Background Report Reference

AP-42 Section Number: 12.20

Background Chapter: 4

Reference Number: 57

Title: Source Test Report 85-481,

Plato Products

September 1985

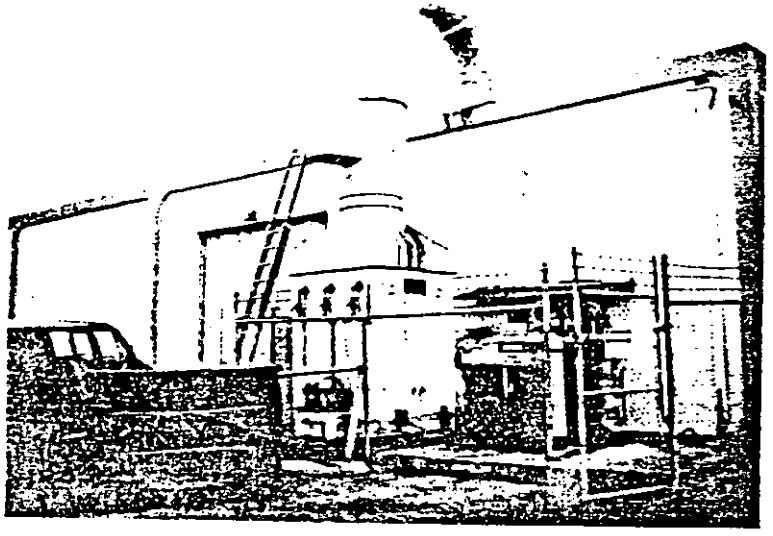
South Coast Air Quality Management District

Field Report

ELECTROPLATING

REF. 4-56

APPL. NO.



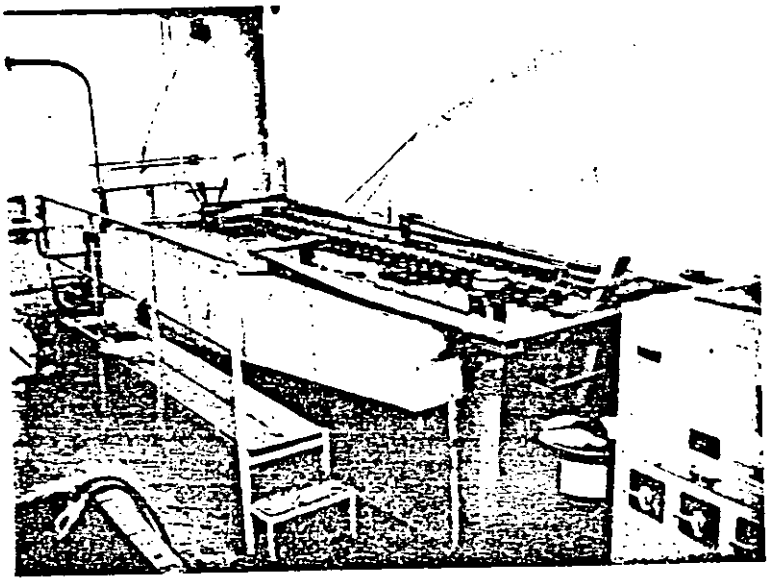
B. JOHN ATAIAN
Air Quality Engineer

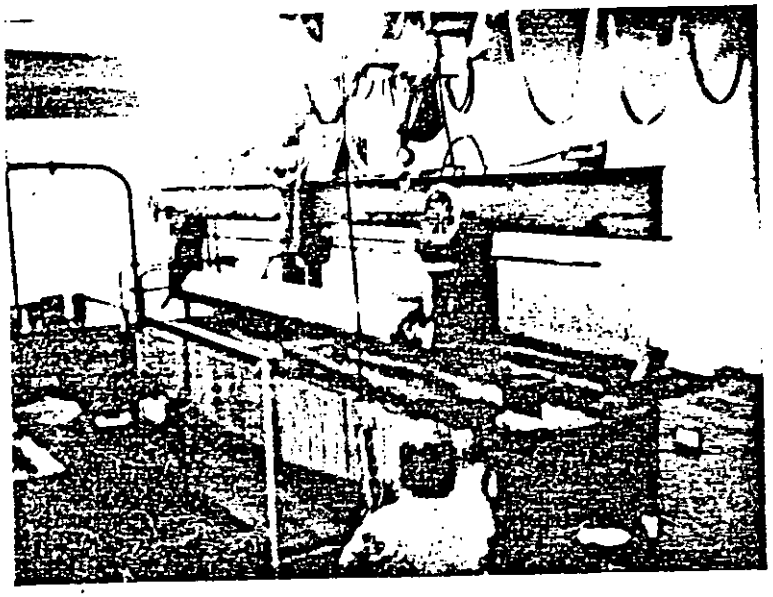
South Coast
Air Quality Management District
Engineering Division

9150 Flair Drive
El Monte, CA 91731
(~~216~~) 572-6180
(818)

SCRUBBER IS LOCA. THIS WALL

CHROME TANK





DURING LOADING • F
A ROLLER

EMISSION FACTOR DETERMINAION
HARD CROME PLATING TANK

REFERENCE: PAMARCO PACIFIC INC.,APPLICATION NO.133197
TRUESDAIL LAB. NO. 05789(FEB.6,1986)

BASIC EQUIPMENT DESIGN & OPERATING DATA:
TANK DIMENSIONS: 3'-8"W.X15'-0"LX3'-6"D.
OPERATING TEM.: 135 F
SOLUTION : 50 OZ/GAL CHROMIC ACID
APPLIED POWER : 6V/2300A
INTERNAL CONTROL: FLOATS

CONTROL EQUIPMENT DESIGN & OPERATING DATA:
EQUIPMENT : VERTICAL PACKED TYPED WET SCRUBBER WITH 9 NOZZLES, 5'-0"W. X 5'-0" L. X 2'-0"H., PACKING & 10" MESH TYPE MIST ELIMINATOR.
TYPE OF PACKING : TRI-PACK NO.2
VELOCITY : 500 FT/MIN
SCRUBBER DIMENSIONS:5'-0"W.X5'-0"L.X8'-0"D.
EQUIVALENT DIAMETER:5'-5"
RECIRCULATION RATE: 100 GPM
GAL/1000CFM: 10
THE SCRUBBER SUMP CAPACITY IS 180GALLONS.
90 GALLONS OF SCRUBBING SOLUTION IS SENT TO THE TANK ONCE DAY & A FRESH WATER IS ADDED TO THE SCRUBBER WITH NO OVERFLOW

EMISSION FACTOR (UNCONTROLLED):
SOLID PARTICULATES : (1.29 Lb/Hr)/(55 SQ.FT.)= 0.023 Lb/Hr-SQ.FT.
CHROMIUM : (0.009Lb/Hr)/(55 SQ.FT.)=0.00016Lb/Hr-SQ.FT.

EMISSION FACTOR (CONTROLLED)
SOLID PARTICULATES:(1.51Lb/Hr)/(55SQ.FT.)= 0.027Lb/Hr-SQ.FT.
CHROMIUM:(0.005LB/Hr)/(55SQ.FT.)= 0.000091Lb/Hr-SQ..FT.

PARTICULATE REMOVAL EFFICIENCY: (-17%)
CHROMIUM REMOVAL EFFICIENCY: 44.4%

RECEIVED ON 4/14/86
IT WAS HANDED TO ME BY MR. STOCKING

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH - DEVELOPMENT - TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Dalco Engineering
15222 Los Flores
La Mirada, CA. 90638
ATTN: Dale Stocking

DATE April 11, 1986

RECEIVED February 4, 1986

LABORATORY NO. 05789

SAMPLE Inlet and OUtlet of Scrubber Serving Chrome Dip Tank

P.O. NO. 0313

INVESTIGATION Particulate and Chromium Removal Efficiencies

RESULTS

On February 6, 1986 representatives of Truesdail Laboratories, Inc. conducted tests to determine the total particulate matter, total chromium (Cr^{+}), and hevalent chromium (Cr^{+6}) at the inlet and outlet of a scrubber serving the chrome dip tank at Pamarco Company in Orange, Calif.

The tests were conducted at both sampling locations simultaneously and the test period covered the entrance, exit, and 63-minute dip time of the part in the chrome tank. The scrubber discharged into a drum reservoir and sampling was conducted upstream of this point.

For each test location, the particulate matter was collected isokinetically for 3 minutes at each of 24 sampling points (12 on each diameter). The sampling train consisted of a glass probe connected with Teflon tubing to a set of Greenburg-Smith impingers charged with 200 mls of distilled water and followed by a glass fiber backup filter, a vacuum pump and a dry gas meter.

Impinger method

The flue gas flow rate was determined before the sampling traverse by measuring the average velocity head with either an S-type or a Standard Pitot tube and a Magnehelic differential pressure gage, and by measuring the average temperature with a Chromel-Alumel thermocouple and a Micromite potentiometer.

The particulate collections were filtered through their respective backup filters and aliquots of the filtrates were analyzed for total chromium by atomic absorption. The remaining filtrate portions were evaporated to dryness at 100°C and all sample residues were desiccated to a constant weight. No analysis for hexavalent chromium was made because the detection limit for this method was higher than the amount analyzed as total Cr^{+}.

The location of the sampling holes at the scrubber inlet did not meet minimum requirements for velocity measurements. The velocity measurements obtained at this location were used only for isokinetic sampling rates. The flow rates calculated from these measurements disagreed with those of the outlet. Since the outlet location was the less turbulent of the two, allemission rates were calculated from outlet flow rates.

The results were as follows:

PAMARCO
2-6-86

Flue Gas	Scrubber Inlet	Scrubber Outlet
Temperature, °F	68	61
Static Pressure, In. H_2O	-1.4	-0.01
Velocity, Ft/Sec	34.7	27.5
Flue Dimensions, in.	21 x 36	30
Flue Area, sq. ft.	5.25	4.91
Flow Rate, ACFM	(10,900)	8110
, SCFM	(10,800)	8050
, DSCFM	(10,700)	7900 -
Moisture, % by Vol.	1.3	1.9
Saturation, % by vol.	2.3	1.8
Particulate Matter		
Collection, Grams		
Filter	0.0000	0.0001
Impingers	0.0489	0.0449
Total	0.0489	0.0450
Sample Volume, DSCF	39.50	31.07
Concentration, grains/DSCF	0.0191	0.0223
Emission Rate, lbs/hr	1.29*	1.51
Chromium (Cr^+), mg/m^3	0.30	0.18
, lbs/hr	0.009*	0.005
Particulate Removal, %	-17.1	
Chromium Removal, %	44.4	

* Calculated with Outlet Flow Rate.

Respectfully Submitted

TRUESDAIL LABORATORIES, INC.

S. Hugh Brown

S. Hugh Brown, Supervisor
Air Pollution Testing

HEXAVALENT

0.02 MG/DSCM

APPENDIX

Sampling Location: Dalco Inlet — Static Pressure, Ps: -1

Test No.: 3 — Barometric Pressure: 29.

	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec
2.3	17	0		0	9	.04	66	11.10	1	.90	66	17.54
6.8	18	.34	67	32.38	10	.52	67	40.04	2	.66	67	45.11
11.3	19	.65	67	44.77	11	.80	67	49.67	3	.86	68	51.54
15.8	20	.50	68	39.30	12	.8	68	49.71	4	.95	68	54.17
20.3	21	.45	68	37.29	13	1.0	68	55.58	5	.90	68	52.73
24.8	22	.50	68	39.30	14	1.0	68	55.58	6	.40	68	35.15
29.2	23	.62	68	43.76	15	.50	68	39.30	7	.08	68	15.7
33.8	24	.15	68	21.53	16	.0		0	8	0		0

Erickson

A. AVERAGE VELOCITY (TRAVERSE) ft/sec 34.64

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec

C. AVERAGE VELOCITY (REFERENCE PT.) ft/sec

D. FLUE FACTOR C/B

E. PITOT TUBE CORRECTION FACTOR 0.83

F. GAS DENSITY CORRECTION FACTOR 1.001

G. CORRECTED VELOCITY, AxExF, ft/sec 34.67
or, AxDxExF, ft/sec

H. AREA OF FLUE, SQ. FT. 5.25

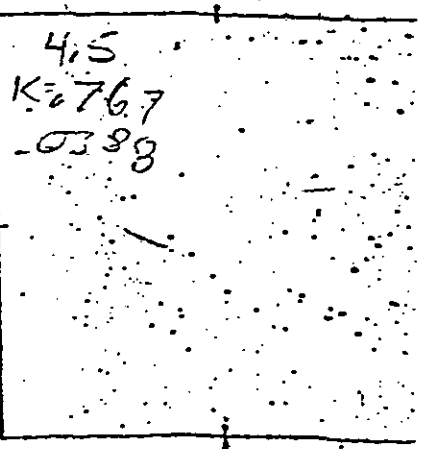
J. AVERAGE FLUE TEMPERATURE, °F 68

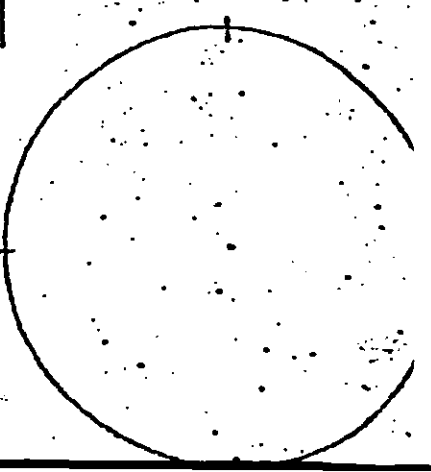
K. FLOW RATE, G x H x 60, CFM 10921

L. FLOW RATE, $K \times \frac{520}{460 + J} \times \frac{BP + Ps/13.6}{29.9}$, SCFM (519) 10842

M. FLOW RATE, L x MOISTURE CORR., DSCFM (0.987) 10701

4.5
K=.767
.0383





Sampling Location: DALCO

Static Pressure, Ps: -0.(

Test No.: Outlet

Barometric Pressure: 29.7

	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	~~Velocity ft/sec~~	Point	~~Vel. Head H_2O"~~	Temp. °F	Velocity ft/sec
0.6	1	0.14	60	24.82				0.20	61	29.70		
2.0	2	0.15	61	25.72				0.20	61	29.70		
3.5	3	0.16	61	26.56				0.20	61	29.70		
5.3	4	0.17	61	27.38				0.20	61	29.70		
7.5	5	0.17	61	27.38				0.20	61	29.70		
10.7	6	0.17	61	27.38				0.18	61	28.17		
14.3	7	0.17	61	27.38				0.17	61	27.38		
22.5	8	0.11	61	27.38				0.16	61	26.56		
27.7	9	0.17	61	27.38				0.16	61	26.56		
26.5	10	0.17	61	27.38				0.16	61	26.56		
28.0	11	0.17	61	27.38				0.16	61	26.56		
29.1	12	0.15	61	25.72				0.15	61	25.72		

A. AVERAGE VELOCITY (TRAVERSE) ft/sec (Enclosed) 27.48

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec _____

C. AVERAGE VELOCITY (REFERENCE PT.) ft/sec _____

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR STD 1.0

F. GAS DENSITY CORRECTION FACTOR 1.002

G. CORRECTED VELOCITY, AxExF, ft/sec 27.53
or, AxDxExF, ft/sec _____

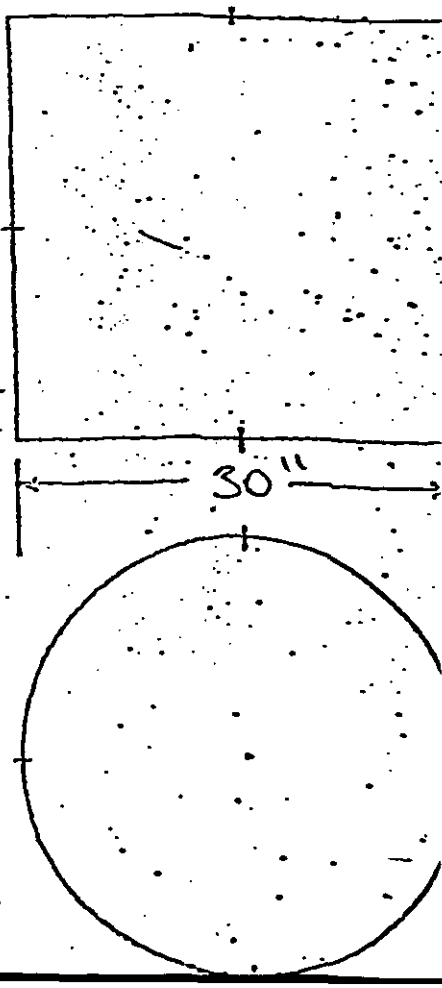
H. AREA OF FLUE, SQ. FT. 4.91

J. AVERAGE FLUE TEMPERATURE, °F 61

K. FLOW RATE, G x H x 60, CFM 8109

L. FLOW RATE, K x $\frac{520}{460 + J}$ x $\frac{BP + Ps/13.6}{29.9}$, SCFM 8050

M. FLOW RATE, L x MOISTURE CORR., DSCFM 7900
or 9814



TRUESDAIL LABORATORIES, INC.

Lab. No. _____

EPA FIELD TEST DATA

Plant Dalco chrome

Sampling Station Inlet

Date 2-6-86

Flue Dimensions 36"X21"

Test No. _____

Amb. Temp., °F _____

Bar. Pressure, In. Hg 29.73

Stack Pressure, In. H_2O -1.4

Sampling Nozzle Diam., In. .225

Pf .83

K = .7672

Sampling Apparatus No.: 580 .03880

Trav. Point No.	Sampling Time	Sample Volume, Cu. Ft.	Vel. Head $\sqrt{Ps}$	Orifice ΔH In.H_2O	TEMPERATURE, °F					
					Stack	Probe CFM	Oven	Impinger Inlet	Impinger Outlet	Gas Meter
1	10:36	5.16	.01	.05	66	.28			40	64
2	10:39	5.90	.61	.50	67	.72				64
3	10:42	7.90	.86	.72	68	.82				64
4	10:45	10.50	.95	.75	68	.86			43	64
5	10:48	13.05	.90	.72	68	.84				65
6	10:51	15.60	.40	.32	68	.56				65
7	10:54	17.48	.09	.015	68	.25			45	66
8	10:57	18.28	0							
Start		18.28								
9	11:01	18.28	.04	.04	66	.18			40	66
10	11:04	18.99	.52	.44	67	.64				66
11	11:07	20.92	.80	.96	67	.80				67
12	11:10	23.36	.80	.68	69	.80			43	67
13	11:13	25.90	1.0	.82	69	.84				68
14	11:16	28.50	1.0	.87	68	.84				68
15	11:19	31.20	.50	.43	68	.63			43	69
16	11:21	33.14	0							
	11:24	33.14								
17	11:24	33.14	0							
18	11:27	33.14	.34	.30	67	.52			40	69
19	11:30	34.90	.65	.52	67	.72				70
20	11:33	36.90	.50	.42	68	.63			43	70
21	11:36	38.76	.45	.40	68	.60				70
22	11:39	40.60	.50	.42	69	.63				70
23	11:42	42.52	.67	.54	69	.71			45	71
24	11:45	44.70	.15	.10	69	.35				71
	11:48	45.77								
TOTAL		40.61								
AVG.			0.62	.46	68				43	67

Operator(s) CF

3m1 cond

TRUESDAIL LABORATORIES, INC.

Date: 2-6-86

Sampling Location: DALCO - INLET

Barometric Pressure: 29.73

Test No. INLET

Nozzle Diameter: 0.225

Time	Gas Meter			Impinger Temp °F T_i	Sample Point				
	Reading cu. ft. V_m	Press. "H_2O P_m	Temp. °F T_m						
	40.61	046	67	43					

Weight Collected, grams

A. Total Weight .0489

B. Condensate Volume, ml. 3

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + T_m}{B.P. + P_m/13.6} \times B$, cu. ft. 0.14

D. Total Sample Volume, $V_m + C$, cu. ft. 40.75

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. + P_m/13.6}{29.9} \times$ Moisture corr., DSCF 39.50 / 1.12 m^3 (.98?)

F. Concentration, 15.43 x A/E, grains/DSCF 0.0191

G. Stack Gas Flow Rate, DSCFM 10701

H. Emissions, 60 x G x F/7000, lbs/hr 1.75

Cr + 0.30 mg/m3

TRUESDAIL LABORATORIES, INC.

Sampling Station DALCO - INLET Date 2-6-86

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, In. Hg. (Absolute) 29.76

B. Vapor pressure of water at impinger temp., In. Hg. 0.2782

C. Volume of metered gas, Cu. Ft. 40.61

D. Volume of water vapor metered, B X C/A, Cu. Ft. 0.38

E. Volume of water vapor condensed, Cu. Ft. 0.14

F. Total volume of water vapor in gas sample, D+E, Cu. Ft. 0.52

G. Total volume of gas sample, C+E, Cu. Ft. 40.75

H. Percent water vapor in sampled gas, 100 X F/G 1.3

Gas Density Correction Factor

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	0.013	1.0	18.0	0.234
Carbon Dioxide	0.004 Dry Basis	0.987	44.0	0.174
Carbon Monoxide	Dry Basis		28.0	—
Oxygen	0.210 Dry Basis		32.0	6.633
Nitrogen & Inerts	0.786 Dry Basis		28.2	21.877
			Average Molecular Weight	28.918

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.9989

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.001

TRUESDAIL LABORATORIES, INC.

Date: 2/6/85

Sampling Location: DALCO

Barometric Pressure: 29.73

Test No. Outlet Port #1

Nozzle Diameter: 0.225

	Time	Gas Meter Reading cu.ft. V_m	Gas Meter Press. "H_2O P_m	Gas Meter Temp. °F T_m	Impinger Temp °F T_i	cfm Sample Point	V_t	T_{st}		
0	10:39	15.60	0.15	63	34	0.40	0.14	60		
3	10:42	16.80	0.16	64	44	0.42	0.15	61		
6	10:45	18.06	0.18	64	45	0.43	0.16	61		
9	10:48	19.35	0.18	64	45	0.44	0.17	"		
12	10:51	20.67	0.20	65	"	0.44	0.17	"		
15	10:54	21.99	0.20	66	"	"	0.17	"		
18	10:57	23.31	0.20	66	"	"	0.17	"		
21	11:00	24.63	0.20	66	46	"	0.17	"		
24	11:03	25.95	"	"	"	"	0.17	"		
27	11:06	27.27	"	"	"	"	0.17	"		
30	11:09	28.59	"	"	"		0.17	"		
33	11:12	29.91	"	"	47	0.42	0.15	"		
36	11:15	31.15								
		32.04	.20	68	46					

K = 0.9228.

Weight Collected, grams .92

TNer 00975

A. Total Weight 0.0450

B. Condensate Volume, ml. 6ml

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + T_m}{B.P. + P_m/13.6} \times B$, cu. ft. 0.28

D. Total Sample Volume, $V_m + C$, cu. ft. 32.32

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. + P_m/13.6}{29.9} \times$ Moisture corr., DSCF $\frac{31.07}{0.879}$ m^3

F. Concentration, 15.43 x A/E, grains/DSCF 0.0223

G. Stack Gas Flow Rate, DSCFM 7900

H. Emissions, 60 x G x F/7000, lbs/hr 1.51

TRUESDAIL LABORATORIES, INC.

Date:

Sampling Location: DALCO

Barometric Pressure: 29.73

Test No. Outlet Port 2

Nozzle Diameter: 0.225

	Time	Gas Meter: Reading cu. ft. V_m	Gas Meter: Press. "H_2O P_m	Gas Meter: Temp. °F T_m	Impinger Temp °F T_i	CFM Sample Point	V_H	T_S		
0	11:20	31.15	0.25	70	47	0.49	0.20	61		
3	11:23	32.62	"	70	48	"	0.20	"		
6	11:26	34.09	"	70	48	"	0.20	"		
9	11:29	35.56	"	"	49	"	0.20	"		
12	11:32	37.03	"	"	50	"	0.20	"		
15	11:35	38.50	"	69	51	0.46	0.18	"		
18	11:38	39.88	0.22	69	50	0.45	0.17	"		
21	11:41	41.23	0.21	70	50	0.43	0.16	"		
24	11:44	42.52	0.17	70	48	"	0.16	"		
27	11:47	43.81	0.17	70	46	"	0.16	"		
30	11:50	45.10	0.17	71	46	"	0.16	"		
33	11:53	46.39	0.16	71	"	0.42	0.15	"		
36	11:56	47.64	"	"	"					

Weight Collected, grams Sheet 2

A. Total Weight _____

B. Condensate Volume, ml. _____

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + T_m}{B.P. + P_m/13.6} \times B$, cu. ft. _____ (530)

D. Total Sample Volume, $V_m + C$, cu. ft. _____

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. + P_m/13.6}{29.9} \times$ Moisture corr., DSCF _____ ?

F. Concentration, $15.43 \times A/E$, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, $60 \times G \times F/7000$, lbs/hr _____

TRUESDAIL LABORATORIES, INC.

Sampling Station Dalco Outlet Date 2-6-86

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, In. Hg. (Absolute) 29.74

B. Vapor pressure of water at impinger temp., In. Hg. .30

C. Volume of metered gas, Cu. Ft. 32.04

D. Volume of water vapor metered, B X C/A, Cu. Ft. .32

E. Volume of water vapor condensed, Cu. Ft. .28

F. Total volume of water vapor in gas sample, D+E, Cu. Ft. = .60

G. Total volume of gas sample, C+E, Cu. Ft. 32.32

H. Percent water vapor in sampled gas, 100 X F/G 1.86

Gas Density Correction Factor

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	.0186	1.0	18.0	.335
Carbon Dioxide	.004 Dry Basis	.9814	44.0	.1727
Carbon Monoxide	Dry Basis		28.0	
Oxygen	.210 Dry Basis		32.0	6.595
Nitrogen & Inerts	.786 Dry Basis		28.2	21.753
			Average Molecular Weight	28.86

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{26.95}$ = .9967

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.002

ELECTROPLATING
REF. 4-57

OCT 29 1985

South Coast
AIR QUALITY MANAGEMENT DISTRICT
9150 FLAIR DRIVE, EL MONTE, CA 91731 (818) 572-6200

#10

SOURCE TEST REPORT

85-481

CONDUCTED AT

Plato Products Inc.
2120 E. Allen Ave.
Glendora, CA

EFFICIENCY OF, AND EMISSIONS FROM THE SCRUBBER SERVING A HARD CHROME PLATING TANK

TESTED: September 18, 1985

ISSUED: OCT 28 1985

REPORT BY: Wayne A. Nakagawa
Air Quality Instrument Specialist II

REVIEWED:

Steven Marinoff

Steven Marinoff, Senior Air Quality Engineer

ARNOLD STEIN, ACTING MANAGER,
SOURCE TESTING & MONITORING BRANCH

EDWARD CAMARENA
DIRECTOR, ENFORCEMENT DIVISION

```
                XROM "METH 5"
RUN NUMBER
                                RUN
METER BOX Y?
                                RUN
DELTA H?
                    .8800       RUN
BAR PRESS ?
                  29.0200       RUN
METER VOL ?
                  47.6880       RUN
MTR TEMP F?
                  87.0000       RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                                RUN
STATIC HOH IN ?
                                RUN
STACK TEMP.
                  77.0000       RUN
ML. WATER ?
                  13.0000       RUN


SAT % = 3.2


IMP. % HOH = 1.3

% HOH=1.3


% CO2?
                    .7000       RUN
% OXYGEN?
                 21.0000        RUN
MOL WT OTHER?
                                RUN

MWd =28.95
MW WET=28.80


PITOT CP ?
                    .8350       RUN
SQRT PSTS ?
                  16.8822       RUN
TIME MIN ?
                  60.0000       RUN
NOZZLE DIA ?
                    .2500       RUN
STK DIA INCH ?
                  16.0000       RUN

* VOL MTR STD = 44.746
  STK PRES ABS = 29.02
  VOL HOH GAS = 0.61
  % MOISTURE = 1.35
  MOL DRY GAS = 0.987
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.80
  VELOCITY FPS = 41.68
  STACK AREA = 1.40
  STACK ACFM = 3,492.
* STACK DSCFM = 3,285.
  % ISOKINETIC =  93.04


 END OF FIELD DATA
```

```
                XROM "METH 5"
RUN NUMBER
                                RUN
METER BOX Y?
                                RUN
DELTA H?
                    .8400       RUN
BAR PRESS ?
                  29.0200       RUN
METER VOL ?
                  49.8300       RUN
MTR TEMP F?
                  82.0000       RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                                RUN
STATIC HOH IN ?
                                RUN
STACK TEMP.
                  72.0000       RUN
ML. WATER ?
                  25.0000       RUN


SAT % = 2.7


IMP. % HOH = 2.4

% HOH=2.4


% CO2?
                    .7000       RUN
% OXYGEN?
                 21.0000        RUN
MOL WT OTHER?
                                RUN

MWd =28.95
MW WET=28.69


PITOT CP ?
                    .8350       RUN
SQRT PSTS ?
                  17.0760       RUN
TIME MIN ?
                  60.0000       RUN
NOZZLE DIA ?
                    .2500       RUN
STK DIA INCH ?
                  16.0000       RUN

* VOL MTR STD = 47.183
  STK PRES ABS = 29.02
  VOL HOH GAS = 1.18
  % MOISTURE = 2.43
  MOL DRY GAS = 0.976
  % NITROGEN = 78.30
  MOL WT DRY = 28.95
  MOL WT WET = 28.69
  VELOCITY FPS = 42.25
  STACK AREA = 1.40
  STACK ACFM = 3,539.
* STACK DSCFM = 3,324.
  % ISOKINETIC =  96.95


END OF FIELD DATA
```

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91731

Test No. 85-481 -2- Date 9/18/85

INTRODUCTION

(a) Firm Tested ..... Plato Products, Inc.

(b) Test Location ..... 2120 E. Allen Ave., Glendora, CA

(c) Unit Tested ..... Scrubber Serving Chrome Plating Tank (A/N 126220)

(d) Test Requested by ..... Tran Vo, Engineering

(e) Reason for Test Request ..... Engineering Information

(f) Date of Test ..... September 18, 1985

(g) Source Test Performed by ..... S. Marinoff, R. Schneider, A. Roy Chowdhury, B. van Aalst, X. Vu, W. Nakagawa, J.R. Manker

(h) Test Arrangements Made Through ..... Richard L. Hartman (818) 967-3821

(i) Source Test Observed by ..... Tran Vo, Mark Liu - Engineering

(j) Company I.D. No. 045443

SAMPLING SUMMARY SHEET

PLANT _____ LOCATION _____

SAMPLED SOURCE _____

Run	Date	N_p	(3) Y_m	(4) ΔH	P Bar.	(5) V_m	(6) T_m	(7) V_m Std.	(8) %	(9) P_{st}	(10) P_s	17 T_s	(18) VP	(19) V_w	(20) $V_{w_{gas}}$	21 %M	22 M_d	23
In	9-18-85	7	?	.88	29.02	47.688	87	44.746	/	0.0	29.02	77	/	13	0.61	1.35	.987	
Out	9-18-85	12	?	.84	29.02	49.830	82	47.183	/	0.0	29.02	72	/	25	1.18	2.43	.976	

Run	(24) CO_2	(25) O_2	26 N_2	(27) CO	(28) ___	29 MW_d	30 MW	(31) $C_p\sqrt{\Delta P_s(T_s + 460)}$	(32) T_t	(33) D_n	(34) V_s	35 D_s	(36) Area	(37) ACFM	38 DSCFM	(39) %I	40
In	0.7	21	78.3	/	/	28.95	28.80	.835	16.8822	60	0.25	41.7	0.16	1.40	3492	3285	93.04	
Out	0.7	21	78.3	/	/	28.95	28.69	.835	17.0760	60	0.25	42.3	0.16	1.40	3539	3324	97.0	

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

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

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

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

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

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

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

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

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

N_p = Total No. of Sampling points

Y_m = Meter Box Correction Factor

ΔH = Average Orfice Pressure Drop, inches H_2O

P Bar. = Barometric Pressure, Inches Hg, Absolute

V_m = Volume of Dry Gas at Meter Conditions, DCF

T_m = Average Meter Temperature, °F.

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

% = Per Cent other gas removed before Dry Gas Meter

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

P_s = Stack Gas Pressure, inches Hg.

T_s = Average Stack Temperature, °F

VP = Vapor Pressure of H_2O At Stack Temperature

V_w = Total H_2O Collected in Impingers and Silica Gel

$V_{w_{gas}}$ = 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.

PLANT _____ SUMMARY EMISSIONS

SAMPLED SOURCE _____ LOCATION _____

RUN	DATE	(1) V_m Std.	(2) DSCFM

FRONT HALF MILLIGRAMS

PROBE	CYCLONE	FILTER	(3) TOTAL

(4) BACK HALF	5 FRONT + BACK TOTAL

CONCENTRATIONS

FRONT HALF

RUN	Gr/DSCF	Mg/M^3	Lb/Hr	Kg/Hr

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: _____

Test No. 85-481 -3- Date 9/18/85

Results

Scrubber Inlet Flow Rate 91 dscmm (3214 dscfm)
Scrubber Outlet Flow Rate 93 dscmm (3279 dscfm)
Process Weight - kg/hr (- lbs/hr)

Contaminant	Emissions		Applicable Rule
	Measured	Allowed	
Particulate Matter Concentration			
Inlet	4.6 mg/dscm (0.002 gr/dscf)	—	—
Outlet	2.3 mg/dscm (0.001 gr/dscf)	276 mg/dscm (0.121 gr/dscf)	404
Solid Particulate Mass Flow Rate			Information
Inlet	0.021 kg/hr (0.046 lb/hr)	—	"
Outlet	0.016 kg/hr (0.036 lb/hr)	—	"
Scrubber Efficiency (Particulates)	32%		Information
Total Chromium Conc.			Information
Inlet	< 0.015 mg/dscm ($< 6.7 \times 10^{-6}$ gr/dscf)	—	"
Outlet	< 0.015 mg/dscm ($< 6.4 \times 10^{-6}$ gr/dscf)	—	"
Hexavalent Chrom. Conc.			Information
Inlet	0.014 mg/dscm (6.3×10^{-6} gr/dscf)	—	"
Outlet	0.0080 mg/dscm (3.5×10^{-6} gr/dscf)	—	"

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91731

Test No. 85-481 -4- Date 9/18/85

Results

Scrubber Inlet Flow Rate 91 dscmm (3214 dscfm)
Scrubber Outlet Flow Rate 93 dscmm (3279 dscfm)
Process Weight - kg/hr (- lbs/hr)

Contaminant	Emissions		Applicable Rule
	Measured	Allowed	
Total Chromium Mass Flow Rate			Information
Inlet	$< 8.2 \times 10^{-5}$ kg/hr ($< 1.8 \times 10^{-4}$ lb/hr)	———	"
Outlet	$< 8.2 \times 10^{-5}$ kg/hr ($< 1.8 \times 10^{-4}$ lb/hr)	———	"
Hexavalent Chrom Mass Flow Rate			Information
Inlet	7.9×10^{-5} kg/hr (1.7×10^{-4} lb/hr)	———	"
Outlet	4.5×10^{-5} kg/hr (0.99×10^{-4} lb/hr)	———	"

INTRODUCTION

On September 18, 1985, personnel from the Source Testing and Monitoring Branch of the South Coast Management District conducted a source test on the inlet and outlet of a cross-flow sprayed water scrubber controlling the exhaust from a hard chrome plating tank at Plato Products, Inc. The purpose of this test was to measure any potential toxic emissions of chromium from this tank. and from the scrubber.

PROCESS DESCRIPTION

This company specializes in manufacturing soldering iron tips at this location. The process starts with solid copper tips, which are degreased after machining and initially plated with iron. The soldering tips are then waxed on the tip, etched with HCl and subsequently plated with nickel and chrome on the unwax portion.

The plating bath is a mixture of chromic acid and sulfuric acid solutions kept at 130 - 140 °F and kept covered with polyethylene beads. The plating is accomplished at 6V and 2000 AMP DC. The emissions from this tank are controlled by a cross-flow sprayed water scrubber. The measured water overflow rate from the scrubber is 2.5 liters per minute and the water recirculation rate is about 60-70 gallons per minute.

SAMPLING AND ANALYTICAL PROCEDURES

GAS FLOW RATE

The gas velocities and temperatures at the outlet and the inlets to the scrubber serving the chrome plating tank (designated as chrome scrubber) were measured using a Pitot tube, Magnehelic gage, and a Minimite potentiometer with a type "K" thermocouple. This scrubber serves only tank 33 (FIGURE 1). The gas flow rates were determined from the gas velocity, temperature, pressure, density of the gas and the cross-sectional area of the discharge stack and the inlet duct.

PARTICULATE SAMPLING

The particulate samples were collected isokinetically at the outlet and inlet of the scrubber using the wet impingement method (FIGURE 2) with glass probes. Total and hexavalent chromium content of the particulates were analyzed by atomic absorption spectroscopy and diphenyl carbizide spectrophotometry, respectively. A liquid sample from the tank was also taken for analysis of chromium content.

The residue from the particulate samples were submitted to two laboratories for total chromium and hexavalent chromium analysis. For hexavalent chromium the results from the two laboratories are in close agreement so an average of their results were used in calculating the hexavalent chromium emissions. The results are at the lower detectable limit of the analytical methods and, therefore, the accuracy should be poor. The total chrome concentration was below the detectable limit for the analytical methods used by both laboratories. The analytical procedures used by one laboratory gave a lower detectable limit, which was used in calculating the uppper limit of total chromium emissions.

The results indicate that most or all of the chromium emissions are of the hexavalent form.

Liquid Samples

Samples of the tank bath were submitted to the lab for analysis. The composition of the bath is contained in the lab reports.

TEST CRITIQUE

The equipment was operating normally during the source test. No problems were encountered during the test. The isokinetic sampling rates at the inlet and outlet were 98% and 101% respectively. The internal and the large external doors of the room containing the tank solutions were open prior to testing, and Plato personnel closed these doors shortly after our arrival.

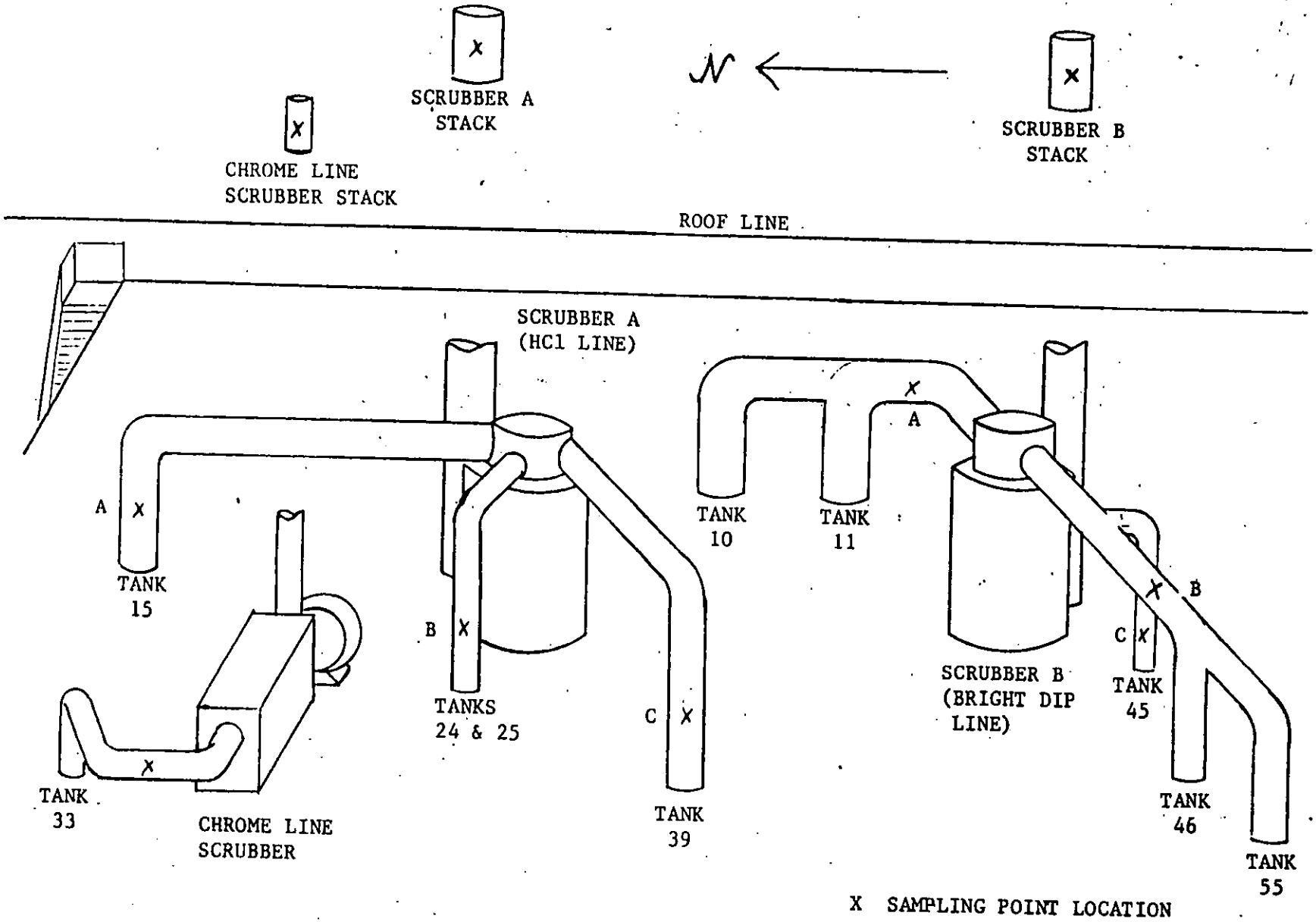


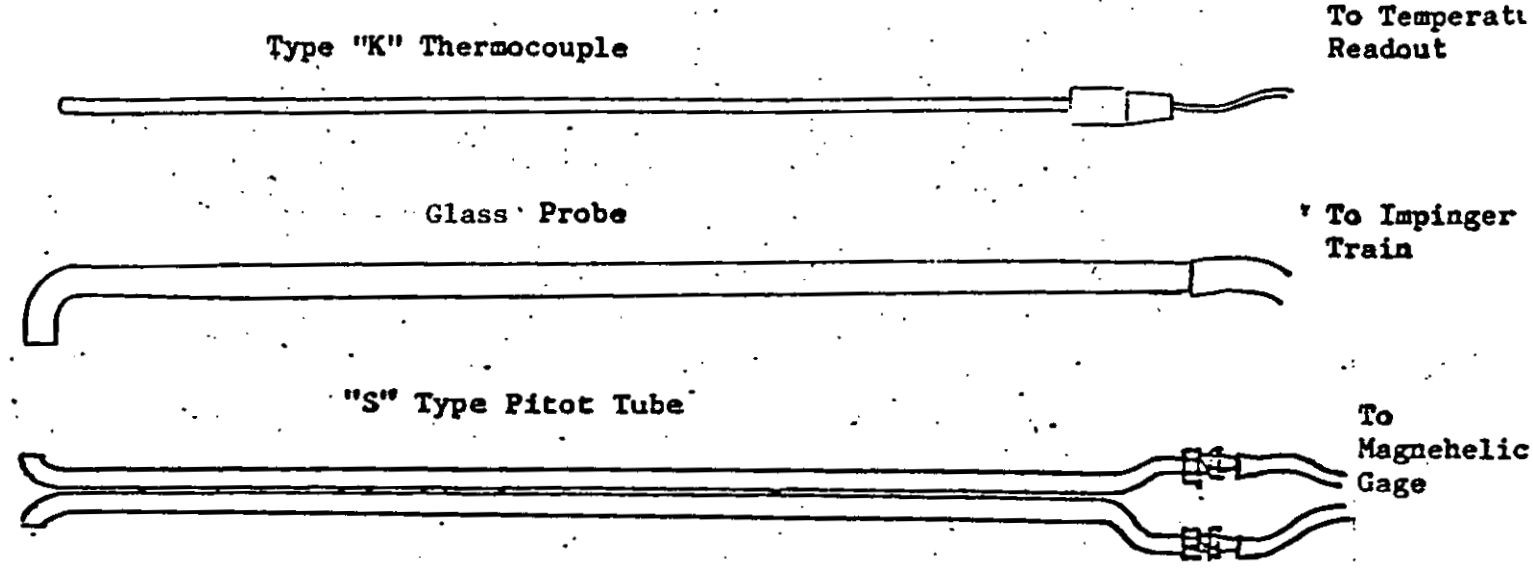
FIGURE 1

PLATO PRODUCTS, INC.
PLATING PROCESS EXHAUST CONTROL SCHEMATIC

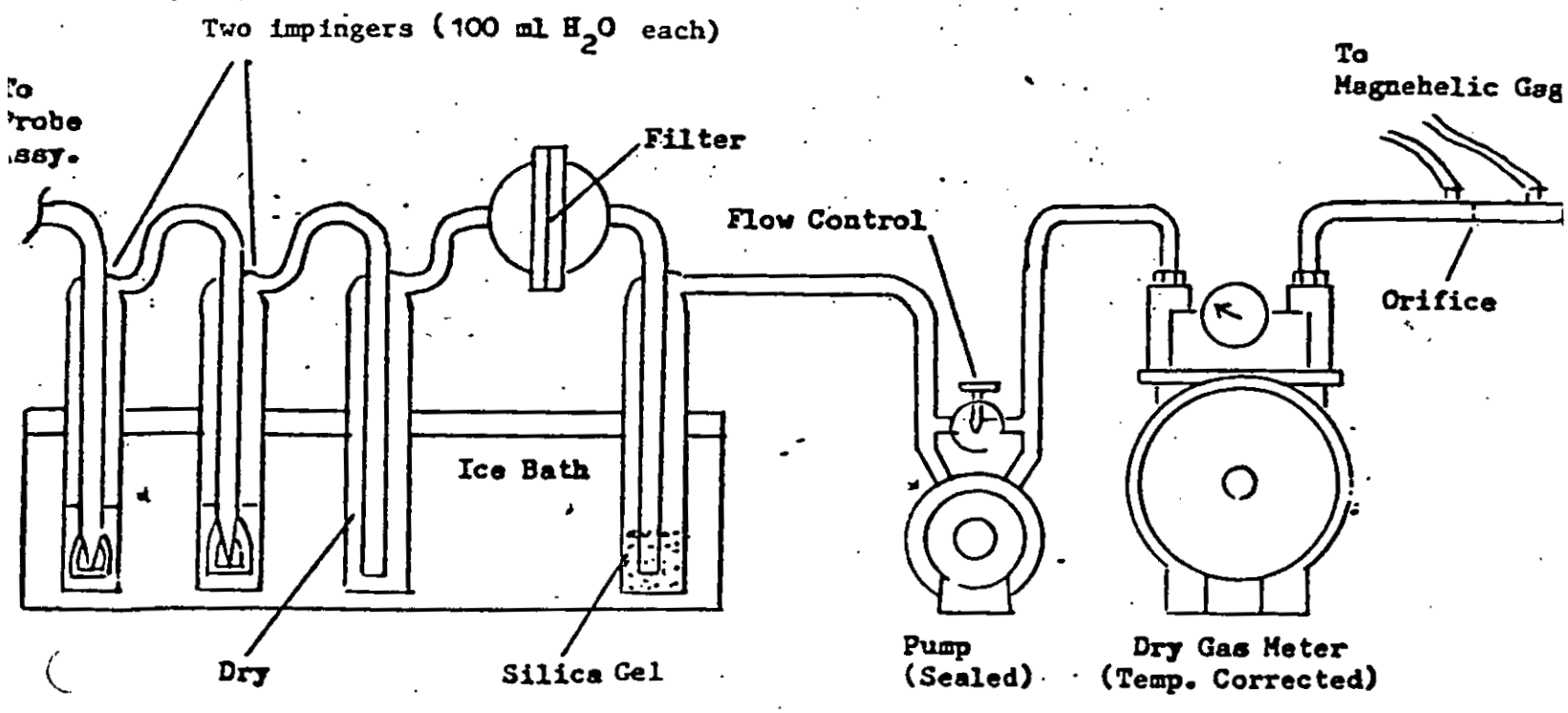
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91731

Test No. 85-481 Date 9-18-85

Figure No. 2



PROBE SET-UP



IMPINGER TRAIN SET-UP
(Wet Impingement Method)

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
ENFORCEMENT DIVISION
SOURCE TESTING AND MONITORING BRANCH
CALCULATION SHEET

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PROCESSED BY W. NAKAGAWA	CHECKED BY

PLATO PRODUCTS, INC.

% ISOKINETIC SAMPLING RATE = (METER VOL)(STACK AREA)(FLUE FACTOR)(100) / (NOZZLE AREA)(SAMPLING TIME)(FLOW RATE)

INLET :

$$\% = \frac{(46.25\ dscf)(1.40\ ft^2)(0.994)(100)}{(.000\ 341\ ft^2)(60\ min)(3214\ dscfm)}$$

$$= 97.9$$

OUTLET:

$$\% = \frac{(48.33\ dscf)(1.40\ ft^2)(1.00)(100)}{(.000\ 341\ ft^2)(60\ min)(3279\ dscfm)}$$

$$= 100.9$$

EFFICIENCY OF SCRUBBER

INLET TO SCRUBBER	.053	lbs/hr
OUTLET FROM SCRUBBER	.036	lbs/hr

$$\text{EFFICIENCY OF SCRUBBER} \quad \frac{.053 - .036}{.053} \times 100$$

$$= \frac{.017}{.053} \times 100$$

$$= 32\ \%$$

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
ENFORCEMENT DIVISION
SOURCE TESTING AND MONITORING BRANCH
CALCULATION SHEET

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W. NAKAGAWA	

PLATO PRODUCTS, INC.

TOTAL CHROMIUM AND HEXAVALENT CHROMIUM CALCULATIONS.

	Total Cr Sample Weight (mg)			Cr^{+6} Sample Weight (mg)			Sample Vol. (scf)	Stack Flow (dscfm)
	WL	BTC	Ave.	WL	BTC	Ave.		
INLET	< 0.05	< 0.02	< 0.02	0.02	0.018	0.019	46.25	3214
OUTLET	< 0.05	< 0.02	< 0.02	0.01	0.012	0.011	48.33	3279

$$\text{Material Conc.} = \frac{(0.01543)(\text{mg of Material})}{\text{Sample Vol.}} \quad \left(\frac{gr}{dscf}\right)$$

$$\text{Material Flow Rate} = (0.00857)(\text{Material Conc.})(\text{Stack Gas Flow Rate}) \quad \left(\frac{lb}{hr}\right)$$

	Inlet		Outlet	
	Total Cr	Cr^{+6}	Total Cr	Cr^{+6}
Material Conc., $\frac{gr}{dscf}$	$< 6.7 \times 10^{-6}$	6.3×10^{-6}	$< 6.4 \times 10^{-6}$	3.5×10^{-6}
Material Flow Rate, $\frac{lb}{hr}$	$< 1.8 \times 10^{-4}$	1.7×10^{-4}	$< 1.8 \times 10^{-4}$	0.99×10^{-4}

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER INLET

Gas Velocity Data

Time	Point	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.
11:43	1	.54	77	49.38	.52	77	48.46	.52	77	48.46
	2	.54		49.38	.52		48.46	.52		48.46
	3	.40		42.50	.38		41.43	.40		42.50
	4	.52		48.46	.52		48.46	.52		48.46
	5	.62		52.92	.63		52.92	.60		52.05
	6	.62		52.92	.60		52.05	.60		52.05
	7	.62	77	52.92	.62	77	52.92	.62	77	52.92
	8	.64		53.76	.64		53.76	.63		53.34
	9	.60		52.05	.59		51.62	.60		52.05
	10	.40		42.50	.38		41.43	.40		42.50
	11	.46		45.58	.44		44.58	.44		44.58
	12	.46		45.58	.46		45.58	.44		44.58

(NEG) 1.5" H_2O = .11" Hg

Static Pressure in Stack (P_S), In. Hg Abs . . 29.02 - .11 = 28.91 Conducted by JM, RS

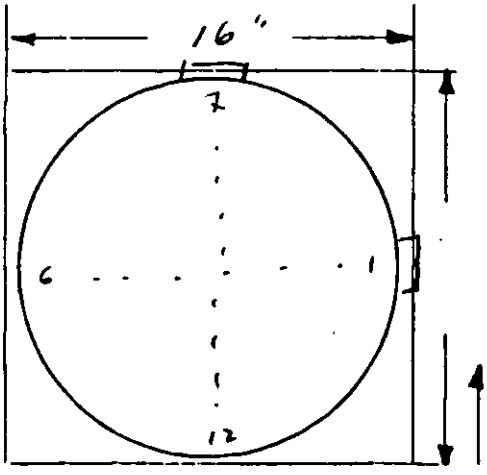
Pitot # 209 Magnehelic # 130-4 Minimite # B974 Thermocouple # 2-1

A. Average Velocity (Traverse) . . . . . 48.65 ft/sec
B. Average Velocity (Reference Pt.) . . . . . 48.96 ft/sec
C. Flue Factor A/B 994
D. Velocity Pressure Correction Factor $\sqrt{\frac{29.92}{P_S}}$ 1.02
E. Pitot Correction Factor 835
F. Gas Density Correction Factor 1.00
G. Corrected Velocity, A x D x E x F . . . . — ft/sec
or B x C x D x E x F . . . . . 41.44 ft/sec
H. Area of Flue . . . . . 1.4 ft^2
I. Average Flue Temperature . . . . . 77 °F
J. Flow Rate, H x G x 60 . . . . . 3480.6 cfm

Flow Rate, $\frac{P_S}{29.92}$ x $\frac{520}{(I + 460)}$ x J . . . . 3256.6 scfm

L. Percent Water Vapor in Gas Sample . . . . 1.3 %

M. Dry Gas Flow Rate, K $(1 - \frac{L}{100})$ . . . . . 3214 dscfm



Stack Layout

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER INLET

PARTICULATES Train

Meter Data and Calculations

On Time	Off Time	Sample Point	Reading Cu. Ft. V_M	Filter Temp. °F T_F		Orifice P. In. H_2O	Samp. Rate (cfm)	Stack Vel fps	Stack Temp. °F	Stack Vel Head In. H_2O
12:23		1	045.950	BAD MOTOR		.87	.78	48.92	77	.53
	12:27:04		49.095	#351020						
		1	42.970			.87	.78	48.92	77	.53
		2	47.20			.87	.78	48.92	77	.53
		3	55.57			.66	.68	42.50	77	.40
		4	62.59			.86	.78	48.46	77	.52
		5	70.50			1.00	.84	52.49	77	.61
		6	79.05			1.00	.84	52.49	77	.61
	1:32		87.513							
							AVG:	48.96	77	

Total $V_m = 3.145 + 44.543 = 47.688$

Conducted by XV

Sampling Nozzle Dia..... (¼") 6.35 mm
Barometric Pressure..... 29.02 In Hg.(Abs.) STATIC (P_s) 28.91 IN H_g (ABS)
Weight Collected, mg.....
Meter # 351020 (CALIBRATION DATE: 2-27-85)
Thermocouple # 2-1 (CALIBRATION DATE: 7-18-85)
Magnehelic # 130-4 (PITOT) (CALB. DATE: 6-6-85) 129-3 (ORIFICE) (CALIB. DATE: 6-6-85)
Pitot # 209 (CALIBRATION DATE: 3-5-85)
Minimite # 8974

		Filter + Impinger	Total Chromium	Chromium +6	
A.	Total Weight.....	5	<.002	0.019	mg
B.	Stack Gas Flow Rate.....	3214			dscfm
C.	Gas Pressure at Meter.....	29.02			In. Hg. (Abs.)
D.	Gas Volume Metered, V_MxC/29.92.....	46.25			dscf
E.	Material Concn.,0.01543 x A/D.....	.002	*	*	grains/scf (dry)
F.	Material Concn. E x 54,143/Molec. Wt.....	~			ppm (dry)
G.	Material Flow Rate, .00857 x B x E.....	.046	*	*	lbs/hr
H.	Percent Isokinetic.....	98%			

* SEE CALCULATION SHEET

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER INLET

Water Vapor and Gas Density Calculations

Percent Water Vapor in Gases

A. Gas Pressure at Meter, $P_A - P_g$ . . . . . 29.02 In. Hg. (Abs.)

B. Vapor Pressure of Water at Impinger Temp . . . . . — In. Hg.

C. Volume of Metered Gas . . . . . 46.25 scf

D. Volume of Water Vapor Metered, B x C/A . . . . . — scf

E. Water Vapor Condensed, Liquid Volume . . . . . 13 ml

F. Volume of Water Vapor Condensed, 0.0464 x E . . . . 1.60 scf

G. Total Volume of Water Vapor in Gas Sample, D + F . . 1.60 scf

H. Total Volume of Gas Sample, C + F . . . . . 46.85 scf

I. Water Vapor in Sampled Gas, 100 x G/H . . . . . 1.3 %

Gas Density Correction Factor

Component	Volume Percent/100	(1 - I/100) Moist. Corr.	Mol. Wt.	(Wet Basis) Wt./Mole
Water		1.00	18.0	
Carbon Dioxide	Dry Basis		44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	Dry Basis		32.0	
Nitrogen & Inerts	Dry Basis		28.2	

J. Average Molecular Weight . . . . .

K. Gas Density Factor = $\sqrt{28.95/J}$ 1.00

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-481 Date 9-18-85

Sampling Location Chrome Line Scrubber Outlet (Stack)

Gas Velocity Data

Time	Point	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.
12:08	1	.57	72	50.50	.60	72	51.81	.62	72	52.67
	2	.58	↓	50.94	.57	↓	50.94	.57	↓	50.50
	3	.63		53.09	.62		52.67	.62		52.67
	4	.55		49.61	.55		49.61	.56		50.06
	5	.54		49.15	.55		49.61	.55		49.61
	6	.53	↓	48.70	.53	↓	48.70	.52	↓	48.23
	7	.43	72	43.86	.45	72	44.87	.45	72	44.87
	8	.50	↓	47.30	.48	↓	46.34	.50	↓	47.30
	9	.53		48.70	.52		48.23	.53		48.70
	10	.51		47.77	.50		47.30	.52		48.23
	11	.56		50.06	.56		50.06	.56		50.06
	12	.63	↓	53.09	.62	↓	52.67	.62	↓	52.67

Static Pressure in Stack (P_S), In. Hg Abs . . 29.02 Conducted by RM/BVA

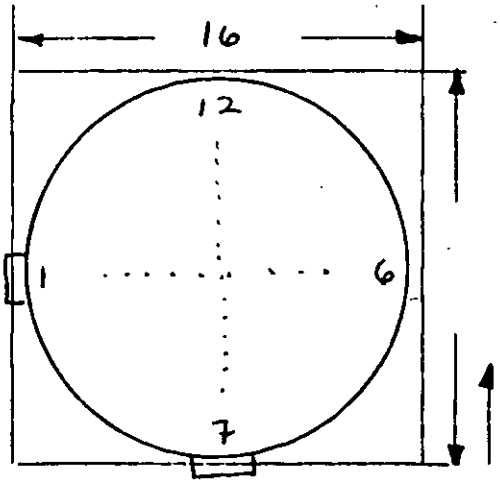
Pitot # 202 Magnehelic # 109-4 Minimite # 2-1 Thermocouple # 4-1

A. Average Velocity (Traverse) . . . . . 49.48 ft/sec
B. Average Velocity (Reference Pt.) . . . . . — ft/sec
C. Flue Factor A/B . . . . . —
D. Velocity Pressure Correction Factor $\sqrt{\frac{29.92}{P_S}}$ 1.02
E. Pitot Correction Factor 835
F. Gas Density Correction Factor 1.00
G. Corrected Velocity, A x D x E x F . . . . 42.14 ft/sec
or B x C x D x E x F . . . . . ft/sec
H. Area of Flue . . . . . 1.40 ft^2
I. Average Flue Temperature . . . . . 72 °F
J. Flow Rate, H x G x 60 . . . . . 3539.9 cfm

Flow Rate, $\frac{P_S}{29.92}$ x $\frac{520}{(I + 460)}$ x J . . . . 3356 scfm

L. Percent Water Vapor in Gas Sample . . . . 2.3 %

M. Dry Gas Flow Rate, K $(1 - \frac{L}{100})$ . . . . . 3279 dscfm



Stack Layout

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER OUTLET (STACK)

PARTICULATES Train

Meter Data and Calculations

On Time	Off Time	Sample Point	Reading Cu. Ft. V_M	Filter Temp. °F T_F		Orifice P. In. H_2O	Samp. Rate (cfm)	Stack Vel fps	Stack Temp. °F	Stack Vel Head In.H_2O
12:23			161.905							
	+5	12	166.15			.95	.86	52.7	72	.62
	+10	11	170.36			.86	.81	50.1	72	.56
	+15	10	174.44			.78	.78	47.8	72	.51
	+20	9	178.51			.81	.79	48.7	72	.53
	+25	8	182.51			.76	.77	47.3	72	.50
	12:53 +30	7	186.325			.69	.73	44.9	72	.45
12:56	+35	6	190.35			.81	.79	48.7	72	.53
	+40	5	194.49			.84	.81	49.6	72	.55
	+45	4	198.67			.84	.81	49.6	72	.55
	+50	3	203.10			.95	.86	52.7	72	.62
	+55	2	207.38			.87	.82	50.5	72	.57
	+60	1	211.735			.92	.84	51.8	72	.60
	13:26									

Total V_M 49.83

Conducted by RM/BVA

Sampling Nozzle Dia.....(1/4") 6.35 mm
Barometric Pressure.....29.02 In Hg.(Abs.)
Weight Collected, mg.....
Meter # 35102/ (CALIBRATED: 2-27-85)
Thermocouple # 4-1 (CALIBRATED: 7-23-85)
Magnehelic # 109-4 (CALIBRATED: 6-25-85)
Pitot # 202 (CALIBRATED: 3-5-85)
Minimite # 2-1 (CALIBRATED: 7-18-85)

			TOTAL CHROMIUM	CHROMIUM +6	
A.	Total Weight	4 (FILTER + IMPINGER)	<0.02	0.011	mg
B.	Stack Gas Flow Rate	3279			dscfm
C.	Gas Pressure at Meter	29.02			In. Hg. (Abs.)
D.	Gas Volume Metered, V_MxC/29.92	48.33			dscf
E.	Material Concn.,0.01543 x A/D	.001	*	*	grains/scf (dry)
F.	Material Concn. E x 54,143/Molec. Wt.	—			ppm (dry)
G.	Material Flow Rate, .00857 x B x E	.036	*	*	lbs/hr
H.	Percent Isokinetic	101 %			

* SEE CALCULATION SHEET

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER OUTLET

Water Vapor and Gas Density Calculations

Percent Water Vapor in Gases

A. Gas Pressure at Meter, $P_A - P_g$ . . . . . 29.02 In. Hg. (Abs.)

B. Vapor Pressure of Water at Impinger Temp . . . . . — In. Hg.

C. Volume of Metered Gas . . . . . 48.33 scf

D. Volume of Water Vapor Metered, B x C/A . . . . . — scf

E. Water Vapor Condensed, Liquid Volume . . . . . 25 ml

F. Volume of Water Vapor Condensed, 0.0464 x E . . . . 1.16 scf

G. Total Volume of Water Vapor in Gas Sample, D + F . . 1.16 scf

H. Total Volume of Gas Sample, C + F . . . . . 49.49 scf

I. Water Vapor in Sampled Gas, 100 x G/H . . . . . 2.3 %

Gas Density Correction Factor

Component	Volume Percent/100	(1 - I/100) Moist. Corr.	Mol. Wt.	(Wet Basis) Wt./Mole
Water		1.00	18.0	
Carbon Dioxide	Dry Basis		44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	Dry Basis		32.0	
Nitrogen & Inerts	Dry Basis		28.2	

J. Average Molecular Weight . . . . .

K. Gas Density Factor = $\sqrt{28.95/J}$ 1.00

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91731
ANALYTICAL LABORATORY REPORT FOR SOURCE TEST

TO: Alex Bailey, Manager
Source Testing & Monitoring

COMPANY: Plato Products, Inc.
Glendora

EQUIPMENT TESTED: Chrome Plating Tank - Scrubbers

SAMPLE DESCRIPTION: Two Particulates Trains.

LAB REPORT DATE: September 25, 1985

LABORATORY NO. 82605-8

TEST NO. 85-481

SOURCE TEST DATE: September 18, 1985

DATE SAMPLE RECEIVED: September 18, 1985

BUDGET PROGRAM CODE: 400

REQUESTED BY: S. Marinoff

ANALYSIS REQUESTED: Particulate & Moisture Gain

METHOD OF ANALYSIS: Gravimetric & Volumetric

SPECIAL INSTRUCTION:

ANALYTICAL WORK PERFORMED AND RESULTS

Particulates by Wet Impingement.

	Chromium Inlet	Scrubber Outlet
Total impinger volume (mL)	198	209
Impinger volume gain (mL)	-2 (loss)	9
Total volume incl. washing (mL)	500	500
Silica gel gain (g)	15	16
Filter catch (mg)	<1	<1
Impinger catch (mg)	5	4
Cr^{III}	*	*
Cr^{IV}	*	*

*To be reported later.

Ref: MJS-3-83

Approved By: Margil W. Wadley
Margil W. Wadley, Ph.D., Acting
Director of Laboratory Services

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91731
ANALYTICAL LABORATORY REPORT FOR SOURCE TEST

TO: Arnold Stein, Acting Manager
Source Testing and Monitoring

COMPANY: Plato Products, Inc.
Glendora

EQUIPMENT TESTED: Chrome Plating Tanks, Scrubbers

SAMPLE DESCRIPTION: Sixteen Bottle Samples Sent to Two Outside Laboratories

LAB REPORT DATE: October 14, 1985

LABORATORY NO. 82605-9-481-Bots.

TEST NO. 85-481

SOURCE TEST DATE: 9-18-85

DATE SAMPLE RECEIVED: 9-19-85

BUDGET PROGRAM CODE: 400

REQUESTED BY: S. Marinoff

ANALYSIS REQUESTED: See attached list sent to Weck Laboratories and to BTC Laboratories

METHOD OF ANALYSIS: Colorimetry, Atomic Absorption, Emission Spectrograph, Volumetry, Gravimetry, Specific Ion Electrode (SIE) for Chloride.

SPECIAL INSTRUCTION:

ANALYTICAL WORK PERFORMED AND RESULTS

Results are reported in three sections: 1) Some Cl^- and HCl results by SIE and titration which follow. 2) Report by Weck Laboratories, Inc. (attached). 3) Report by BTC Laboratories, Inc. (attached).*

Sample No.	HCl by SIE (Cl^-) SCAQMD Lab (Wt.%)	HCl by Titration SCAQMD Lab (Wt. %)
15 Etch	31.0	27.6
24 Etch	29.1	26.2
25 Etch	30.3	28.0
39 Etch	21.5	20.0

*Note: Samples 15, 24, 25 and 39 were analyzed in common by SCAQMD and Weck. Samples 55, 33 and ST train Inlet and Outlet were done in common by BTC and Weck Laboratories.

Ref: F-13-126, 129

Approved By: Margil W. Wadley
Margil W. Wadley, Ph.D., Acting
Director of Laboratory Services

TO: WECK LABORATORIES

1. Test for chemicals listed:

Sample #		
15,24,25,39	hydrochloric acid - 30%, wt. % and g/mL	
10,11	sodium hydroxide - 3 to 4 oz/gal, sodium carbonate - 3 to 4 oz/gal, and may include sodium phosphate	oz/gal and g/mL
45 (2 samples)	one sample contains concentrated hydrochloric acid + iron one sample contains 50% hydrochloric acid + iron	wt.% and g/mL
46 (3 samples)	one sample contains hydrochloric acid-10%, one sample contains bright dip solution phosphoric acid - 1% nitric acid - 3% acetic acid - 3% one sample contains the spent bright dip solution + copper, H_3PO_4, HNO_3, and acetic acid	wt.% and g/mL wt.% and g/mL
55	nickel sulfate - 0.5 oz/gal sodium hypophosphite - 0.5 oz/gal ammonia - 0.1 v/v	oz/gal and g/mL v/v and g/mL
33	Chromium solution, Cr total and Cr^{+6} - 40 oz/gal sulfate - 40 oz/gal	oz/gal and g/mL

2. Two BOD bottles: In the particulate test for the scrubber A/N 126220, which vents the chrome plating sample, please analyze for chromium and hexavalent chromium, in each of "Inlet" and "Outlet". g/mL and (g/mL)X500 0.5 L

Lab No. 82605-8 - Inlet
82605-8 - Outlet

From: F. Faux
South Coast Air Quality Management District
(818) 572-6457

TO: BTC LABORATORIES

1. Expected chemicals in samples tested:

Sample #			
45 (1 sample)	:	one sample contains nickel strip solution: ammonia, Ni (M&T Niplex) if possible	wt.% and g/mL
55	:	nickel sulfate - 0.5 oz/gal sodium hypophosphite - 0.5 oz/gal	oz/gal and g/mL
		ammonia - 0.1% v/v	v/v and g/mL
		other inorganics, (metals), Emission Spectrograph Scan	wt.% and g/mL
33	:	chromium solution, Cr total and Cr^{+6} - 40 oz/gal sulfate - 40 oz/gal	oz/gal and g/mL

2. In the particulate test for the scrubber A/N 126220, which vents the chrome plating sample, please analyze for chromium and hexavalent chromium, in each of "Inlet" and "Outlet". — g/mL and (g/mL)X500

Lab No. 82605-8 - Inlet
82605-8 - Outlet

From: F. Faux
South Coast Air Quality Management District
(818) 572-6457

Weck Laboratories, Inc.
Contract Research

ANALYTICAL SERVICES
PRODUCT & PROCESS DEVELOPMENT
CUSTOM SYNTHESIS
CONSULTING
STATE OF CALIFORNIA
APPROVED WATER LABORATORY

14859 EAST CLARK AVE., INDUSTRY, CALIFORNIA 91745-1396 • (818) 336-2138

CLIENT Mr. Frank J.Faux, Sen. Air Quality Chemist
South Coast Air Quality Management District
Technical Services Division
Chemistry Laboratories Branch
9150 Flair Drive
EL MONTE, CA 91731

DATE Oct. 12, 35

SAMPLE s from Plato Co. as submitted.

DATE RECEIVED Sept. 26, 85

INVESTIGATION see below as requested
Results expressed as requested by client.

LABORATORY NO. 850927-SQA
QMD "A-O"

REPORT

our ID
"E" Sample # 15 "HCl, 30%" "Etch " (yellow liquid)

(1.124g/ml) Titration to MethylOrange : 8.8 N Acid --- 32.08 g HCl/100ml
= 0.32 g HCl/ ml

Density = 1.1239

thus: 32.08 : 1.1239 = 28.55 g HCl/100g sample

Based on chloride titration (Volhard) .... 31.94 g HCl/100 ml

---

"F" Sample #24 "HCl, 30%" "Etch" (green colored)

(1.118g/ml) HCl based on acid titration to Me Orange: 0.292 g HCl/ml
26.1 g HCl/100 g Acid

based on chloride titration: 0.297 g HCl/ml
26.6 g HCl/100 g

"G" Sample # 25 "HCl, 30%" "Etch, 9/18/85" (yellow-brown)

(1.1293g/ml) based on acid titration to Me orange: 0.32 g HCl/ml
28.3 g HCl/100 g

based on chloride titration: 0.33 g HCl/ml

Our ID

I Sample # 39 "Etch",(green liquid) "30% HCl "

..088g/ml)

based on acid titration to MeOrange" 0.23g HCl/ml sol.
21.2 g HCl/100 g

based on chloride titration: 0.236 gHCl/ml sol.

A BOD bottle "Chromium Inlet" # 82605-8 (clear, colorless liq.)

Cr VI ..... 0.05 mg/l = 0.00005g/ml (Diphenylcarbazon)
= 0.025 g in 500 ml

Cr, Total;n.d <0.1 mg/l (AA)

B BOD bottle "Chromium Outlet: # 82605-8 (clear, colorless)

Cr VI 0.02 mg/l = 0.00002 g/ml
- 0.01 g in500 ml

Cr, total: n.d. <0.1 mg/l

C #10, Alk." "Sodium hydroxide3-4 oz/gal. (blueish liquid)
Sod. carbonate 3-4 oz/gal.
may include sodium phosphate"

Spot test for ortho phosphate: negative

Sodium 3 g/100 ml (AA)

CO_2 1.13 g/100 ml (gas evolution)

CO_2 expressed as Na_2CO3 2.72 g/100 ml =0.027g/ml
= 3.63 oz Na_2CO_3/gal.

By difference: Based on Sodium analysis, NaOH content is 0.032 g/ml = 4.3 oz/gal.

our ID

D #11 "Alk"; greenish liquid;
claimed composition like #10 sample.

Spot test for ortho phosphate... negative ($SnCl_2$ method)

Sodium ..... 2.7 g/100 ml (AA)

CO_2 ..... 0.795 g/100 ml (gas evolution)

CO_2 expressed as Na_2CO_3 ..... 1.93 g/100 ml = 0.019 g/ml
= 2.58 oz Na_2CO_3/gal.

By difference: Based on sodium analysis, NaOH content is 0.032 g/ml
= 4.3 oz/gal.

"H" (1.222g/ml) "33 Cr " Rust brown liquid with floating plastic pearls.
" 40 oz/gal Cr; 40 oz/gal. SO_4"

SO_4 test..... negative ($BaCl_2$ inpres. of HCl-→no ppt)

Cr VI - by titration w. FAS ...0.155 g Cr/ml = .298 g CrO_3/ml
20.7ozCr/gal = 39.8 ozCrO_3/gal.

Cr Total : ditto above (AA)

"J" (1.223 g/ml) "45 Fe Strip, Light", 9-18-85 Brown liquid with floating polymer beads
"Conc. HCl and iron"

Acidity by titration to methylOrange: 0.30 g HCl/ml
= 24.5gHCl/100 g

Based on chloride titration: 0.3 g HCl/ml (Volhard)

Iron: ..... 0.076 g Fe/ml = 6.2 g Fe/100 g (byAA)

Our ID

"K" (1.11 5 g/ml)

"# 45, Fe Strip 9-18-85 (light colored brown, clear liq.)

"HCl and iron"

Based on titration to Methyl Orange: 0.264g HCl/ml
= 23.7 g HCl/100 g

Based on chloride titration: 0.256g HCl/ml
= 23 g HCl/100 g

Iron..... 4300 ppm = 0.0043 g Fe/ml
= 0.386g Fe/100 g

"L" (1.148 g/ml)

"# 46 HCl 9-20-85" brown liquid; " 10% HCl"

Based on acid titration: 0.319 g HCl/ml
=27.8 g HCl/100 g

Based on chloride titration: 0.314 g HCl/ml
=27.35 g HCl/100 g

"M" (1.49 g/ml)

"# 46 Bright Dip sol.": "Phosphoric acid 1 % (green liq.)
Nitric Acid 3 %
Acetic acid 3 %"

light green, heavy liquid , Nitric oxide vapors.

Based on distillation and titration .. 0.259g Acetic acid/ml
=17.38g/100 ml

Based on P precipitation w Ammon.molybdate and Stannous chloride method: 67. % = 0.67 g H_3PO_4/ml
= 45 g/100 g

H_3PO_4 based on result by U.S.Agricult.= 45.4g/100 g

Total N byKjeldahl digestion, distil,titr , expressed as HNO_3 = 0.11 g/ml = 7.38 gHNO_3/100 g.

(N determined by US.Agricult. Consultants)

High P content confirmed by titration curve.

Our ID

"N" Sample # 46 "Spent Bright Dip 9-20-85" (blue liquid)

"Contains Bright Dip solution, Cu, H_3PO_4, HNO_3 and CH_3COOH "

1.505 g/ml

Acetic acid ..... 0.206 g/ml (distillation-titration
= 13.69 g/100 g sample

P by Molybdovanadate method *, expressed as

Phosphoric acid .... 0.757 g /ml

= 50.3 g H_3PO_4/100 g sample

Total N by Kjeldahl digestion, distillation and titration,* expressed as Nitric acid ... 0.162 g HNO_3/ml

= 10.76 g HNO_3/100 g

Copper ..... 0.074 g /ml

= 4.92 g Cu/100 g sample

* Run by U.S. Agricultural Consultants

- High H_3PO_4 content confirmed by titration curve.

"O" Sample # 55 "Electroless Ni 9-20-85" (green liquid)

"Nickel sulfate 0.5 oz/gal.
Sod. hypophosphite 0.5 oz/gal.
Ammonia 0.1 v/v"

Ammonia test (Nessler) 23 ppm NH_3

Distillation, titr.) 25.5ppm

Sulfate test (turbidimetric) 3.25 % (wt/vol.)

(gravimetric) 3.17 %

ave. SO_4, expressed as $NiSO_4 7H_2O$ = 9.39g/100ml= 0.09g/ml

=12.5 oz/gal.

cont'd

SCAQMD Oct. 85

Our ID "O" # 55- ELECTROLESS Ni cont'd:

- Nickel (by EDTA,Murexide), expressed as $NiSO_4 7H_2O$ .. 0.052g/ml
  = 6.9 oz/gal.
- Nickel, by AA , expressed as $NiSO_4.7H_2O$ = 7.0 oz/gal.
- Phosphite, by titration with $KMnO_4$, expressed as $NaH_2PO_2.H_2O^4$ = 0.085 g/ml
  =11.4 oz/gal.
- Na by AA 2.5 % - this would correspond to 15.3 oz if expressed as $NaH_2PO_2.H_2O$

There is an excess of Na and So_4 not accounted for in the given composition

H.A.Weck

H.A.Weck

BtC Laboratories Incorporated
2978 SEABORG AVENUE, VENTURA, CA 93003 • 805/656-6074

October 9, 1985

JOB NUMBER: 85-1100-C01
LAB NUMBER: 855987

SCAQMD Engineering Division
9150 Flair Drive
El Monte, California 91731

ATTENTION: Frank Faux

REGARDING: Miscellaneous Plating Solution Analysis

Dear Mr. Faux:

The analysis has been completed on the five (5) samples delivered to us on Sept. 26, 1985. The following results were obtained:

Sample #45

Constituent	Results
Ammonia	0.086% - 0.00086 gm/mL
Nickel	0.065% - 0.00065 gm/mL

Sample #33

Total Chromium	25 oz/gal - 0.1875 gm/mL
Hex Chromium	25 oz/gal - 0.1875 gm/mL
Sulfate	2.72 oz/gal - 0.0204 gm/mL

Sample #55

Nickel Sulfate	3.52 oz/gal - 0.026 gm/mL
Sodium Hypophosphite	8.26 oz/gal - 0.0618 gm/mL
Ammonia	0.0014% - 0.000014 gm/mL

Metals (spectrographic)

Sodium	38700 mg/L
Iron	16 mg/L
Cobalt	57 mg/L
Calcium	227 mg/L
Chromium	3 mg/L
Boron	39 mg/L
Silicon	44 mg/L
Manganese	2 mg/L
Magnesium	5 mg/L

Sample 82605-8 Inlet

Total Chromium	$< 5 \times 10^{-8}$ gm/Ml - $< 2.5 \times 10^{-5}$ gm/mL (@x500)
Hex Chromium	3.7×10^{-8} gm/mL - 1.85×10^{-5} gm/mL (@x500)

Sample 82605-8 Outlet

Total Chromium	$< 5 \times 10^{-8}$ gm/mL - $< 2.5 \times 10^{-5}$ gm/mL (@x500)
Hex Chromium	2.5×10^{-8} gm/mL - 1.25×10^{-5} gm/mL (@x500)

Respectfully submitted,

BTC LABORATORIES, INC.

Tom Porter

TP:hra

OCT 29 1985

Summary of Plato Products Inc. Testing, 9-18-85

Contam.	Chrome Tank 85-481	
	Inlet (lb/hr)	Outlet (lb/hr)
Total Part	0.046	0.035
Total Cr	$<1.8 \times 10^{-4}$	$<1.8 \times 10^{-4}$
Hex Cr	1.7×10^{-4}	0.99×10^{-4}

Element	Scrubber A 84-484			Scrubber B 84-485	
	Inlet (lb/hr)	Outlet (lb/hr)		Inlet (lb/hr)	Outlet (lb/hr)
Total Part.	0.054	0.046	-	0.159	0.082
Si	0.018	0.012	-	0.07	0.018
Ca	0.0017	0.004	+	0.0033	0.008
Al	0.0015	0.001	-	0.0017	0.0029
Fe	3.4×10^{-4}	3×10^{-4}	-	9×10^{-4}	0.0017
Na	0.0013	0.002	+	7×10^{-4}	0.002
B	8×10^{-4}	1.8×10^{-4}	-	2.1×10^{-4}	4×10^{-4}
Mg	5×10^{-4}	7×10^{-4}	+	7×10^{-4}	0.0017
Ti	6×10^{-5}	4×10^{-5}	-	6×10^{-5}	1.1×10^{-4}
Cl	6×10^{-6}	7×10^{-6}	+	6×10^{-4}	1.2×10^{-4}
Cr	1.1×10^{-5}	1.8×10^{-6}	-	1.2×10^{-5}	1.7×10^{-5}
Sr	9×10^{-6}	1.2×10^{-5}	+	1.7×10^{-5}	8×10^{-5}
Co	6×10^{-6}	1.7×10^{-5}	+	1×10^{-4}	3.3×10^{-5}
Mn	1.4×10^{-5}	1.9×10^{-5}	+	2.5×10^{-5}	2.1×10^{-5}
Pb	8×10^{-5}	9×10^{-5}	+	1.4×10^{-4}	1.7×10^{-4}
Sn	7×10^{-5}	3.5×10^{-5}	-	2.1×10^{-4}	2.3×10^{-5}
Ni	2.5×10^{-5}	2.2×10^{-5}	-	4×10^{-5}	5×10^{-5}
Cu	2.3×10^{-5}	2.4×10^{-5}	+	6×10^{-5}	5×10^{-5}
Ag	1.2×10^{-6}	1.5×10^{-6}	+	1.7×10^{-6}	7×10^{-6}
Zn	2×10^{-4}	2.2×10^{-4}	+	6×10^{-4}	5×10^{-4}
Zr	3×10^{-5}	$<2.8 \times 10^{-4}$	-	$<1 \times 10^{-5}$	$<5 \times 10^{-6}$
K	-	-		$<3 \times 10^{-4}$	-

South Coast
AIR QUALITY MANAGEMENT DISTRICT
9150 FLAIR DRIVE, EL MONTE, CA 91731 (818) 572-6200

May 22, 1986

Ms. Frances Cameron
Air Resources Board
1102 Q Street
P.O. Box 2815
Sacramento, CA 95812

Dear Ms. Cameron:

As requested in your letter of May 13, 1986, please find enclosed a copy of the September 18, 1986 source test conducted on the chrome plating operation at Plato Products, Inc.

If you have any questions, please feel free to call me at (818)572-6131.

Sincerely,

Richard Schneider

Richard Schneider
Supervising Air Quality Engineer

RS/mm

Cameron

South Coast
AIR QUALITY MANAGEMENT DISTRICT
9150 FLAIR DRIVE, EL MONTE, CA 91731 (818) 572-6200

SOURCE TEST REPORT

85-481

CONDUCTED AT

Plato Products Inc.
2120 E. Allen Ave.
Glendora, CA

EFFICIENCY OF, AND EMISSIONS FROM THE SCRUBBER SERVING A HARD CHROME PLATING TANK

TESTED: September 18, 1985

ISSUED: OCT 2 8 1985

REPORT BY: Wayne A. Nakagawa
Air Quality Instrument Specialist II

REVIEWED:

Steven Marinoff

Steven Marinoff, Senior Air Quality Engineer

ARNOLD STEIN, ACTING MANAGER,
SOURCE TESTING & MONITORING BRANCH

EDWARD CAMARENA
DIRECTOR, ENFORCEMENT DIVISION

INTRODUCTION

(a) Firm Tested ..... Plato Products, Inc.

(b) Test Location ..... 2120 E. Allen Ave., Glendora, CA

(c) Unit Tested ..... Scrubber Serving Chrome Plating Tank (A/N 12622

(d) Test Requested by ..... Tran Vo, Engineering

(e) Reason for Test Request ..... Engineering Information

(f) Date of Test ..... September 18, 1985

(g) Source Test Performed by ..... S. Marinoff, R. Schneider, A. Roy Chowdhury, B. van Aalst, X. Vu, W. Nakagawa, J.R. Manker

(h) Test Arrangements Made Through ..... Richard L. Hartman (818) 967-3821

(i) Source Test Observed by ..... Tran Vo, Mark Liu - Engineering

(j) Company I.D. No. 045443

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
150 Flair Drive, El Monte, California 91731

Test No. 85-481 -3- Date 9/18/85

Results

Scrubber Inlet Flow Rate 91 dscmm (3214 dscfm)
Scrubber Outlet Flow Rate 93 dscmm (3279 dscfm)
Process Weight - kg/hr (- lbs/hr)

Contaminant	Emissions		Applicable Rule
	Measured	Allowed	
Particulate Matter Concentration			
Inlet	4.6 mg/dscm (0.002 gr/dscf)	—	—
Outlet	2.3 mg/dscm (0.001 gr/dscf)	276 mg/dscm (0.121 gr/dscf)	404
Solid Particulate Mass Flow Rate			Information
Inlet	0.021 kg/hr (0.046 lb/hr)	—	"
Outlet	0.016 kg/hr (0.036 lb/hr)	—	"
Scrubber Efficiency (Particulates)	32%		Information
Total Chromium Conc.			Information
Inlet	< 0.015 mg/dscm (< 6.7×10^{-6} gr/dscf)	—	"
Outlet	< 0.015 mg/dscm (< 6.4×10^{-6} gr/dscf)	—	"
Hexavalent Chrom. Conc.			Information
Inlet	0.014 mg/dscm (6.3×10^{-6} gr/dscf)	—	"
Outlet	0.0080 mg/dscm (3.5×10^{-6} gr/dscf)	—	"

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
150 Flair Drive, El Monte, California 9 31

Test No. 85-481 -4- Date 9/18/85

Results

Scrubber Inlet Flow Rate 91 dscmm (3214 dscfm)
Scrubber Outlet Flow Rate 93 dscmm (3279 dscfm)
Process Weight - kg/hr (- lbs/hr)

Contaminant	Emissions		Applicable Rule
	Measured	Allowed	
Total Chromium Mass Flow Rate			Information
Inlet	$< 8.2 \times 10^{-5}$ kg/hr ($< 1.8 \times 10^{-4}$ lb/hr)	———	"
Outlet	$< 8.2 \times 10^{-5}$ kg/hr ($< 1.8 \times 10^{-4}$ lb/hr)	———	"
Hexavalent Chrom Mass Flow Rate			Information
Inlet	7.9×10^{-5} kg/hr (1.7×10^{-4} lb/hr)	———	"
Outlet	4.5×10^{-5} kg/hr (0.99×10^{-4} lb/hr)	———	"

INTRODUCTION

On September 18, 1985, personnel from the Source Testing and Monitoring Branch of the South Coast Management District conducted a source test on the inlet and outlet of a cross-flow sprayed water scrubber controlling the exhaust from a hard chrome plating tank at Plato Products, Inc. The purpose of this test was to measure any potential toxic emissions of chromium from this tank and from the scrubber.

PROCESS DESCRIPTION

This company specializes in manufacturing soldering iron tips at this location. The process starts with solid copper tips, which are degreased after machining and initially plated with iron. The soldering tips are then waxed on the tip, etched with HCl and subsequently plated with nickel and chrome on the unwax portion.

The plating bath is a mixture of chromic acid and sulfuric acid solutions kept at 130 - 140 °F and kept covered with polyethylene beads. The plating is accomplished at 6V and 2000 AMP DC. The emissions from this tank are controlled by a cross-flow sprayed water scrubber. The measured water overflow rate from the scrubber is 2.5 liters per minute and the water recirculation rate is about 60–70 gallons per minute.

SAMPLING AND ANALYTICAL PROCEDURES

GAS FLOW RATE

The gas velocities and temperatures at the outlet and the inlets to the scrubber serving the chrome plating tank (designated as chrome scrubber) were measured using a Pitot tube, Magnehelic gage, and a Minimite potentiometer with a type "K" thermocouple. This scrubber serves only tank 33 (FIGURE 1). The gas flow rates were determined from the gas velocity, temperature, pressure, density of the gas and the cross-sectional area of the discharge stack and the inlet duct.

PARTICULATE SAMPLING

The particulate samples were collected isokinetically at the outlet and inlet of the scrubber using the wet impingement method (FIGURE 2) with glass probes. Total and hexavalent chromium content of the particulates were analyzed by atomic absorption spectroscopy and diphenyl carbizide spectrophotometry, respectively. A liquid sample from the tank was also taken for analysis of chromium content.

The residue from the particulate samples were submitted to two laboratories for total chromium and hexavalent chromium analysis. For hexavalent chromium the results from the two laboratories are in close agreement so an average of their results were used in calculating the hexavalent chromium emissions. The results are at the lower detectable limit of the analytical methods and, therefore, the accuracy should be poor. The total chrome concentration was below the detectable limit for the analytical methods used by both laboratories. The analytical procedures used by one laboratory gave a lower detectable limit, which was used in calculating the uppper limit of total chromium emissions.

The results indicate that most or all of the chromium emissions are of the hexavalent form.

Liquid Samples

Samples of the tank bath were submitted to the lab for analysis. The composition of the bath is contained in the lab reports.

TEST CRITIQUE

The equipment was operating normally during the source test. No problems were encountered during the test. The isokinetic sampling rates at the inlet and outlet were 98% and 101% respectively. The internal and the large external doors of the room containing the tank solutions were open prior to testing, and Plato personnel closed these doors shortly after our arrival.

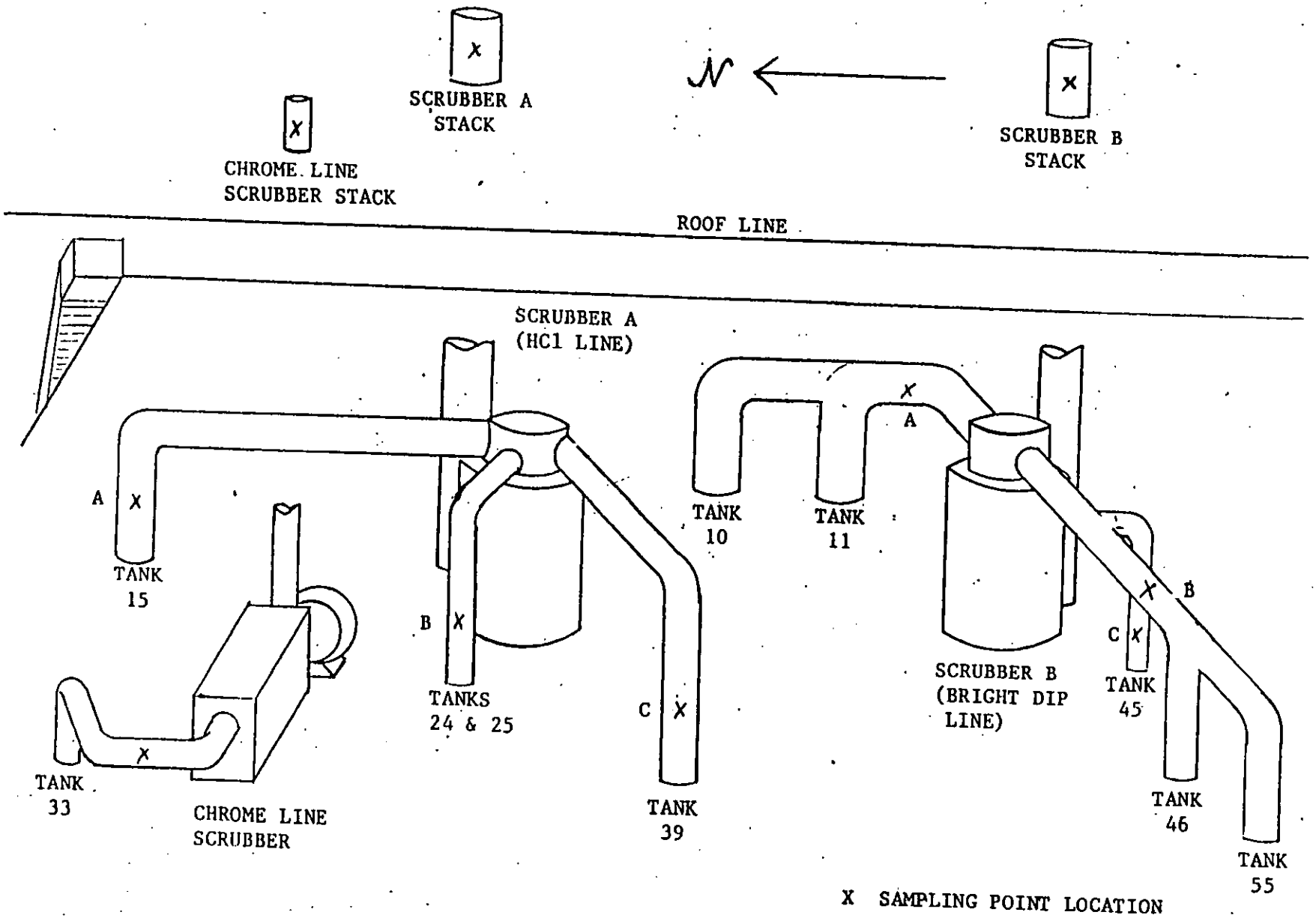


FIGURE 1

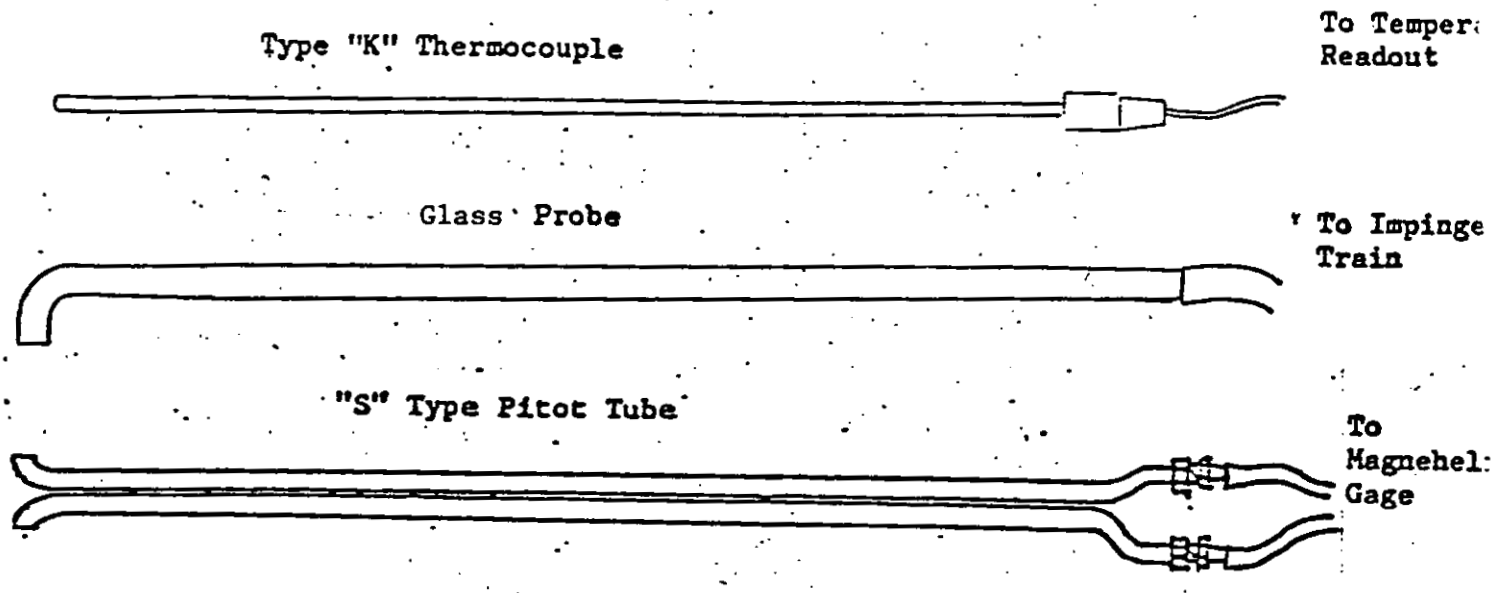
PLATO PRODUCTS, INC.
PLATING PROCESS EXHAUST CONTROL SCHEMATIC

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91731

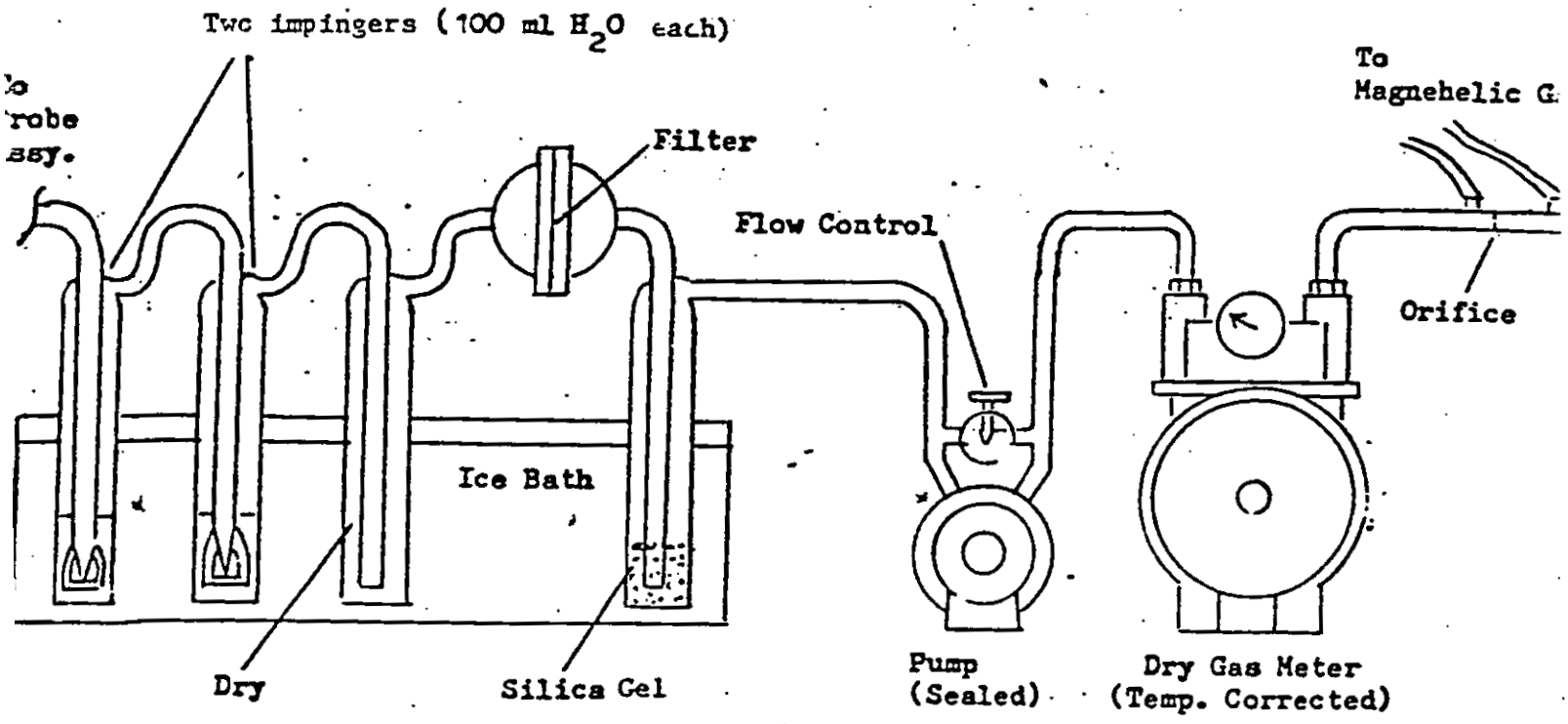
Test No. 85-481

Date 9-18-85

Figure No. 2



PROBE SET-UP



IMPINGER TRAIN SET-UP
(Wet Impingement Method)

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
ENFORCEMENT DIVISION
SOURCE TESTING AND MONITORING BRANCH
CALCULATION SHEET

GES	PAGE 9
TEST NO. 95-481	DATE 9-18-95
PROCESSED BY W. NAKAGAWA	CHECKED BY

PLATO PRODUCTS, INC.

% ISOKINETIC SAMPLING RATE = (METER VOL)(STACK AREA)(FLUE FACTOR)(100)
(NOZZLE AREA)(SAMPLING TIME)(FLOW RATE)

INLET :

$$\% = \frac{(46.25\ dscf)(1.40\ ft^2)(0.994)(100)}{(.000\ 341\ ft^2)(60\ min)(3214\ dscfm)}$$

$$= 97.9$$

OUTLET:

$$\% = \frac{(48.33\ dscf)(1.40\ ft^2)(1.00)(100)}{(.000\ 341\ ft^2)(60\ min)(3279\ dscfm)}$$

$$= 100.9$$

EFFICIENCY OF SCRUBBER

INLET TO SCRUBBER	.053	lbs/hr
OUTLET FROM SCRUBBER	.036	lbs/hr

EFFICIENCY OF SCRUBBER $\frac{.053 - .036}{.053} \times 100$

$$= \frac{.017}{.053} \times 100$$

$$= 32\ \%$$

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
ENFORCEMENT DIVISION
SOURCE TESTING AND MONITORING BRANCH
CALCULATION SHEET

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TEST NO. 85-481	DATE 9-18-85
PROCESSED BY W. NAKAGAWA	CHECKED BY

PLATO PRODUCTS, INC.

TOTAL CHROMIUM AND HEXAVALENT CHROMIUM CALCULATIONS.

	Total Cr Sample Weight (mg)			Cr^{+6} Sample Weight (mg)			Sample Vol. (scf)	Stack Flow (dscfm
	WL	BTC	Ave.	WL	BTC	Ave		
INLET	< 0.05	< 0.02	< 0.02	0.02	0.018	0.019	46.25	3214
OUTLET	< 0.05	< 0.02	< 0.02	0.01	0.012	0.011	48.33	3274

$$\text{Material Conc.} = \frac{(0.01543)(\text{mg of Material})}{\text{Sample Vol.}} \quad \left(\frac{gr}{dscf}\right)$$

$$\text{Material Flow Rate} = (0.00857)(\text{Material Conc.})(\text{Stack Gas Flow Rate}) \quad \left(\frac{lb}{hr}\right)$$

	Inlet		Outlet	
	Total Cr	Cr^{+6}	Total Cr	Cr^{+6}
Material Conc., $\frac{gr}{dscf}$	$< 6.7 \times 10^{-6}$	6.3×10^{-6}	$< 6.4 \times 10^{-6}$	3.5×10^{-6}
Material Flow Rate, $\frac{lb}{hr}$	$< 1.8 \times 10^{-4}$	1.7×10^{-4}	$< 1.8 \times 10^{-4}$	0.99×10^{-4}

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER INLET

Gas Velocity Data

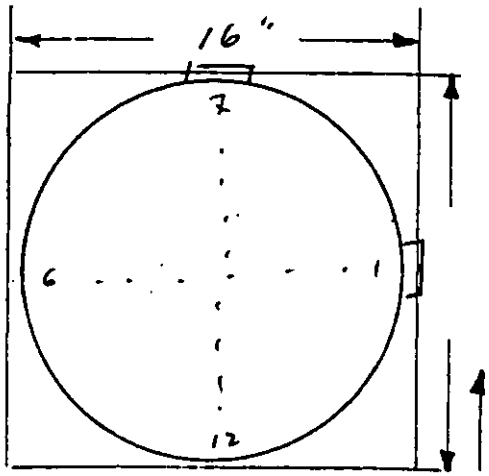
Time	Point	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.
11:43	1	.54	77	49.38	.52	77	48.46	.52	77	48.46
	2	.54	↓	49.38	.52	↓	48.46	.52	↓	48.46
	3	.40		42.50	.38		41.43	.40		42.50
	4	.52		48.46	.52		48.46	.52		48.46
	5	.62		52.92	.62		52.92	.60		52.05
	6	.62		52.92	.60		52.05	.60		52.05
	7	.62	77	52.92	.62	77	52.92	.62	77	52.92
	8	.64	↓	53.76	.64	↓	53.76	.63	↓	53.34
	9	.60		52.05	.59		51.62	.60		52.05
	10	.40		42.50	.38		41.43	.40		42.50
	11	.46		45.58	.44		44.58	.44		44.58
	12	.46		45.58	.46		45.58	.44		44.58

(DEG) 1.5 "H_2O = .11 "Hg

Static Pressure in Stack (P_S), In. Hg Abs . . 29.02 - .11 = 28.91 Conducted by JOE, RS

Pitot # 209 Magnehelic # 130-4 Minimite # 8974 Thermocouple # 2-1

A. Average Velocity (Traverse) . . . . . 48.65 ft/sec
B. Average Velocity (Reference Pt.) . . . . . 48.96 ft/sec
C. Flue Factor A/B 994
D. Velocity Pressure Correction Factor $\sqrt{\frac{29.92}{P_S}}$ 1.02
E. Pitot Correction Factor 835
F. Gas Density Correction Factor 1.00
G. Corrected Velocity, A x D x E x F . . . . — ft/sec
or B x C x D x E x F . . . . . 41.44 ft/sec
H. Area of Flue . . . . . 1.4 ft^2
I. Average Flue Temperature . . . . . 77 °F
J. Flow Rate, H x G x 60 . . . . . 3480.6 cfm
K. Flow Rate, $\frac{P_S}{29.92}$ x $\frac{520}{(I + 460)}$ x J . . . . 3256.6 scfm
L. Percent Water Vapor in Gas Sample . . . . 1.3 %
M. Dry Gas Flow Rate, K $(1 - \frac{L}{100})$ . . . . . 3214 dscfm



Stack Layout

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER INLET

PARTICULATES Train

Meter Data and Calculations

On Time	Off Time	Sample Point	Reading Cu. Ft. V_M	Filter Temp. °F T_F		Orifice P. In. H_2O	Samp. Rate (cfm)	Stack Vel fps	Stack Temp. °F	Stack Vel Head In.H_2O
12:23		1	045.950	BAD MOTOR		.87	.78	48.92	77	.53
	12:27:04		49.045	#351020						
		1	42.970			.87	.78	48.92	77	.53
		2	47.20			.87	.78	48.92	77	.53
		3	55.57			.66	.68	42.50	77	.40
		4	62.59			.86	.78	48.46	77	.52
		5	70.50			1.00	.84	52.49	77	.61
		6	79.05			1.00	.84	52.49	77	.61
	1:32		87.513							
							Ave:	48.96	77	

Total $V_m = 3.145 + 44.543 = 47.688$

Conducted by XV

Sampling Nozzle Dia..... (¼") 6.35 mm

Barometric Pressure..... 29.02 In Hg.(Abs.) STATIC (P_s) 28.91 in H_g (Abs)

Weight Collected, mg.....

Meter # 351020 (CALIBRATION DATE: 2-27-85)

Thermocouple # 2-1 (CALIBRATION DATE: 7-18-85)

Magnehelic # 130-4 (PITOT) (CAL. DATE: 6-6-85) 129-3 (ORIFICE) (CALIB. DATE: 6-6-85)

Pitot # 209 (CALIBRATION DATE: 3-5-85)

Minimite # 0974

		Filter + Impinger	Total Chromium	Chromium +6	
A.	Total Weight.....	5	<.002	0.019	mg
B.	Stack Gas Flow Rate.....	3214			dscfm
C.	Gas Pressure at Meter.....	29.02			In. Hg. (Abs.)
D.	Gas Volume Metered, V_MxC/29.92.....	46.25			dscf
E.	Material Concn.,0.01543 x A/D.....	.002	*	*	grains/scf (dry)
F.	Material Concn. E x 54,143/Molec. Wt.....	~			ppm (dry)
G.	Material Flow Rate, .00857 x B x E.....	.046	*	*	lbs/hr
H.	Percent Isokinetic.....	98%			

* SEE CALCULATION SHEET

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91731

Test No. 85-401 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER INLET

Water Vapor and Gas Density Calculations

Percent Water Vapor in Gases

A. Gas Pressure at Meter, $P_A - P_g$ . . . . . 29.02 In. Hg. (Abs.)

B. Vapor Pressure of Water at Impinger Temp . . . . . — In. Hg.

C. Volume of Metered Gas . . . . . 46.25 scf

D. Volume of Water Vapor Metered, B x C/A . . . . . — scf

E. Water Vapor Condensed, Liquid Volume . . . . . 13 ml

F. Volume of Water Vapor Condensed, 0.0464 x E . . . . 1.60 scf

G. Total Volume of Water Vapor in Gas Sample, D + F . . 1.60 scf

H. Total Volume of Gas Sample, C + F . . . . . 46.85 scf

I. Water Vapor in Sampled Gas, 100 x G/H . . . . . 1.3 %

Gas Density Correction Factor

Component	Volume Percent/100	(1 - I/100) Moist. Corr.	Mol. Wt.	(Wet Basis) Wt./Mole
Water		1.00	18.0	
Carbon Dioxide	Dry Basis		44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	Dry Basis		32.0	
Nitrogen & Inerts	Dry Basis		28.2	

J. Average Molecular Weight . . . . .

K. Gas Density Factor = $\sqrt{28.95/J}$ 1.00

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-481 Date 9-18-85

Sampling Location Chrome Line Scrubber Outlet (Stack)

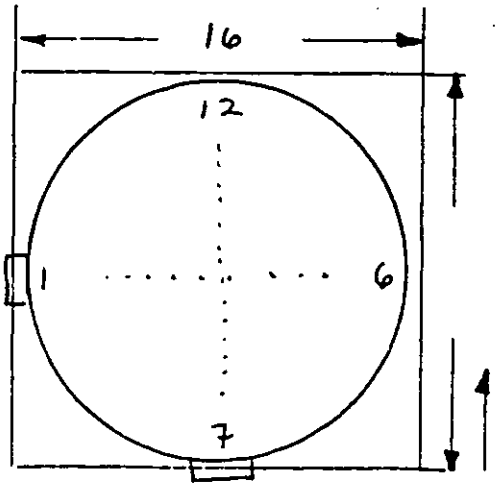
Gas Velocity Data

Time	Point	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.
12:08	1	.57	72	50.50	.60	72	51.81	.62	72	52.67
	2	.58		50.94	.57		50.94	.57		50.50
	3	.63		53.09	.62		52.67	.62		52.67
	4	.55		49.61	.55		49.61	.56		50.06
	5	.54		49.15	.55		49.61	.55		49.61
	6	.53	↓	48.70	.53	↓	48.70	.52	↓	48.23
	7	.43	72	43.86	.45	72	44.87	.45	72	44.87
	8	.50		47.30	.48		46.34	.50		47.30
	9	.53		48.70	.52		48.23	.53		48.70
	10	.51		47.77	.50		47.30	.52		48.23
	11	.56		50.06	.56		50.06	.56		50.06
	12	.63	↓	53.09	.62	↓	52.67	.62	↓	52.67

Static Pressure in Stack (P_S), In. Hg Abs . . 29.02 Conducted by RM/BVA

Pitot # 202 Magnehelic # 109-4 Minimite # 2-1 Thermocouple # 4-1

A. Average Velocity (Traverse) . . . . . 49.48 ft/sec
B. Average Velocity (Reference Pt.) . . . . . — ft/sec
C. Flue Factor A/B . . . . . —
D. Velocity Pressure Correction Factor $\sqrt{\frac{29.92}{P_S}}$ 1.02
E. Pitot Correction Factor 835
F. Gas Density Correction Factor 1.00
G. Corrected Velocity, A x D x E x F . . . . 42.14 ft/sec
or B x C x D x E x F . . . . . ft/sec
H. Area of Flue . . . . . 1.40 ft^2
I. Average Flue Temperature . . . . . 72 °F
J. Flow Rate, H x G x 60 . . . . . 3539.9 cfm
K. Flow Rate, $\frac{P_S}{29.92}$ x $\frac{520}{(I + 460)}$ x J . . . . 3356 scfm
L. Percent Water Vapor in Gas Sample . . . . 2.3 %
M. Dry Gas Flow Rate, K $(1 - \frac{L}{100})$ . . . . . 3279 dscfm



Stack Layout

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Test No. 85-481 Date 9-18-85

Sampling Location CHROMIC LINE SCRUBBER OUTLET (STACK)

PARTICULATES Train

Meter Data and Calculations

On Time	Off Time	Sample Point	Reading Cu. Ft. V_M	Filter Temp. °F T_F		Orifice P. In. H_2O	Samp. Rate (cfm)	Stack Vel fps	Stack Temp. °F	Stack Vel Head In.H_2O
12:23			161.905							
	+5	12	166.15			.95	.86	52.7	72	.62
	+10	11	170.36			.86	.81	50.1	72	.56
	+15	10	174.44			.78	.78	47.8	72	.51
	+20	9	178.51			.81	.79	48.7	72	.53
	+25	8	182.51			.76	.77	47.3	72	.50
	12:53 +30	7	186.325			.69	.73	44.9	72	.45
12:56	+35	6	190.35			.81	.79	48.7	72	.53
	+40	5	194.49			.84	.81	49.6	72	.55
	+45	4	198.67			.84	.81	49.6	72	.55
	+50	3	203.10			.95	.86	52.7	72	.62
	+55	2	207.38			.87	.82	50.5	72	.57
	+60	1	211.735			.92	.84	51.8	72	.60
	13:26									

Total V_m 49.83

Conducted by RM/BVA

Sampling Nozzle Dia.....(1/4") 6.35 mm
Barometric Pressure.....29.02 In Hg.(Abs.)
Weight Collected, mg.....
Meter # 35102I (CALIBRATED: 2-27-85)
Thermocouple # 4-1 (CALIBRATED: 7-23-85)
Magnehelic # 109-4 (CALIBRATED: 6-25-85)
Pitot # 202 (CALIBRATED: 3-5-85)
Minimite # 2-1 (CALIBRATED: 7-18-85)

			TOTAL CHROMIUM	CHROMIUM +6	
A.	Total Weight	4 (FILTER + IMPINGER)	<0.02	0.011	mg
B.	Stack Gas Flow Rate	3279			dscfm
C.	Gas Pressure at Meter	29.02			In. Hg. (Abs.)
D.	Gas Volume Metered, V_MxC/29.92	48.33			dscf
E.	Material Concn.,0.01543 x A/D	.001	*	*	grains/scf (dry)
F.	Material Concn. E x 54,143/Molec. Wt.	—			ppm (dry)
G.	Material Flow Rate, .00857 x B x E	.036	*	*	lbs/hr
H.	Percent Isokinetic	101 %			

* SEE CALCULATION SHEET

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER OUTLET

Water Vapor and Gas Density Calculations

Percent Water Vapor in Gases

A.	Gas Pressure at Meter, $P_A - P_g$	29.02 In. Hg. (Abs.
B.	Vapor Pressure of Water at Impinger Temp	— In. Hg
C.	Volume of Metered Gas	48.33 scf
D.	Volume of Water Vapor Metered, B x C/A	— scf
E.	Water Vapor Condensed, Liquid Volume	25 ml
F.	Volume of Water Vapor Condensed, 0.0464 x E	1.16 scf
G.	Total Volume of Water Vapor in Gas Sample, D + F	1.16 scf
H.	Total Volume of Gas Sample, C + F	49.49 scf
I.	Water Vapor in Sampled Gas, 100 x G/H	2.3 %

Gas Density Correction Factor

Component	Volume Percent/100	(1 - I/100) Moist. Corr.	Mol. Wt.	(Wet Basis) Wt./Mole
Water		1.00	18.0	
Carbon Dioxide	Dry Basis		44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	Dry Basis		32.0	
Nitrogen & Inerts	Dry Basis		28.2	

J. Average Molecular Weight . . . . .

K. Gas Density Factor = $\sqrt{28.95/J}$ 1.00

South Coast
AIR QUALITY MANAGEMENT DISTRICT
9150 FLAIR DRIVE, EL MONTE, CA 91731 (818) 572-6200

May 22, 1986

Ms. Frances Cameron
Air Resources Board
1102 Q Street
P.O. Box 2815
Sacramento, CA 95812

Dear Ms. Cameron:

As requested in your letter of May 13, 1986, please find enclosed a copy of the September 18, 1986 source test conducted on the chrome plating operation at Plato Products, Inc.

If you have any questions, please feel free to call me at (818)572-6131.

Sincerely,

Richard Schneider

Richard Schneider
Supervising Air Quality Engineer

RS/mm

Cameron

South Coast
AIR QUALITY MANAGEMENT DISTRICT
9150 FLAIR DRIVE, EL MONTE, CA 91731 (818) 572-6200

SOURCE TEST REPORT

85-481

CONDUCTED AT

Plato Products Inc.
2120 E. Allen Ave.
Glendora, CA

EFFICIENCY OF, AND EMISSIONS FROM THE SCRUBBER SERVING A HARD CHROME PLATING TANK

TESTED: September 18, 1985

ISSUED: OCT 2 8 1985

REPORT BY: Wayne A. Nakagawa
Air Quality Instrument Specialist II

REVIEWED:

Steven Marinoff

Steven Marinoff, Senior Air Quality Engineer

ARNOLD STEIN, ACTING MANAGER,
SOURCE TESTING & MONITORING BRANCH

EDWARD CAMARENA
DIRECTOR, ENFORCEMENT DIVISION

SOUTH AST AIR QUALITY MANAGEMENT DIS T
9150 Flair Drive, El Monte, California 91731

Test No. 85-481 -2- Date 9/18/85

INTRODUCTION

(a) Firm Tested ..... Plato Products, Inc.

(b) Test Location ..... 2120 E. Allen Ave., Glendora, CA

(c) Unit Tested ..... Scrubber Serving Chrome Plating Tank (A/N 12622

(d) Test Requested by ..... Tran Vo, Engineering

(e) Reason for Test Request ..... Engineering Information

(f) Date of Test ..... September 18, 1985

(g) Source Test Performed by ..... S. Marinoff, R. Schneider, A. Roy Chowdhury, B. van Aalst, X. Vu, W. Nakagawa, J.R. Manker

(h) Test Arrangements Made Through ..... Richard L. Hartman (818) 967-3821

(i) Source Test Observed by ..... Tran Vo, Mark Liu - Engineering

(j) Company I.D. No. 045443

Test No. 85-481 -3- Date 9/18/85

Results

Scrubber Inlet Flow Rate 91 dscmm (3214 dscfm)
Scrubber Outlet Flow Rate 93 dscmm (3279 dscfm)
Process Weight - kg/hr (- lbs/hr)

Contaminant	Emissions		Applicable Rule
	Measured	Allowed	
Particulate Matter Concentration			
Inlet	4.6 mg/dscm (0.002 gr/dscf)	—	—
Outlet	2.3 mg/dscm (0.001 gr/dscf)	276 mg/dscm (0.121 gr/dscf)	404
Solid Particulate Mass Flow Rate			Information
Inlet	0.021 kg/hr (0.046 lb/hr)	—	"
Outlet	0.016 kg/hr (0.036 lb/hr)	—	"
Scrubber Efficiency (Particulates)	32%		Information
Total Chromium Conc.			Information
Inlet	<0.015 mg/dscm ($<6.7\times10^{-6}$ gr/dscf)	—	"
Outlet	<0.015 mg/dscm ($<6.4\times10^{-6}$ gr/dscf)	—	"
Hexavalent Chrom. Conc.			Information
Inlet	0.014 mg/dscm (6.3×10^{-6} gr/dscf)	—	"
Outlet	0.0080 mg/dscm (3.5×10^{-6} gr/dscf)	—	"

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
150 Flair Drive, El Monte, California 91731

Test No. 85-481 -4- Date 9/18/85

Results

Scrubber Inlet Flow Rate 91 dscmm (3214 dscfm)
Scrubber Outlet Flow Rate 93 dscmm (3279 dscfm)
Process Weight ___ kg/hr (___ lbs/hr)

Contaminant	Emissions		Applicable Rule
	Measured	Allowed	
Total Chromium Mass Flow Rate			Information
Inlet	$< 8.2 \times 10^{-5}$ kg/hr ($< 1.8 \times 10^{-4}$ lb/hr)	———	"
Outlet	$< 8.2 \times 10^{-5}$ kg/hr ($< 1.8 \times 10^{-4}$ lb/hr)	———	"
Hexavalent Chrom Mass Flow Rate			Information
Inlet	7.9×10^{-5} kg/hr (1.7×10^{-4} lb/hr)	———	"
Outlet	4.5×10^{-5} kg/hr (0.99×10^{-4} lb/hr)	———	"

INTRODUCTION

On September 18, 1985, personnel from the Source Testing and Monitoring Branch of the South Coast Management District conducted a source test on the inlet and outlet of a cross-flow sprayed water scrubber controlling the exhaust from a hard chrome plating tank at Plato Products, Inc. The purpose of this test was to measure any potential toxic emissions of chromium from this tank and from the scrubber.

PROCESS DESCRIPTION

This company specializes in manufacturing soldering iron tips at this location. The process starts with solid copper tips, which are degreased after machining and initially plated with iron. The soldering tips are then waxed on the tip, etched with HCl and subsequently plated with nickel and chrome on the unwax portion.

The plating bath is a mixture of chromic acid and sulfuric acid solutions kept at 130 - 140 °F and kept covered with polyethylene beads. The plating is accomplished at 6V and 2000 AMP DC. The emissions from this tank are controlled by a cross-flow sprayed water scrubber. The measured water overflow rate from the scrubber is 2.5 liters per minute and the water recirculation rate is about 60-70 gallons per minute.

SAMPLING AND ANALYTICAL PROCEDURES

GAS FLOW RATE

The gas velocities and temperatures at the outlet and the inlets to the scrubber serving the chrome plating tank (designated as chrome scrubber) were measured using a Pitot tube, Magnehelic gage, and a Minimite potentiometer with a type "K" thermocouple. This scrubber serves only tank 33 (FIGURE 1). The gas flow rates were determined from the gas velocity, temperature, pressure, density of the gas and the cross-sectional area of the discharge stack and the inlet duct.

PARTICULATE SAMPLING

The particulate samples were collected isokinetically at the outlet and inlet of the scrubber using the wet impingement method (FIGURE 2) with glass probes. Total and hexavalent chromium content of the particulates were analyzed by atomic absorption spectroscopy and diphenyl carbizide spectrophotometry, respectively. A liquid sample from the tank was also taken for analysis of chromium content.

The residue from the particulate samples were submitted to two laboratories for total chromium and hexavalent chromium analysis. For hexavalent chromium the results from the two laboratories are in close agreement so an average of their results were used in calculating the hexavalent chromium emissions. The results are at the lower detectable limit of the analytical methods and, therefore, the accuracy should be poor. The total chrome concentration was below the detectable limit for the analytical methods used by both laboratories. The analytical procedures used by one laboratory gave a lower detectable limit, which was used in calculating the uppper limit of total chromium emissions.

The results indicate that most or all of the chromium emissions are of the hexavalent form.

Liquid Samples

Samples of the tank bath were submitted to the lab for analysis. The composition of the bath is contained in the lab reports.

TEST CRITIQUE

The equipment was operating normally during the source test. No problems were encountered during the test. The isokinetic sampling rates at the inlet and outlet were 98% and 101% respectively. The internal and the large external doors of the room containing the tank solutions were open prior to testing, and Plato personnel closed these doors shortly after our arrival.

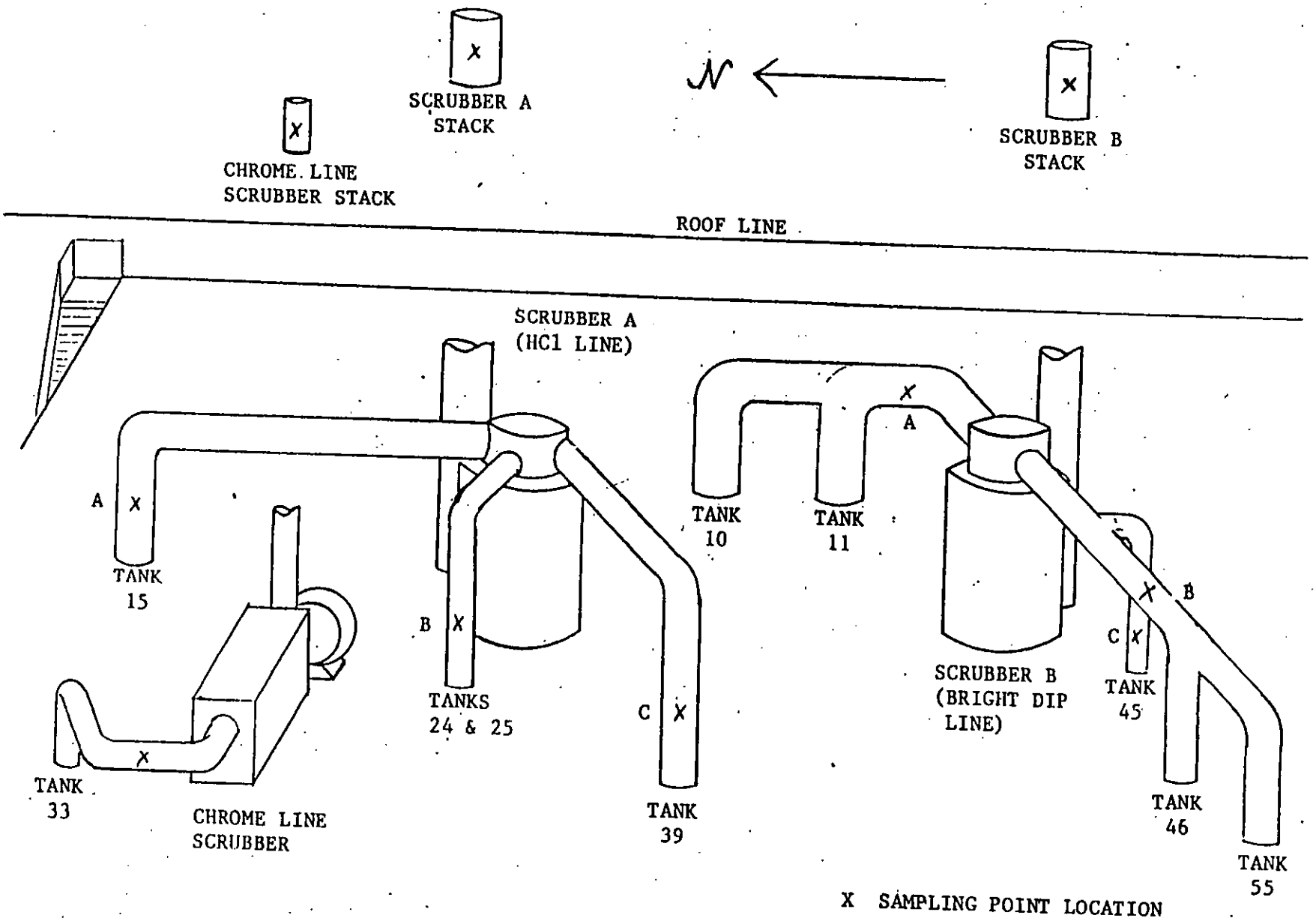


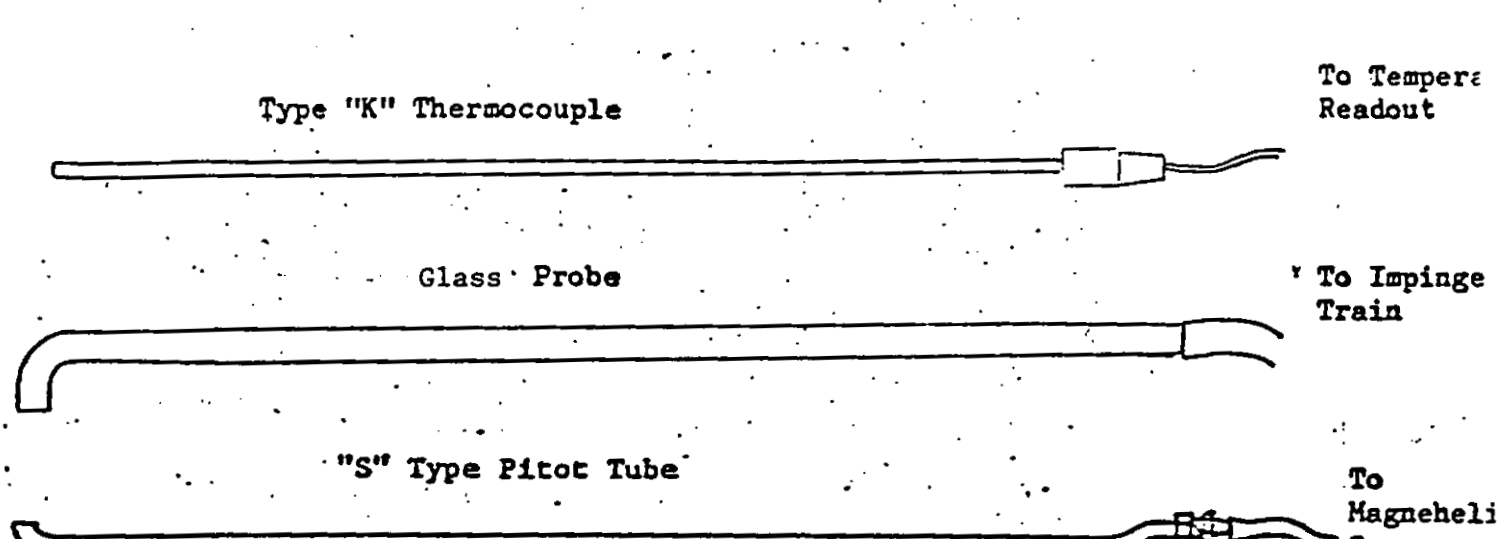
FIGURE 1

PLATO PRODUCTS, INC.
PLATING PROCESS EXHAUST CONTROL SCHEMATIC

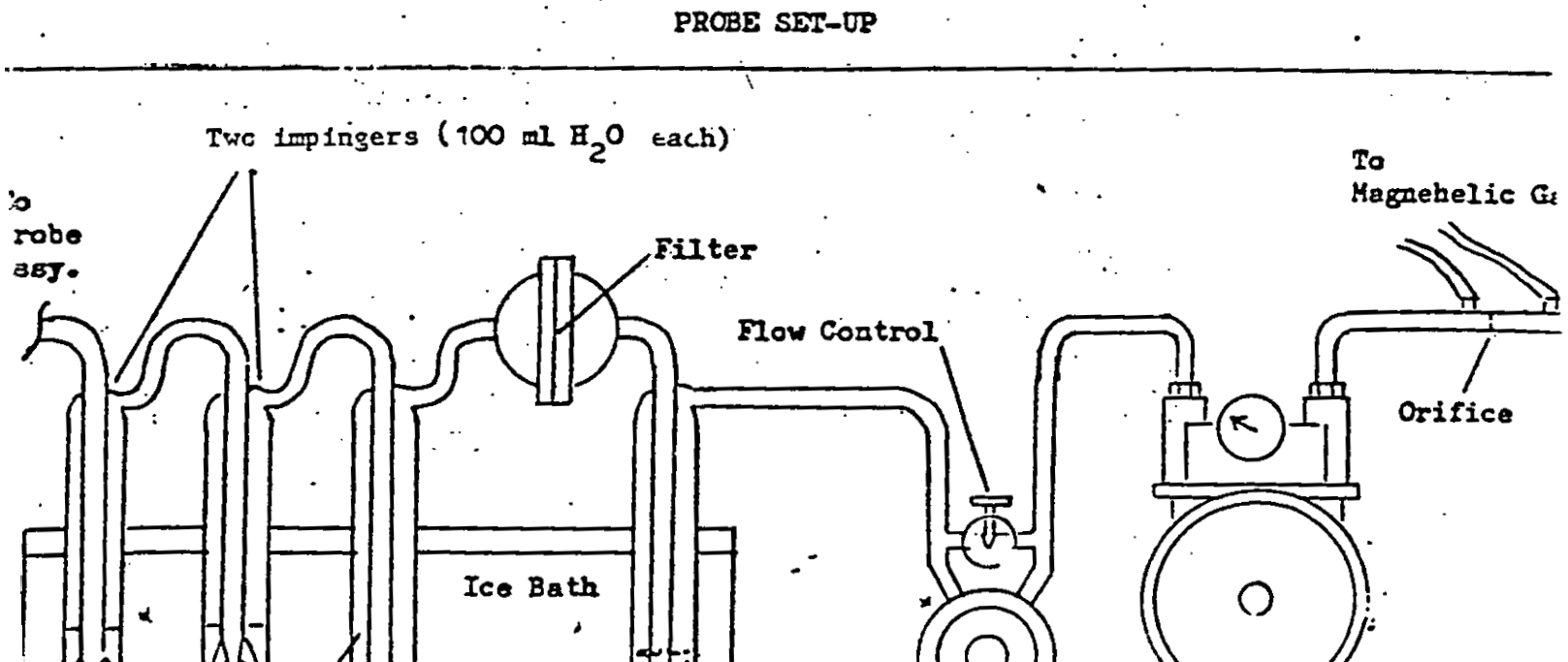
SOU... COAST AIR QUALITY MANAGEMENT ...STRICT
9150 Flair Drive, El Monte, California 91731

Test No. 85-481 Date 9-18-85

Figure No. 2



PROBE SET-UP



IMPINGER TRAIN SET-UP
(Wet Impingement Method)

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
ENFORCEMENT DIVISION
SOURCE TESTING AND MONITORING BRANCH
CALCULATION SHEET

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PROCESSED BY W. NAKAGAWA	CHECKED BY

PLATO PRODUCTS, INC.

% ISOKINETIC SAMPLING RATE = (METER VOL)(STACK AREA)(FLUE FACTOR)(100)
(NOZZLE AREA)(SAMPLING TIME)(FLOW RATE)

INLET :

$$\% = \frac{(46.25\ dscf)(1.40\ ft^2)(0.994)(100)}{(.000\ 341\ ft^2)(60\ min)(3214\ dscfm)}$$

$$= 97.9$$

OUTLET:

$$\% = \frac{(48.33\ dscf)(1.40\ ft^2)(1.00)(100)}{(.000\ 341\ ft^2)(60\ min)(3279\ dscfm)}$$

$$= 100.9$$

EFFICIENCY OF SCRUBBER

INLET TO SCRUBBER	.053	lbs/hr
OUTLET FROM SCRUBBER	.036	lbs/hr

$$\text{EFFICIENCY OF SCRUBBER} \quad \frac{.053 - .036}{.053} \times 100$$

$$= \frac{.017}{.053} \times 100$$

$$= 32\ \%$$

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
ENFORCEMENT DIVISION
SOURCE TESTING AND MONITORING BRANCH
CALCULATION SHEET

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PROCESSED BY W. NAKAGAWA	CHECKED BY

PLATO PRODUCTS, INC.

TOTAL CHROMIUM AND HEXAVALENT CHROMIUM CALCULATIONS.

	Total Cr Sample Weight (mg)			Cr^{+6} Sample Weight (mg)			Sample Vol. (scf)	Stack Flow (dscfm
	WL	BTC	Ave.	WL	BTC	Ave		
INLET	< 0.05	< 0.02	< 0.02	0.02	0.018	0.019	46.25	3214
OUTLET	< 0.05	< 0.02	< 0.02	0.01	0.012	0.011	48.33	3274

$$\text{Material Conc.} = \frac{(0.01543)(\text{mg of Material})}{\text{Sample Vol.}} \quad \left(\frac{gr}{dscf}\right)$$

$$\text{Material Flow Rate} = (0.00857)(\text{Material Conc})(\text{Stack Gas Flow Rate}) \quad \left(\frac{lb}{hr}\right)$$

	Inlet		Outlet	
	Total Cr	Cr^{+6}	Total Cr	Cr^{+6}
Material Conc., $\frac{gr}{dscf}$	$< 6.7 \times 10^{-6}$	6.3×10^{-6}	$< 6.4 \times 10^{-6}$	3.5×10^{-6}
Material Flow Rate, $\frac{lb}{hr}$	$< 1.8 \times 10^{-4}$	1.7×10^{-4}	$< 1.8 \times 10^{-4}$	0.99×10^{-4}

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER INLET

Gas Velocity Data

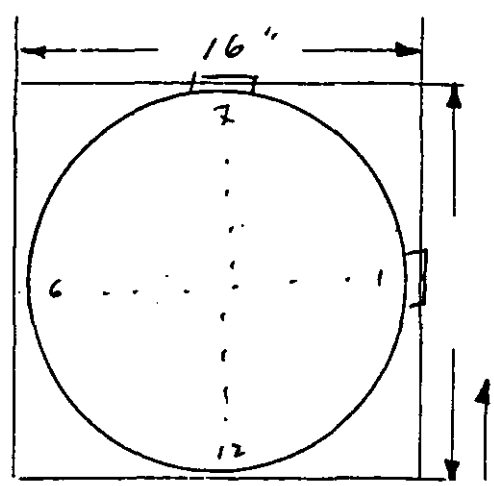
Time	Point	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.
11:43	1	.54	77	49.38	.52	77	48.46	.52	77	48.46
	2	.54	↓	49.38	.52	↓	48.46	.52	↓	48.46
	3	.40		42.50	.38		41.43	.40		42.50
	4	.52		48.46	.52		48.46	.52		48.46
	5	.62		52.92	.62		52.92	.60		52.05
	6	.62		52.92	.60		52.05	.60		52.05
	7	.62	77	52.92	.62	77	52.92	.62	77	52.92
	8	.64	↓	53.76	.61	↓	53.76	.63	↓	53.34
	9	.60		52.05	.59		51.62	.60		52.05
	10	.40		42.50	.38		41.43	.40		42.50
	11	.46		45.58	.44		44.58	.44		44.58
	12	.46	↓	45.58	.46	↓	45.58	.44	↓	44.58

(NEG) 1.5" H_2O = .11" Hg

Static Pressure in Stack (P_S), In. Hg Abs . . 29.02-.11 = 28.91 Conducted by JW, RS

Pitot # 209 Magnehelic # 130-4 Minimite # 8974 Thermocouple # 2-1

A. Average Velocity (Traverse) . . . . . 48.65 ft/sec
B. Average Velocity (Reference Pt.) . . . . 48.96 ft/sec
C. Flue Factor A/B 994
D. Velocity Pressure Correction Factor $\sqrt{\frac{29.92}{P_S}}$ 1.02
E. Pitot Correction Factor 835
F. Gas Density Correction Factor 1.00
G. Corrected Velocity, A x D x E x F . . . . — ft/sec
or B x C x D x E x F . . . . . 41.44 ft/sec
H. Area of Flue . . . . . 1.4 ft^2
I. Average Flue Temperature . . . . . 77 °F
J. Flow Rate, H x G x 60 . . . . . 3480.6 cfm
K. Flow Rate, $\frac{P_S}{29.92}$ x $\frac{520}{(I + 460)}$ x J . . . . 3256.6 scfm
L. Percent Water Vapor in Gas Sample . . . . 1.3 %
M. Dry Gas Flow Rate, K (1 - $\frac{L}{100}$) . . . . . 3214 dscfm



Stack Layout

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER INLET

PARTICULATES Train

Meter Data and Calculations

On Time	Off Time	Sample Point	Reading Cu. Ft. V_M	Filter Temp. °F T_F		Orifice P. In. H_2O	Samp. Rate (cfm)	Stack Vel fps	Stack Temp. °F	Stack Vel Head In.H_2O
12:23		1	045.950	BAD MOTOR		.87	.78	48.92	77	.53
	12:27:04		49.095	#351020						
		1	42.970			.87	.78	48.92	77	.53
		2	47.20			.87	.78	48.92	77	.53
		3	55.57			.66	.68	42.50	77	.40
		4	62.59			.86	.78	48.46	77	.52
		5	70.50			1.00	.84	52.49	77	.61
		6	79.05			1.00	.84	52.49	77	.61
	1:32		87.513							
							AVG:	48.96	77	

Total $V_m = 3.145 + 44.543 = 47.688$

Conducted by XV

Sampling Nozzle Dia..... (¼") 6.35 mm
Barometric Pressure..... 29.02 In Hg.(Abs.) STATIC (P_s) 28.91 IN H_g (ABS)
Weight Collected, mg.....
Meter # 351020 (CALIBRATION DATE: 2-27-85)
Thermocouple # 2-1 (CALIBRATION DATE: 7-18-85)
Magnehelic # 130-4 (PITOT) (CALB. DATE: 6-6-85) 129-3 (ORIFICE) (CALIB. DATE: 6-6-85)
Pitot # 209 (CALIBRATION DATE: 3-5-85)
Minimite # 8974

		Filter + Impinger	Total Chromium	Chromium +6	
A.	Total Weight.....	5	<.002	0.019	mg
B.	Stack Gas Flow Rate.....	3214			dscfm
C.	Gas Pressure at Meter.....	29.02			In. Hg. (Abs.)
D.	Gas Volume Metered, V_MxC/29.92.....	46.25			dscf
E.	Material Concn.,0.01543 x A/D.....	.002	*	*	grains/scf (dry)
F.	Material Concn. E x 54,143/Molec. Wt.....	~			ppm (dry)
G.	Material Flow Rate, .00857 x B x E.....	.046	*	*	lbs/hr
H.	Percent Isokinetic.....	98%			

* SEE CALCULATION SHEET

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-401 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER INLET

Water Vapor and Gas Density Calculations

Percent Water Vapor in Gases

A. Gas Pressure at Meter, $P_A - P_g$ . . . . . 29.02 In. Hg. (Abs.)

B. Vapor Pressure of Water at Impinger Temp . . . . . — In. Hg.

C. Volume of Metered Gas . . . . . 46.25 scf

D. Volume of Water Vapor Metered, B x C/A . . . . . — scf

E. Water Vapor Condensed, Liquid Volume . . . . . 13 ml

F. Volume of Water Vapor Condensed, 0.0464 x E . . . . 0.60 scf

G. Total Volume of Water Vapor in Gas Sample, D + F . . 0.60 scf

H. Total Volume of Gas Sample, C + F . . . . . 46.85 scf

I. Water Vapor in Sampled Gas, 100 x G/H . . . . . 1.3 %

Gas Density Correction Factor

Component	Volume Percent/100	(1 - I/100) Moist. Corr.	Mol. Wt.	(Wet Basis) Wt./Mole
Water		1.00	18.0	
Carbon Dioxide	Dry Basis		44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	Dry Basis		32.0	
Nitrogen & Inerts	Dry Basis		28.2	

J. Average Molecular Weight . . . . .

K. Gas Density Factor = $\sqrt{28.95/J}$ 1.00

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-481 Date 9-18-85

Sampling Location Chrome Line Scrubber Outlet (Stack)

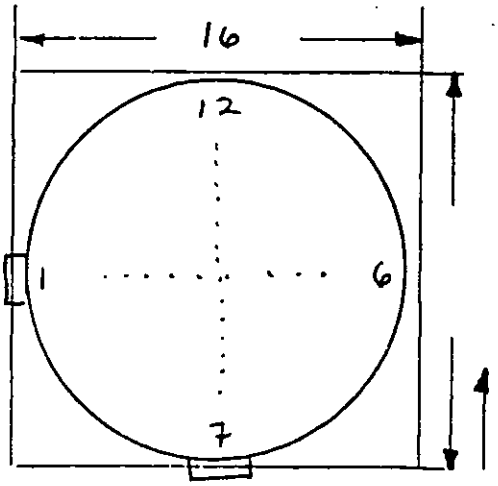
Gas Velocity Data

Time	Point	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.	Vel.Head In. H_2O	Temp. °F	Velocity Ft./Sec.
12:08	1	.57	72	50.50	.60	72	51.81	.62	72	52.67
	2	.58		50.94	.57		50.94	.57		50.50
	3	.63		53.09	.62		52.67	.62		52.67
	4	.55		49.61	.55		49.61	.56		50.06
	5	.54		49.15	.55		49.61	.55		49.61
	6	.53	↓	48.70	.53	↓	48.70	.52	↓	48.23
	7	.43	72	43.86	.45	72	44.87	.45	72	44.87
	8	.50		47.30	.48		46.34	.50		47.30
	9	.53		48.70	.52		48.23	.53		48.70
	10	.51		47.77	.50		47.30	.52		48.23
	11	.56		50.06	.56		50.06	.56		50.06
[illegible]	12	.63	↓	53.09	.62	↓	52.67	.62	↓	52.67

Static Pressure in Stack (P_S), In. Hg Abs . . 29.02 Conducted by RM/BVA

Pitot # 202 Magnehelic # 109-4 Minimite # 2-1 Thermocouple # 4-1

A. Average Velocity (Traverse) . . . . . 49.48 ft/sec
B. Average Velocity (Reference Pt.) . . . . . — ft/sec
C. Flue Factor A/B . . . . . —
D. Velocity Pressure Correction Factor $\sqrt{\frac{29.92}{P_S}}$ 1.02
E. Pitot Correction Factor 835
F. Gas Density Correction Factor 1.00
G. Corrected Velocity, A x D x E x F . . . . 42.14 ft/sec
or B x C x D x E x F . . . . . ft/sec
H. Area of Flue . . . . . 1.40 ft^2
I. Average Flue Temperature . . . . . 72 °F
J. Flow Rate, H x G x 60 . . . . . 3539.9 cfm
K. Flow Rate, $\frac{P_S}{29.92}$ x $\frac{520}{(I + 460)}$ x J . . . . 3356 scfm
L. Percent Water Vapor in Gas Sample . . . . 2.3 %
M. Dry Gas Flow Rate, K $(1 - \frac{L}{100})$ . . . . . 3279 dscfm



Stack Layout

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER OUTLET (STACK)

PARTICULATES Train

Meter Data and Calculations

On Time	Off Time	Sample Point	Reading Cu. Ft. V_M	Filter Temp. °F T_F		Orifice P. In. H_2O	Samp. Rate (cfm)	Stack Vel fps	Stack Temp. °F	Stack Vel Head In.H_2O
12:23			161.905							
	+5	12	166.15			.95	.86	52.7	72	.62
	+10	11	170.36			.86	.81	50.1	72	.56
	+15	10	174.44			.78	.78	47.8	72	.51
	+20	9	178.51			.81	.79	48.7	72	.53
	+25	8	182.51			.76	.77	47.3	72	.50
	12:53 +30	7	186.325			.69	.73	44.9	72	.45
12:56	+35	6	190.35			.81	.79	48.7	72	.53
	+40	5	194.49			.84	.81	49.6	72	.55
	+45	4	198.67			.84	.81	49.6	72	.55
	+50	3	203.10			.95	.86	52.7	72	.62
	+55	2	207.38			.87	.82	50.5	72	.57
	+60	1	211.735			.92	.84	51.8	72	.60
	13:26									

Total V_m 49.83

Conducted by RM/BVA

Sampling Nozzle Dia..... (1/4") 6.35 mm
Barometric Pressure..... 29.02 In Hg.(Abs.)
Weight Collected, mg.....
Meter # 351021 (CALIBRATED: 2-27-85)
Thermocouple # 4-1 (CALIBRATED: 7-23-85)
Magnehelic # 109-4 (CALIBRATED: 6-25-85)
Pitot # 202 (CALIBRATED: 3-5-85)
Minimite # 2-1 (CALIBRATED: 7-18-85)

			TOTAL CHROMIUM	CHROMIUM +6	
A.	Total Weight.....	4 (FILTER + IMPINGER)	<0.02	0.011	mg
B.	Stack Gas Flow Rate.....	3279			dscfm
C.	Gas Pressure at Meter.....	29.02			In. Hg. (Abs.)
D.	Gas Volume Metered, V_MxC/29.92.....	48.33			dscf
E.	Material Concn.,0.01543 x A/D.....	.001	*	*	grains/scf (dry)
F.	Material Concn. E x 54,143/Molec. Wt.....	—			ppm (dry)
G.	Material Flow Rate, .00857 x B x E.....	.036	*	*	lbs/hr
H.	Percent Isokinetic.....	101 %			

* SEE CALCULATION SHEET

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte, California 91737

Test No. 85-481 Date 9-18-85

Sampling Location CHROME LINE SCRUBBER OUTLET

Water Vapor and Gas Density Calculations

Percent Water Vapor in Gases

A.	Gas Pressure at Meter, $P_A - P_M$	29.02 In. Hg. (Abs.
B.	Vapor Pressure of Water at Impinger Temp	— In. Hg.
C.	Volume of Metered Gas	48.33 scf
D.	Volume of Water Vapor Metered, B x C/A	— scf
E.	Water Vapor Condensed, Liquid Volume	25 ml
F.	Volume of Water Vapor Condensed, 0.0464 x E	1.16 scf
G.	Total Volume of Water Vapor in Gas Sample, D + F	1.16 scf
H.	Total Volume of Gas Sample, C + F	49.49 scf
I.	Water Vapor in Sampled Gas, 100 x G/H	2.3 %

Gas Density Correction Factor

Component	Volume Percent/100	(1 - I/100) Moist. Corr.	Mol. Wt.	(Wet Basis) Wt./Mole
Water		1.00	18.0	
Carbon Dioxide	Dry Basis		44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	Dry Basis		32.0	
Nitrogen & Inerts	Dry Basis		28.2	

J. Average Molecular Weight . . . . .

K. Gas Density Factor = $\sqrt{28.95/J}$ 1.00