90)(28.78)}}$

$V_{s(avg)} =$ 10.89 ft/sec.

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

$Q_s = 60\ V_s\ A = 60\ (10.89)(0.1963)$

$Q_s =$ 128.26 acfm

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

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

$Q_{(std)} = 17.64(128.26)(1-0.02)\frac{(29.90)}{(546.5)}$

$Q_{std} =$ 121.31 dsofm

8. Isokinetic Variation

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

$= 0.0945\ \frac{(546.5)(295.343)}{(29.90)(10.89)(\quad)(307)(1-0.02)}$

$\%I =$ 98.42 %

FIELD DATA

Plant Electrolyzing Inc.
Date 1-19-89
Sampling Location INLET
Sample Type CHROME
Run Number ~~CME-I~~ CME-I
Operator SIMON/COTTONE
Ambient Temperature 75 F
Barometric Pressure
Static Pressure (P_s) -0.3
Filter Number(s) TEFLON - NA
Pretest Leak Rate = 0.002 cfm @ 15 in. Hg
Pretest Pitot Leak Check ✓
Pretest Orsat Leak Check NA.
Read and Record all Data Every 30 Minutes

Schematic of Traverse Point Layout

Probe Length and Type 3' Teflon Lined
Pitot Tube I.D. No.
Nozzle I.D. 0.520" 31955
Assumed Moisture, % 1.0
Temp. Readout S/N
Meter Box Number NUTECH
Meter $\Delta H_@$ 1.92
C Factor
Meter Gamma 1.003
Heater Box Setting NONE
Reference Δp 0.027
Post Test Leak Rate = 0.002 cfm @ 10 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	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
~~C1~~ A1	0	/ 10:30	782.137	0.025	1.80		64	72	70	5.0		40
~~C1~~	30	/ 11:00	803.0	0.026	1.90		68	82	75	5.0		58
~~C1~~	60	/ 11:30	824.6	0.027	1.80		69	94	79	5.0		59
~~C1~~	90	/ 12:00	845.8	0.027	1.6		68	96	86	4.5		61
~~C1~~	120	/ 12:30	867.2	0.027	2.2		73	101	98	4.5		65
~~C1~~	150	/ 13:00	889.8	0.028	2.3		75	105	104	4.5		60
~~B1~~	180	/ 13:30	913.4	0.030	2.3		72	97	95	5.5		53
~~B1~~	210	/ 14:00	938.0	0.026	2.9		73	94	94	5.0		50
~~C1~~	240	/ 14:30	962.7	0.030	2.4		87	118	114	5.0		57
~~C1~~	270	/ 15:00	987.7	0.030	2.3		82	104	103	4.5		54
~~C1~~ ↓	300	/ 15:30	012.1	0.029	2.1		78	101	101	4.0		52
		/ 15:37	025.42		STOPPED TEST							
		/										
		/										
		/										
		/										
		/										
		/										
		/										
		/										
		/										
		/										
		/										

CONTINUED

PACIFIC ENVIRONMENTAL SERVICES, INC.

243.005

FIELD DATA

Plant Electrolizing Inc
Date 1-19-89
Sampling Location OUTLET - STACK
Sample Type EPA CHROME
Run Number ~~CME-10~~ CME-O
Operator CONNOR
Ambient Temperature 75
Barometric Pressure 29.9
Static Pressure (P_g) +0.02
Filter Number(s) NA · TFE
Pretest Leak Rate = 0.007 cfm @ 15 in. Hg
Pretest Pitot Leak Check ~~+.002~~ OK
Pretest Orsat Leak Check
Read and Record all Data Every ___ Minutes

Schematic of Traverse Point Layout

Probe Length and Type 3' TEFLON
Pitot Tube I.D. No.
Nozzle I.D. 0.520 9 CLASS
Assumed Moisture, % 1
Temp. Readout S/N NUTECH
Meter Box Number 304
Meter $\Delta H_@$ 1.735
C Factor 1.05
Meter Gamma 0.993
Heater Box Setting NA
Reference Δp 0.26
Post Test Leak Rate = 0.000 cfm @ 6 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_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	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
CENTROID G1	0	1030	015.017	0.044	3.1	3.1	85	66		5.5	AMBIENT	
1	30	1100	43.3	0.037	2.7	2.7	85	72		4.5	AMBIENT	
1	60	1130	69.4	0.037	2.7	2.7	85	78		4.5	AMB	
	90	1200	96.2	0.036	2.4	2.5	85	81		4.0		
	120	1230	122.9	0.037	2.65	2.65	84	84		4.0		
	150	1300	150.8	0.036	2.5	2.5	91	96		4.0		
	180	1330	176.5	0.035	2.6	2.6	89	87		4.5		
	210	1400	203.9	0.033	2.45	2.45	90	85		4.0		
	240	1430	230.2	0.033	2.45	2.45	90	97		4.0		
	270	1500	258	0.035	2.6	2.6	86	95		4.0		
	300	1530	284	0.037	2.6	2.6	86	98		4.0		
		1537	299.914		STOPPED TEST							
								85 56				

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CHROME PLATING PROCESS DATA
METAL FINISHING ASSOCIATION OF SOUTHERN CALIFORNIA

PLATING SHOP ELECTROLYZING
TEST DATE 1-19-89
TANK NUMBER _____
LENGTH _____ INCHES
WIDTH _____ INCHES
DEPTH _____ INCHES
ADDITIVE NA
FREEBOARD 3 INCHES
POLYBALLS 3/4 INCH DIA, 150 PERCENT COVERAGE
HOOD TYPE _____
MIX AIR _____

RECTIFIER 10
CAL DATE Dec 1, 1988

TIME	DC VOLTS	AMPS	SET Temp DC VOLTS	ACTUAL TEMP AMPS	DC VOLTS	AMPS
1100	6.5	1029	140			
1130	6.4	1024	140			
1200	6.4	1045	140	140		
1230	6.5	1061	140			
1300	6.5	1063	140			
1330	6.4	1069	140	151		
1400	6.4	1078	140	150		
1430	6.5	1080	140	150		
1500	6.5	1085	140	145		
1530	6.5	1111	140	152		

PES

SAMPLE RECOVERY DATA

Plant: Electrolyzing Inc.

Date: 1-19-89

Sampling Location: SCRUBBER INLET & OUTLET

Sample Type: EPA CHROME

Run Number: CME-I and CME-O

Sample Box Number: SEE FIELD DATA FORM FOR MORE INFO

Clean-up Man: SIMON/COTTONE

Job Number: 3625

Comments: These Samples have filters

FRONT HALF

Filter Number:	CME-FI	CME-FO	
Description of Filter:	89mm Teflon Coated		

MOISTURE

Impingers			
Final Volume:	~~≈260 mL~~ 29 ml	~~280ml~~ ~~≈260mL~~ ml	ml
Initial Volume:	200 mL ml	200mL ml	ml
Net Volume:	60 mL ml	90 ml	ml
Total H_2O:			
Silica Gel		(BROKEN IMPINGER)	
Final Volume:	290.9 g	~~29~~ LOST g	g
Initial Volume	250.1 g	250.9 g	g
Net Volume	40.8 g	g	g
Total Moisture:			

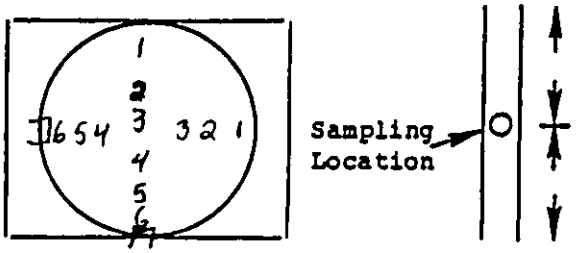
Description of Impinger Catch: INLET - LIGHT Yellow

OUTLET - Clear

POST TEST

~~PRELIMINARY~~ VELOCITY TRAVERSE

Plant: Electrolyzing Inc
Date: 1-14-1989
Location: CAUSE Scrubber Inlet & Outlet
Stack I.D.: 0.5'
Barometric Pressure, in. Hg: 29.9
Stack Gauge Pressure, in. H_2O:
Operators: Simon Cotting
Pitot Tube I.D. Number: "A" (Type S) Cp=0.84
Temperature Readout I.D.:
Pitot Tube Leak Check: ✓



Schematic of Traverse Point Layout

Inlet Stack Gauge = -.3

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
C-1	0.028	73.55°	
C-2	0.031		
C3	0.030		
C-4	0.029		
C-5	0.027		
C-6	0.012		
D-1	0.026		
D-2	0.026		
D-3	0.027		
D-4	0.027		
D-5	0.026		
D6	0.025		
		$V = 85.49(0.84)\sqrt{\Delta p}_{avg}\sqrt{\frac{(T_s)}{(P_s)(M_s)}}$	
		$M_s = 28.62$	
		$P_s = 29.88$, $T_s = 583.55$	
	$(\sqrt{\Delta p})_{avg}$		Velocity
Average	0.159		9.02 ft/s

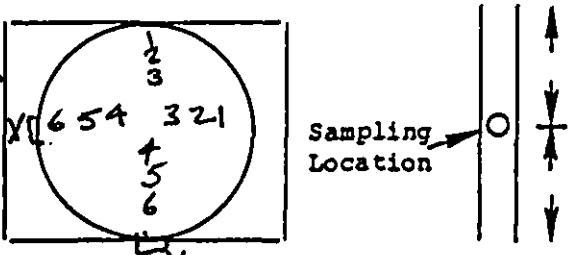
Outlet Stack Gauge = -0.02

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
G 1	0.034	~~545.45~~ 585.45	
G 2	0.037		
G 3	0.038		
G 4	0.037		
G 5	0.036		
G 6	0.084		
H 1	0.035		
H 2	0.037		
H 3	0.038		
H 4	0.037		
H 5	0.035		
H 6	0.032		
		$T_s = 585.45$	
		$M_s = 28.66$	
		$P_s = 29.9$	
	$\sqrt{\Delta p}_{avg}$		Velocity
Average	0.189		10.83 ft/s

PES

PRELIMINARY VELOCITY TRAVERSE

Plant: ELECTROLYZING INC.
Date: 4-18-89
Location: SCRUBBER INLET ABOVE TANK
Stack I.D.: CME-INLET = 6"
Barometric Pressure, in. Hg: 29.86
Stack Gauge Pressure, in. H_2O: N.A.
Operators: SIMON/PARK
Pitot Tube I.D. Number: "A" $C_p = 0.99$
Temperature Readout I.D.: —
Pitot Tube Leak Check: ✓



Schematic of Traverse Point Layout

$$\text{Velocity} = 85.49\,(0.99)\,(\sqrt{\Delta P})_{AVG}\sqrt{\frac{(T_s)^{\circ R}}{(P_s)(M_s)}}$$

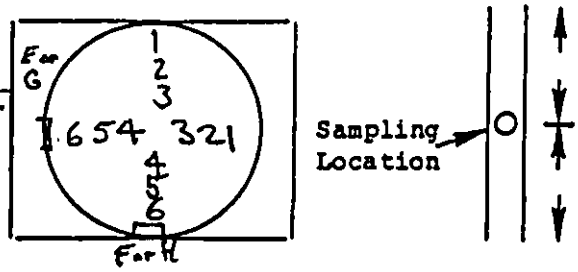
Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
X-1	0.020	70°	
X-2	0023	70°	
X-3	0.024	70°	
X-4	0.023	70°	
X-5	0.019	70°	
X-6	0.016	70°	
Y-1	0.014	70°	
Y-2	0.018	70°	
Y-3	0.020	70°	
Y-4	0.020	70°	
Y-5	0.020	70°	
Y-6	0.021	70°	
	$(\sqrt{\Delta P})_{AVG}$		VELOCITY
Average	0.1405		9.37 F/S

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
	$(\sqrt{\Delta P})_{AVG}$		VELOCITY
Average			

PES

PRELIMINARY VELOCITY TRAVERSE

Plant: ELECTROLYZING INC.
Date: 1-18-89
Location: SCRUBBER OUTLET
Stack I.D.: OUTLET FROM CMBE UNIT
Barometric Pressure, in. Hg: ~~29.9~~ 29.66
Stack Gauge Pressure, in. H_2O: -0.30
Operators: SIMON/PARKS
Pitot Tube I.D. Number: "A" C=0.99
Temperature Readout I.D.: —
Pitot Tube Leak Check: ✓



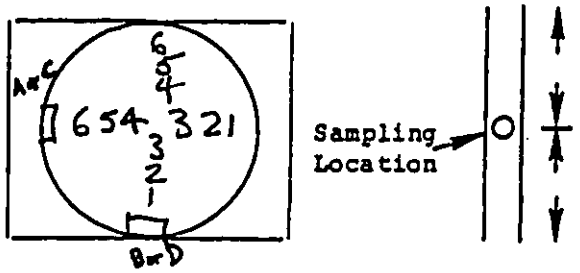
Schematic of Traverse Point Layout

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
E-1	0.015		
E-2	0.020		
E-3	0.023		
E-4	0.024		
E-5	0.023		
E-6	0.022		
F-1	0.016		
F-2	0.018		
F-3	0.022		
F-4	0.024		
F-5	0.023		
F-6	0.023		
	$(\sqrt{\Delta P})_{AVG.}$		VELOCITY
Average	0.1448		9.65 ft/s

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
G-1	0.020		
G-2	0.023		
G-3	0.025		
G-4	0.024		
G-5	0.023		
G-6	0.020		
H-1	0.016		
H-2	0.020		
H-3	0.022		
H-4	0.024		
H-5	0.023		
H-6	0.022		
	$(\sqrt{\Delta P})_{AVG}$		VELOCITY
Average	0.1475		9.85 ft/s

PRELIMINARY VELOCITY TRAVERSE

Plant: Electrolyzing Inc.
Date: 1-18-89
Location: SCRUBBER INLET
Stack I.D.: INLET TO CASE = 6"
Barometric Pressure, in. Hg: 29.66
Stack Gauge Pressure, in. H_2O: +0.02
Operators: SIMON/PARKS
Pitot Tube I.D. Number: A 0.99=C
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	0.013		
A-2	0.015		
A-3	0.019		
A-4	0.020		
A-5	0.019		
A-6	0.016		
B-1	0.017		
B-2	0.019		
B-3	0.020		
B-4	0.017		
B-5	0.014		
B-6	0.011		
	$(\sqrt{\Delta P})_{AVG}$		VELOCITY
Average	0.1286		8.57 FT/S

Traverse Point Number	Velocity Head (Δp_s) in. H_2O	Stack Temp. (T_s), °F	Cyclonic Flow Check ° from Null
C-1	0.015		
C-2	0.018		
C-3	0.020		
C-4	0.021		
C-5	0.018		
C-6	0.017		
D-1	0.012		
D-2	0.015		
D-3	0.018		
D-4	0.020		
D-5	0.018		
	$(\sqrt{\Delta P})_{AVG}$		VELOCITY
Average	0.1326		8.86 FT/S

Received: 01/20/89

TMA Inc. REPORT

Results by Sample

Work Order # 89-01-092

SAMPLE ID CME-I SAMPLE # 01 FRACTIONS: A

Date & Time Collected 01/19/89 Category

CR_HEX 23. mg/L CR_L 32.2 mg/L WC 545 ml

SAMPLE ID CME-O SAMPLE # 02 FRACTIONS: A

Date & Time Collected 01/19/89 Category

CR_HEX 0.3 mg/L CR_L 0.46 mg/L WC 650 ml

SAMPLE ID CME-B SAMPLE # 03 FRACTIONS: A

Date & Time Collected 01/19/89 Category

CRHGAW 0.002 mg/L (ppm) CR_HEX <0.05 mg/L WC 475 ml

SAMPLE ID CME-FI SAMPLE # 04 FRACTIONS: A

Date & Time Collected 01/19/89 Category

CR_S 182. Total ug

PACIFIC ENVIRONMENTAL SERVICES, INC.

SAMPLE ID CME-FD SAMPLE # 05 FRACTIONS: A
Date & Time Collected 01/19/89 Category

CR_S 76. Total ug

SAMPLE ID CME-FB SAMPLE # 06 FRACTIONS: A
Date & Time Collected 01/19/89 Category

CR_S 9.5 Total ug

SAMPLE ID CME-EL-PRI SAMPLE # 07 FRACTIONS: A
Date & Time Collected 01/19/89 Category

CR_HEX 140,000 mg/L CR_L 143,500 mg/L

SAMPLE ID CME-SCR-ORIG SAMPLE # 08 FRACTIONS: A
Date & Time Collected 01/19/89 Category

CR_HEX 1.7 mg/L CR_L 2.20 mg/L PH 7.93 pH units

PACIFIC ENVIRONMENTAL SERVICES, INC.