California Environmental Protection Agency

Air Resources Board

Decorative Chromium Plating Emissions Testing Program

SOURCE TEST REPORTS

T-03-010, Sigma Plating Company, Inc
T-03-011, Excello Plating Company, Inc, and
T-03-019, Van Nuys Plating, Inc.

Prepared by:
Monitoring and Laboratory Division
Stationary Source Testing Branch

August 2003

Foreword

This report is a compilation of the results from four source tests conducted during 2003 at three decorative hexavalent chromium platers in Southern California. Testing was conducted by the Air Resources Board's (ARB) Monitoring and Laboratory Division, with the cooperation and assistance of the South Coast Air Quality Management District (SCAQMD). The testing is part of our evaluation of the Airborne Toxic Control Measure (ATCM) for Chrome Plating and Chromic Acid Anodizing. The goal of the emissions testing program is to characterize hexavalent chromium emissions from fume suppressant controlled plating tanks at decorative chromium plating businesses. The three facilities tested are Sigma Plating Company, Incorporated; Excello Plating Company, Incorporated; and Van Nuys Plating, Incorporated. At Sigma Plating, a second test was also conducted to evaluate the efficiency of a composite mesh pad system.

In response to comments on the draft reports received from the SCAQMD and a consultant for the facilities tested, an addendum is provided for clarification and provides supplemental information regarding these source tests.

As you review the reports, please keep in mind that the emission rate results from these tests SHOULD NOT be used to calculate hexavalent chromium emissions from each facility. This is because the facilities tested have additional add-on controls to further reduce emissions and their production was sometimes supplemented to ensure an adequate sample for analysis was collected. Therefore, if the results are used to calculate actual hexavalent chromium emissions, they will not be representative.

Addendum to Test Reports T-03-010 (Sigma Plating Company, Inc.); T-03-011 (Excello Plating Company, Inc.); and T-03-019 (Van Nuys Plating, Inc.)

- Emissions presented in the reports are after in tank controls. The controls for each facility include:

Facility	Fume suppressant	Polyballs
Sigma Plating	Benchbrite - CR 1700	No polyballs
Excello Plating	Atotech - Fumetrol 140	100% polyball coverage
Van Nuys Plating	Atotech – Dis Mist NP	No polyballs

- The surface tension measurements for each facility performed by the following administrator and instrument:

Facility	Administrator	Instrument
Sigma	Operator	Stalagmometer
Sigma	SCAQMD	Stalagmometer
Sigma	SCAQMD	Tensiometer
Excello	Anachem	Tensiometer
Excello	SCAQMD	Stalagmometer
Excello	SCAQMD	Tensiometer
Van Nuys	Operator	Stalagmometer
Van Nuys	SCAQMD	Stalagmometer
Van Nuys	SCAQMD	Tensiometer

- Indoor samples were collected at each facility but should not be considered as representative of indoor concentrations. Samplers were placed close to the tank at each facility without hindering the operation. They can not be compared with ambient air sampler results from the ambient air network. At two of the facilities there were other chromium plating tanks that may have contributed to indoor air chromium concentrations. Sigma Plating has another decorative chromium plating line which was being used during the source test. Excello Plating has hard chromium and acid anodizing tanks, however, they were not being used at the time of testing.

- The ampere meters for each facility were calibrated within six months of the source test. We timed the ampere meter against the ampere-hour totalizer to confirm the accuracy of the totalizer.

- The capture efficiency of the hood for Van Nuys Plating is estimated to be 60-70% as determined by the smoke test.

- Sampling was conducted during normal plating operation when possible. However, production was supplemented at two facilities with "dummy" parts to acquire adequate sample. In these instances, ARB staff simulated plating. The table below shows when "dummy" parts were used and the approximate plating cycles employed to simulate the decorative chromium plating process.

Facility	Use of dummy parts	Plating of dummy parts
Sigma Plating	No	Not applicable
Excello Plating	Yes, most of the time	5 min on / 2-3 min off
Van Nuys Plating	Yes, half the time	5 min on / 2-3 min off

California Environmental Protection Agency

Air Resources Board

SOURCE TEST REPORT

Total and Hexavalent Chromium Emissions
Sigma Plating Company, Inc.
Hoist Line Decorative Chromium Plating Tank

MONITORING AND LABORATORY DIVISION
STATIONARY SOURCE TESTING BRANCH

FILE NO: T-03-010

DATE: August 28, 2003

APPROVED:

David F Todd

David Todd, Project Engineer
Engineering Development and Testing Section

Pat Bennett

Pat Bennett, Manager
Engineering Development and Testing Section

Manjit Ahuja

Manjit Ahuja, Chief
Stationary Source Testing Branch

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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California Environmental Protection Agency
AIR RESOURCES BOARD
Monitoring and Laboratory Division

Total and Hexavalent Chromium Emissions from Sigma Plating Co., Inc. Hoist Line Decorative Chromium Plating Tank

I. INTRODUCTION

At the request of the Air Resources Board (ARB) Stationary Source Division (SSD), staff of the Monitoring and Laboratory Division (MLD) performed emissions testing of a decorative chrome electroplating tank operated by Sigma Plating Company, Inc. located at 1040 Otterbein Street in La Puente California. Emissions testing for total and hexavalent chromium were conducted at the facility during the month of January 2003.

II. PROCESS DESCRIPTION

The Sigma Plating Company performs decorative chromium plating to original manufacturer's specifications (OMS) on a variety of motor vehicle accessories such as bumpers and side step rails. Sigma operates two electrolytic hexavalent chromium decorative plating lines. The older of these two lines, identified as their 'hoist line,' was sampled for this report.

The hoist line plating tank has a capacity of 1600 gallons and is 12 feet 8 inches long by 3 feet 3 inches wide and 5 feet 4 inches deep. The plating tank is equipped with its own rectifier. Amperage and voltage into the tank varies with the type and area of the parts to be plated. Plating bath temperature is controlled. SSD staff periodically recorded voltage, amperage, bath temperature, amp-hour readings and other information during the test.

The hoist line chromium plating tank is equipped with an independent venting and emission control system. This consists of a collection system, two-stage mist eliminator, pre-filter, HEPA filter, and ventilation fan. The collection system is comprised of two tank side vents designed to capture any chromic acid mist that escapes from the tank. At each end of each side vent are 10-inch diameter vertical ducts. At each end of the tank, these vertical ducts merge together then carry the fumes horizontally out the sidewall of the building. Outside of the building, the ducts turn down and merge to a single 14-inch diameter duct. This duct turns horizontally and enters a vertical two-stage mesh pad mist eliminator. Emissions collected by the mesh pad mist eliminator are 'washed off' the pads and returned to the plating tank as a liquid. The remaining emissions are then ducted out of mist eliminator and

directed to a pre-filter and a High Efficiency Particulate Arresting (HEPA) filter. These filters further reduce the level of chromium emitted from plating tank. No samples were collected after the pre-filter or the HEPA filter.

The collection system has an induction fan that pulls the emissions through the side vents, ducts, mist eliminators, filters, and pushes the remaining material out a vertical stack rising above the building and into the atmosphere. The entire system is rated at 4000 cubic feet per minute (CFM).

In addition to the control systems described above, a chemical foaming fume suppressant is used on the surface of the bath to reduce chromic acid mist that is generated during plating operations. The specific gravity of the plating bath is checked periodically by Sigma staff to ensure that a consistent fume suppressant and chromic acid concentration is maintained at all times.

According to the Permit to Operate, electrical usage for the hoist line decorative chromium plating tank may not exceed 70 million ampere-hours per year and the chromic acid concentration of that tank shall not exceed 32 ounces/gallon. The permit also requires daily recording of the amp-hour totalizer meter and a recording of chromic acid concentration of the tank during replenishment.

III. SIGMA PLATING COMPANY HOIST LINE CHROMIUM SOURCE TEST

A. Exhaust Chromium Samples

Two individual chromium source tests of three runs each were performed at the Sigma Plating Hoist Line decorative chrome plating tank during the month of January 2003. ARB Method 425 was used to determine hexavalent and total chromium emissions collected during the source tests. During the first test, sampling was performed in the exhaust duct in front of any control system to quantify the emissions from the plating tank itself. The second test was performed to determine the control efficiency of the two-stage mesh pad mist eliminator. During this test, concurrent sampling was performed before and after the mesh pad mist eliminator of the hoist line tank.

During the first week of sampling, the hoist line was operated at normal capacity (plating of automotive parts). During the second week, the hoist line operations experienced problems which suspended plating operations. During Run 04, plating operations were suspended for approximately 4 hours. During Run 05, plating operations were suspended for approximately 25 minutes.

As shown in Table III-1, the source tests were performed over a two-week period. During the second week, staff deployed two independent sampling trains during each day of testing to collect emissions up and downstream of the mist eliminator. Each week of testing consisted of collecting three runs per test. During the first

TABLE III-1

Sampling Schedule

Sample Period	Plating Tank	Mist Eliminator
Week 1 (January 8-10, 17*)	"SI" Trains – Exhaust Only (same as Mist Eliminator inlet)	
Week 2 (January 14-16)		"SI" Trains – Inlet "SO" Trains – Outlet

* Run 1 during Week 1 was voided. Run 1 was repeated with Run 7 on January 17th of Week 2.

week, staff used one train per run to quantify tank emissions for a total of three trains. During the second week, staff used two trains per run (inlet and outlet of the mist eliminator) for a total of six trains. Each sample train was recovered in 3 containers:

- Container 1 - rinses from the nozzle, sample probe, and transfer line;
- Container 2 – first impinger catch;
- Container 3 – second and third impinger catch.

Two sampling ports, each three inches in diameter and 90 degrees apart, were installed at each of the two sampling locations. The first, located before the mist eliminator, was used to collect samples to determine emissions from the plating tank (week 1) and to collect samples to determine emissions into the control device (week 2). The ports were located on the 14-inch diameter (13.5 inches ID) horizontal duct leading into the mist eliminator. These sampling ports were oriented vertically and horizontally. The sampling ports were 48 inches (3.56 diameters) downstream of the latest flow interference (vertical bend) and 36 inches (2.67 diameters) upstream of the next flow interference (mist eliminator inlet).

The second sampling location was used to collect samples to determine emissions from the mist eliminator (week 2 only). Samples at this location were collected concurrently with samples at the mist eliminator inlet. The second set of ports were located on a 14-inch diameter (13.5 inches ID) vertical duct between the mist eliminator and the housing for the pre- and HEPA filters. These sampling ports were oriented horizontally. The sampling ports were 60 inches (4.4 diameters) downstream of the latest flow interference (vertical bend out of the mist eliminator) and 28 inches (2.1 diameters) upstream the next flow interference (vertical bend into the filter housing).

B. Indoor Ambient Samples

Indoor ambient samples were collected with a BGI PQ 100 ambient sampler. Samples were collected on 37 mm Teflon coated filter. The filters were analyzed

for multiple metals, including total chromium, by Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) in accordance with SOP MLD061. Hexavalent chromium analysis is not possible by this method because acid is used as part of the sample preparation for analysis.

The indoor sampler was placed on a shelf about 6 feet across the walkway from the chromium plating tank. The sampler inlet was about 6 feet above the walkway. The sampler was placed at least 1 meter from any obstruction, except the adjacent wall, per specifications for locating ambient monitors. The wall was covered with sheet plastic by more than 1 meter in each direction from the sampler inlet to offset locating the monitor within 1 meter of the wall.

Indoor ambient samples were collected concurrently during the source tests at the rate of one ambient filter sample per day (Note: indoor ambient samples were not collected on Friday, January 17th).

IV. TEST METHODS

A. Source Sampling Procedure

Stack and duct flows were determined by ARB Stationary Source Test Method 1 (velocity traverse), Method 2 (stack velocity and flow rate), Method 3 (stack gas dry molecular weight), and Method 4 (moisture content). For Method 3, atmospheric concentrations of carbon dioxide, nitrogen, and oxygen were used to determine dry molecular weight.

In accordance with Method 1, sampling from each sampling location was conducted at 24 traverse points using 12 sampling points on each diagonal (usually at 15 minutes per point). Due to liquid possibly collecting in the horizontal ducts (upstream of the mist eliminator) sample Runs 2, 3, and 7 were on the horizontal traverse only (still 24 sampling points). Some of this liquid collected in the Pitot tube sometime during or after collecting the sample for the vertical portion of Run 1. Part of that liquid drained into the sample recovery container, invalidating the Run 1. This liquid was not in the duct when the sample ports were cut or Run 1 began. Using the horizontal traverse only also minimized the interference of the liquid in the duct on emission factors for the plating tank. However a vertical traverse from the top of the duct was used the second week when collecting samples to determine control efficiency of the mist eliminator – controlling emissions from liquid collected in the duct is part of the task for the mist eliminator. The sample collection times for most sample runs were approximately 6 hours. Runs 3 and 7 were shortened to allow the test crews to return to Sacramento the same day. As mentioned above, Runs 3 and 7 were inlet samples only and discoloration from previous runs indicated these shortened times would still be sufficient to collect a measurable sample.

Hexavalent and total chromium samples were collected isokineticaly in accordance with ARB Method 425 (adopted January 22, 1987, amended August 27, 2002), "Determination of Total Chromium and Hexavalent Chromium Emissions from Stationary Sources." The sampling train configuration consisted of a glass nozzle, a Teflon union, a 48 inch glass-lined stainless steel probe (with attached Pitot tube and thermocouple), a ten-foot Teflon™ line from the probe to the first impinger, a modified and a Greenburg-Smith impinger each containing 100 milliliters of 0.1 normal (N) sodium bicarbonate solution, an empty impinger, a silica gel holder, a 50-foot umbilical line, a vacuum pump, a dry gas meter, and a calibrated orifice connected to an inclined oil manometer. The amended method does not include a filter.

Type S pitot tubes bundled with the sampling probes were used to determine stack velocity in accordance with Method 2. The weight of the impinger solution and silica gel were recorded before and after each test in order to obtain the moisture content of the stack gas as required by Method 4. In addition, stack temperature, ambient temperature, and barometric pressure were measured and recorded during each test. Leak checks were performed on each sample train and Pitot tube setup before and after each sample collection.

Approved modifications to Method 425 (amended 8/27/02) implemented during this source test included the use of unheated sample lines and probes, the use of 0.1 N sodium bicarbonate impinger solution in place of 0.1 N sodium hydroxide, and the deletion of the post impinger sampling train filter.

The amperage and voltage supplied by the rectifier was monitored and recorded by SSD staff during the source tests. SSD staff also recorded tank temperature and totalizer amp-hours. In addition, SSD staff collected samples of the plating bath solution during the source tests. The samples were then analyzed by outside, independent laboratories to determine plating bath surface tension and chromic acid content.

After sampling, rinses of the sampling train nozzle, probe and transfer line, as well as the catch from the impingers, were recovered into three, 500-ml glass sample jars. All sample jars were pre-cleaned and tested to ensure the absence of chromium prior to the source test.

The pH of the sodium bicarbonate solution used for the probe rinse and impingers was maintained at ≥ 8.0. The sodium bicarbonate solution pH was checked prior to charging the sampling impingers and after sample recovery and measurement for moisture determinations. Additionally, the impinger solution was chilled with ice to 4 °C (39 °F) or less during sample collection. All samples were chilled with ice to 4 °C (39 °F) or less during transport, and storage prior to analysis to reduce the conversion of hexavalent chromium to trivalent chromium. During sample retrieval, disposable vinyl gloves were worn to help prevent contamination. At the

conclusion of each sampling week, staff transported the collected samples to the laboratory for analyses.

B. Indoor Ambient Sampling

Indoor ambient samples were collected on 37 mm filters in 45 mm sampling cassettes using a PQ100 ambient sampler. Where possible, indoor ambient samples were collected in parallel with plating tank and mist eliminator samples at the rate of 1 indoor filter sample per day. However, when chromium sampling was suspended due to plating line problems, indoor sampling continued. After sampling, the filters, in their sampling cassette, were placed back in their original container and returned to the laboratory for analysis with the other weekly plating tank samples.

C. Analytical Procedures

Laboratory analyses for hexavalent and total chromium for the plating tank and mist eliminator samples was performed by ARB's Northern Laboratory Branch. Hexavalent chromium (also known as hex chrome, Cr(VI), or Cr^{+6}) was measured using ion chromatography (IC), Method MLD039. The limit of detection (LOD) of the analytical procedure for hexavalent chromium is 0.2 nanograms per milliliter (ng/ml). Total chromium was determined using an atomic absorption/ graphite furnace (GFAA) technique. To deal with the high carbonate fixative concentrations, laboratory staff used a variation of Method MLD005. The LOD of the analytical procedure for total chromium is 1.0 ng/ml.

Laboratory analysis of the indoor ambient filters for metals (including total chromium) was by inductively coupled plasma-mass spectrometry (ICP-MS), Method MLD061. The LOD of this analytical procedure for total chromium is 1.0 ng/ml.

V. QUALITY ASSURANCE / QUALITY CONTROL

To ensure that data collected are consistent, relevant, and defensible, appropriate field and laboratory Quality Assurance (QA) procedures were followed throughout the source test. A detailed explanation of the ARB's standard field and laboratory QA procedures are contained in ARB Quality Assurance manuals, Stationary Source Test Methods, and laboratory SOPs.

As required by ARB Method 425 (amended 8/27/02), all surfaces that came into contact with a sample were either glass or Teflon™ and were pre-cleaned using the following procedure:

- the glassware was first washed with detergent;
- soaked with a 10% solution of nitric acid for several hours;

- flushed with liberal amounts of tap water;
- rinsed with de-ionized water; and
- final rinsed with 0.1 N sodium bicarbonate solution.

To ensure that the sampling equipment was clean and free of chromium contamination, a sample of the final rinse was analyzed for total chromium (Cr). If any Cr was detected in the final rinse, all sampling equipment were re-cleaned until a sample of the final rinse contained no detectable Cr. In addition, extra pre-cleaned equipment were deployed to ensure that no equipment needed to be re-cleaned or re-used during field sampling.

Both sampling consoles used during the source test were calibrated prior to testing and the Type S pitot tubes used for stack velocity determinations met the required specifications for a baseline coefficient of 0.84 as specified in ARB Method 2. Each console assembly, including pitot tubes and sample collection trains, passed leak checks before and after each velocity determination.

Prior to deploying to the field, a blank of the sodium bicarbonate solution used for rinses and impinger solutions was collected and given to the laboratory staff for analysis and correction of field sample results. During each week of sample recovery, staff collected a field blank of the same sodium bicarbonate solution for analysis with the samples. These blanks are not used to correct laboratory results, but indicate any contamination. The laboratory created a hexavalent chromium spike in sodium bicarbonate solution that was taken into the field the first sampling week and returned for analysis with the first week's samples. The laboratory also created a spike for each sampling week that was added to the second impinger solution of a sampling train. All spikes were 1000 nanograms from standards developed in accordance with Method MLD039 for as standards for the IC.

All test samples were collected using an iced impinger set. After recovery, samples were stored on ice to maintain their temperature at or below 4 °C (39 °F) as required by Method 425. Collected and recovered samples remained on ice while on site and during transport to the laboratory for analyses. Staff of the Northern Laboratory Branch ensured that the samples were maintained at or below 4 °C (39 °F) while awaiting analysis.

During sample collection and transport, the pH of the sodium bicarbonate solution used for the probe rinse and impinger charging was maintained at ≥ 8.0 as required by Method 425. This is necessary to ensure that any collected hexavalent chromium is not reduced to trivalent chromium. The pH of the impinger solutions was checked before sampling, after sample recovery, and during transfer to the laboratory.

Chain of custody was maintained for all collected samples. A chain of custody sheet was prepared for each sample train and samples are included in Appendix D.

VI. TEST RESULTS

Results of the source tests for the Sigma Plating Company Hoist Line decorative chromium plating tank are presented in Table VI-1 and VI-2. Sampling data and calculated results are in Appendices A (week 1) and B (week 2). Laboratory results are in Appendix C.

As previously mentioned, Samples 1, 2, and 3 were collected during the first week of testing. Sample 1 was voided because of liquid chromic acid that collected in the pitot tube during or after sampling, and then drained into the sample recovery container. Sample 7, replacing Sample 1, was collected at the end of the second week.

In the second week of testing, three samples each were collected simultaneously before and after the mist eliminator. During the second week, the sampling crew noted the sample trains upstream of the mist eliminator were collecting less "color." Upon further investigation, it was noted the liquid level in the plating tank was lower than the first week.

The results shown in each Table include only those values that are above the limit of detection (LOD). Any sample below the detection limit is less than 5% of the reported detected amount of that sample, and therefore, insignificant for the purposes of this report when compared to the detected amount.

All stack samples were collected before the final control device so any comparison of hexavalent or total chromium to permit requirements is not possible with this source test report.

Table VI-3 presents the results of the indoor ambient metals sampler. These results have not and should not be used to change or "correct" any of the plating tank results. It is not known why the results for the January 8 sample are higher than the other samples. That day was much windier than the other days. As a result, the doors, including a roll-up near the hoist line, were closed that day. Normally, the doors were open.

Tables VI-4 and VI-5 presents a summary of the plating tank observations by SSD staff. A further summary of these observations is included in Appendix E. Table VI-6 presents a summary of surface tension data. The surface tension data from the independent lab is included in Appendix F.

Table VI-1
Sigma Plating Company, Inc. Hoist Line Decorative Chromium Plating Tank
SAMPLING WEEK 1 TEST RESULTS

Sampling Location	Plating Tank Exhaust					
Sample Number	SI-02	SI-03	SI-07			
Sampling Date	1/9/2003	1/10/2003	1/17/2003			
Plating Tank Data						
Totalizer (amp-hours)	12,468	9,080	4,634			
Production Rate (amp-hrs/hr)	2,078	1,892	1,655			
Stack Data						
Temperature (^{0}F)	69	63	67			
Velocity (ft/sec)	57	53	58			
Static Pressure ("H_20)	-4.4	-4.4	-4.4			
Stack Area (sq. ft.)	0.994	0.994	0.994			
Flow Rate (DSCFM)	3300	3100	3400			
Moisture (% of v/v)	0.7	0.9	0.1			
Sampling Data						
Sampling Time (minutes)	360	288	168			
Sample Volume (DSCF)	428.10	326.64	191.63			
Chromium Data (ng/sample)						
Total Chromium	3.5E+6	2.8E+6	1.9E+5			
Hexavalent Chromium	1.4E+6	6.8E+5	7.8E+4			
Isokinetic Rate (%)	104	106	98			
EMISSIONS						
Concentration (ng/dscf)						
Total Chromium	8.2E+3	8.6E+3	1.0E+3			
Hexavalent Chromium	3.3E+3	2.1E+3	4.1E+3			
Emission Rate (mg/hr)						
Total Chromium	1600	1600	210			
Hexavalent Chromium	660	390	83			
Emissions Factors (mg/amp-hr)[1]						
Total Chromium	**0.77**	**0.85**	**0.13**			
Hexavalent Chromium	**0.32**	**0.21**	**0.05**			

DSCF means dry standard cubic feet. Standard conditions are 68 F and 29.92 inches Hg.
DSCFM means dry standard cubic feet per minute.

[1] Emissions Factors (mg/amp-hr) = Emission Rate (mg/hr) / Plating Tank Production Rate (amp-hrs/hr)

Table VI-2
Sigma Plating Company, Inc. Hoist Line Decorative Chromium Plating Tank Mist Eliminator
SAMPLING WEEK 2 TEST RESULTS

Sampling Location	Upstream of Mist Eliminator	Downstream of Mist Eliminator	Upstream of Mist Eliminator	Downstream of Mist Eliminator	Upstream of Mist Eliminator	Downstream of Mist Eliminator
Test Number	SI-04[1]	SO-04[1]	SI-05	SO-05	SI-06	SO-06
Sampling Date	1/14/2003		1/15/2003		1/16/2003	
Plating Tank Data						
Totalizer (amp-hrs)	6,059[1]		8,874		9,002	
Production Rate (amp-hrs/hr)	1,010		1,479		1,500	
Stack Data						
Temperature (^{0}F)	69	67	72	72	76	72
Velocity (ft/sec)	59	66	59	65	59	61
Static Pressure ("$H_2$0)	-4.4	-7.4	-4.4	-7.4	-4.4	-7.4
Stack Area (sq. ft.)	0.994	0.994	0.994	0.994	0.994	0.994
Flow Rate (DSCFM)	3400	3800	3400	3700	3400	3500
Moisture (% of v/v)	1.0	1.0	0.6	0.8	0.2	0.5
Sampling Data						
Sampling Time (minutes)	360	360	360	360	360	360
Sample Volume (DSCF)	238.39	280.24	253.58	273.84	249.54	257.45
Chromuim Data (ng/sample)						
Total Chromium	2.1E+6	2.4E+3	4.2E+4	7.0E+3	5.9E+3	5.5E+3
Hexavalent Chromium	9.5E+5	2.5+E3	2.9E+4	5.6E+3	3.2E+3	4.2E+3
Isokinetic Rate (%)	100.1	106.4	106.1	105.3	105.3	105.0
EMISSIONS						
Concentration (ng/dscf)						
Total Chromium	8600	8.7	170	26	24	21
Hexavalent Chromium	4000	9.1	120	20	13	16
Emission Rate (mg/hr)						
Total Chromium	1800	2.0	34	5.7	4.8	4.5
Hexavalent Chromium	820	2.1	24	4.6	2.6	3.5
Mist Eliminator Control Efficiency (%)[2]						
Total Chromium	**99.9**		**83.2**		**6.3**	
Hexavalent Chromium	**99.7**		**80.8**		**—[3]**	
Emission Factor (mg/amp-hr)[4]						
Total Chromium	**1.78**	**2.0E-3**	**2.3E-2**	**3.9E-3**	**3.2E-3**	**3.0E-3**
Hexavalent Chromium	**0.81**	**2.1E-3**	**1.6E-2**	**3.1E-3**	**1.7E-3**	**2.3E-3**

DSCF means dry standard cubic feet. Standard conditions are 68 F and 29.92 inches Hg.
DSCFM means dry standard cubic feet per minute.

[1] Hoist line operations were suspended for ~4 hours during Run 04. Emissions sampling runs were suspended for 2 of the 4 hours.
[2] Efficiency = [(Inlet, SI – Outlet, SO) / Inlet, SI] * 100
[3] Efficiency can not be defined.
[4] Emissions Factors (mg/amp-hr) = Emission Rate (mg/hr) / Plating Tank Production Rate (amp-hrs/hr)

Table VI-3
Sigma Plating Company, Inc. Hoist Line Indoor Ambient Metals

Sampling Dates	1/8/2003[1]	1/9/2003	1/10/2003	1/14/2003	1/15/2003	1/16/2003
Metals (ng/m^3)						
Total Chromium	**1,836**	**131**	**391**	**346**	**285**	**157**
Manganese	68	19	52	71	110	45
Iron	10,430	2,153	4,164	7,099	15,127	3,134
Nickel	3,090	271	695	1,010	1,243	430
Cobalt	1.8	<1	1.6	2	1.9	1.2
Copper	253	55	155	268	192	125
Zinc	472	80	231	395	320	146
Arsenic	1.1	<1	<1	2.2	1.9	<1
Strontium	23	5.3	19	22	23	14
Molybdenum	1.8	<1	2.1	3.9	25	3.2
Tin	44	5.3	11	16	11	30
Antimony	7.2	1.8	7.5	11	15	8
Lead	811	42	122	126	67	47

[1] January 8 was windy and dusty which may account for the higher concentrations.

Table VI-4
Freeboard Space, Chromic Acid Concentration and Average Temperature for the Decorative Chromium Plating Tank During Testing

Date	Run	Freeboard (inches)	Chromic Acid Concentration (oz/gal)	Temperature (°F)
1/09/03	SI-O2	3.0 – 3.0	34.4	112-113
1/10/03	SI-O3	3.0 - 2.75	33.96	112
1/17/03	SI-O7	5.0 - 4.9	33.07	109
1/14/03	SI-O4 & SO-O4	5.0 - 5.2	34.18	110
1/15/03	SI-O5 & SO-O5	4.2 – 4.5	32.85	109
1/16/03	SI-O6 & SO-O6	4.5 – 4.5	32.63	109-110

Note:

- Freeboard space was measured at the beginning and end of the day.
- Chromic acid concentration samples were taken once a day.
- Temperature was measured throughout the day.

Table VI-5
Average Amperes & Volts During Plating and Total Ampere-Hours for the Decorative Chromium Plating Tank Tested

Date	Run	Amperes	Volts	Ampere-Hours
1/09/03	SI-O2	5,200 – 6,600	6.75 – 7.5	12,468
1/10/03	SI-O3	5,000 – 6,200	6.5 – 7.5	9,080
1/17/03	SI-O7	2,800 – 6,700	5.4 – 6.8	4,634
1/14/03	SI-O4 & SO-O4	3,400 – 6,200	5.2 – 7.2	6,059
1/15/03	SI-O5 & SO-O5	4,000 – 5,800	6.0 – 6.6	8,874
1/16/03	SI-O6 & SO-O6	3,500 – 6,200	5.8 – 6.2	9,002

Note: Plating amperes varied at the beginning and end of plating as well as with plating of different parts.

Table VI-6
Surface Tension (dynes/cm) Readings at the Beginning and End of Each Day

Date	Sample	Operator Stalagmometer Reading	SCAQMD Stalagmometer Reading	SCAQMD Tensiometer Reading
1/09/03	SI-O2	34.7 - 41.5	40.0 – 43.2	28.4 – 29.5
1/10/03	SI-O3	30.7 - 31.3	29.0 – 32.6	23.6 – 24.9
1/17/03	SI-O7	41.5 - 35.5	40.1 – 40.2	28.5 – 27.6
1/14/03	SI-O4 & SO-O4	32.4 - 35.5	34.8 – 35.5	25.3 – 26.0
1/15/03	SI-O5 & SO-O5	38.7 - 37.8	39.9 – 40.2	27.9 – 28.7
1/16/03	SI-O6 & SO-O6	42.6 - 43.7	43.5 – 44.6	29.7 – 29.0

APPENDIX A

Test Results and Data Sheets
for
Plating Tank Emissions Factors

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-01-071a
PROJECT NAME: Sigma Plating
RUN NO.: SI-02

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	381.85	cubic feet
Vm Meter Cal. Factor	1.103	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.68	inches Hg
Avg. delta H Orifice Press. (dH avg):	3.679	inches H2O
Pb + dH avg:	29.95	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	1.01	/(inches H2O)
Stack Temperature (Ts)	529	deg. R
Static Pressure	-4.40	inches H2O
Absolute Stack Pressure (Ps)	29.36	inches Hg
Stack Dimensions	13.5	inches dia.
Stack Area (As)	0.994	square feet
H2O in Impingers and Silica Gel (Vlc):	62.1	milliliters
Sampling Time (t):	360	minutes
Nozzle Diameter (Dn):	0.25	inches
Total Chromium Mass Collected (Mn):	3.50E+06	nanograms
Hexavalent Cr. Mass Collected (Mn):	1.40E+06	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	428.10	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.7	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.76	lb/lbmole
Stack Gas Velocity (Vs):	57.45	feet/second
Stack Gas Flow Rate (Qs):	3334	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	104.1	percent
Total Cr Mass Conc. (Cs):	8.18E+03	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	3.27E+03	nanograms/dscf
Total Cr Mass Conc:	2.89E+05	nanograms/dscm
Hex. Cr. Mass Conc:	1.16E+05	nanograms/dscm
Total Cr. Emission Rate (Wm):	1.64E+03	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	6.55E+02	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-01-071a
PROJECT NAME: Sigma Plating
RUN NO.: SI-03

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	291.84	cubic feet
Vm Meter Cal. Factor	1.103	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.66	inches Hg
Avg. delta H Orifice Press. (dH avg):	3.275	inches H2O
Pb + dH avg:	29.90	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.94	/(inches H2O)
Stack Temperature (Ts)	523	deg. R
Static Pressure	-4.40	inches H2O
Absolute Stack Pressure (Ps)	29.34	inches Hg
Stack Dimensions	13.5	inches dia.
Stack Area (As)	0.994	square feet
H2O in Impingers and Silica Gel (Vlc):	61	milliliters
Sampling Time (t):	288	minutes
Nozzle Diameter (Dn):	0.25	inches
Total Chromium Mass Collected (Mn):	2.81E+06	nanograms
Hexavalent Cr. Mass Collected (Mn):	6.81E+05	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	326.64	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.9	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.74	lb/lbmole
Stack Gas Velocity (Vs):	53.28	feet/second
Stack Gas Flow Rate (Qs):	3119	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	106.1	percent
Total Cr Mass Conc. (Cs):	8.60E+03	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	2.08E+03	nanograms/dscf
Total Cr Mass Conc:	3.04E+05	nanograms/dscm
Hex. Cr. Mass Conc:	7.36E+04	nanograms/dscm
Total Cr. Emission Rate (Wm):	1.61E+03	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	3.90E+02	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-01-071a
PROJECT NAME: Sigma Plating
RUN NO.: SI-07

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	171.35	cubic feet
Vm Meter Cal. Factor	1.103	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.64	inches Hg
Avg. delta H Orifice Press. (dH avg):	3.221	inches H2O
Pb + dH avg:	29.88	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	1.03	/(inches H2O)
Stack Temperature (Ts)	527	deg. R
Static Pressure	-4.40	inches H2O
Absolute Stack Pressure (Ps)	29.32	inches Hg
Stack Dimensions	13.5	inches dia.
Stack Area (As)	0.994	square feet
H2O in Impingers and Silica Gel (Vlc):	4.8	milliliters
Sampling Time (t):	168	minutes
Nozzle Diameter (Dn):	0.25	inches
Total Chromium Mass Collected (Mn):	1.92E+05	nanograms
Hexavalent Cr. Mass Collected (Mn):	7.82E+04	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	191.63	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.1	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.82	lb/lbmole
Stack Gas Velocity (Vs):	58.12	feet/second
Stack Gas Flow Rate (Qs):	3402	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	97.8	percent
Total Cr Mass Conc. (Cs):	1.00E+03	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	4.08E+02	nanograms/dscf
Total Cr Mass Conc:	3.54E+04	nanograms/dscm
Hex. Cr. Mass Conc:	1.44E+04	nanograms/dscm
Total Cr. Emission Rate (Wm):	2.05E+02	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	8.33E+01	milligrams/hr Hex. Cr.

Plating Tank Data

Project: Sigma Hoist Line Plating Tank Page: 1 of 2

Project #: 01-071a By: D.Todd

	Time	Volts	Amps	Temp.	Totalizer, amp-hrs	Comments
1	8-Jan	Run SI-01			11,291	start
2					23,175	stop
3					11,884	diff
4	Run 01 invalidated.					
5	9-Jan	Run SI-02			48,010	start
6					60,478	stop
7					**12,468**	diff
8						
9	10-Jan	Run SI-03			89,353	start
10					98,433	stop
11					**9,080**	diff
12						
13	17-Jan	Run SI-07			563	start
14					5,197	stop
15					**4,634**	diff
16	Run 07 replaces Run 01.					
17						
18	Totalizer amp-hours and other tank parameters collected by SSD staff.					
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						

Anyphoss · Valtix 70L Ampss ~ 6000
Start: 48010 Ends 60478

FIELD DATA RECORD

RUN NO. SI-φ2
LOCATION Inlet
DATE ~~DTodd~~ 1/9/03
OPERATOR DTodd
METER BOX NO. 4206
LOCAL TIME
START/STOP 0945/

STACK DIAMETER 13½"
Ym: 1.103
H@: 1.526

PITOT TUBE FACTOR 0.84
NOZZLE DIAMETER 0.250 in.
PROBE LENGTH 4 ft.
ΔH/ΔP = 3.6/1.0 = K = ... = 3.6
SAMPLE TRAIN LEAK TEST
BEFORE 16 in. H_2O OK
AFTER 19 in. H_2O OK
PITOT TUBE LEAK TEST - OK
BEFORE 5.5" ok AFTER 4.6" ok

PROJECT NO. 01-071a
PLANT NAME Sigma
AMBIENT TEMP (F) 67½
METER TEMP (F) 60
BAR. PRESS ("Hg) 29.68
STATIC PRESSURE ("H2O) -4.4
ASSUMED MOISTURE (%) 0.5
ASSUMED O2 (%) 20.9
ASSUMED CO2 (%) 0.0
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

Check Lab results. High total Cr w/ low Hex Cr indicates interference from Inlet duct liquid

POINT	CLOCK TIME	DRY GAS METER (cu. ft.) 258.57	VELOCITY dP (in. H2O)	ORIFICE dH (in. H2O) 3.83 DESIRED	ACTUAL 3.68	TEMPERATURES (F) 1 STACK 68.8	2 PROBE	~~FILTER~~ None	3 ~~RESIN~~ Amb.	4 IMPGR	PUMP VAC (in. Hg)
START	0	~~258.49~~	—	—	—	—	—				
H-1	15	0-272.70	0.78	2.8	2.8	65	65		63	44	10
2	30	287.25	0.80	~~3.1~~ 2.9	2.9	67	67		67	44	10½
3	45	304.00	0.96	3.5	3.5	67	68		68	44	13
4	60	317.72	0.88	3.1	3.1	67	69		66	45	11.5
5	75	332.22	0.85	3.0	3.0	68	69		64	46	11
6	90	348.15	~~1.0~~ 1.1	~~3.6~~ 3.9	~~3.6~~ 3.9	68	70		66	46	14
7	105	363.65	~~0.96~~ 0.97	~~3.4~~ 3.5	~~3.4~~ 3.5	68	70		66	46	12.5
8	120	380.14	1.1	4.0	4.0	69	70		67	47	15
9	135	396.82	1.1	4.0	4.0	69	70		68	46	15
10	150	414.14	1.2	4.3	4.3	70	71		68	47	16½
11	165	431.40	~~1.3~~ 1.2	4.3	4.3	70	71		69	47	16½
12	180	449.45	1.3	4.7 *	4.4 -.3	71	72		70	47	17
H-12	195	466.15	1.3	4.7 *	4.4 -.3	71	72		69	47	17
11	210	483.54	1.3	4.7 *	4.4 -.3	70	72		70	47	17
10	225	500.70	1.2	4.3	4.3	69	71		68	47	16
9	240	518.05	1.2	4.3	4.3	70	71		69	47	16
8	255	534.80	1.1	4.0	4.0	70	71		69	48	15½
7	270	550.22	0.93	3.4	3.4	69	71		67	48	12
6	285	564.20	0.76	2.8	2.8	69	70		68	49	9½
5	300	578.88	0.92	3.3	3.3	69	70		68	49	11
4	315	594.60	1.0	3.6	3.6	68	69		67	48	12½
3	330	610.32	0.99	3.6	3.6	69	69		67	48	12½
2	345	~~24~~ 625.30	0.87	3.2	3.2	69	69		66	49	11
1	360	640.42	0.91	3.3	3.3	69	70		69	49	11½
	Theta: 360	Vm: 381.85	avg dP: 1.03		avg dH: 3.84	avg Ts 69.0			67½		

Amp hr start: 96789353 End: 98433

FIELD DATA RECORD

PAGE 1 of 1

RUN NO. ST-03
LOCATION Inlet
DATE 4/10/03
OPERATOR D Trull / Cukerke
METER BOX NO. 4206
LOCAL TIME
START/STOP 0825

STACK DIAMETER 17½"
Ym: 1.103
H@: 1.526

PITOT TUBE FACTOR 0.84
NOZZLE DIAMETER 0.25 in.
PROBE LENGTH 4 ft.
$\frac{\Delta H}{\Delta P} = \frac{3.6}{1.0} = 3.6 = k$

SAMPLE TRAIN LEAK TEST,
BEFORE 18" in. H_2O ok
AFTER 17½ in. H_2O
PITOT TUBE LEAK TEST
BEFORE 5½" ok AFTER 5½" ok

PROJECT NO. 01-71a
PLANT NAME Sigma
AMBIENT TEMP (F) V 62½
METER TEMP (F) 60
BAR. PRESS ("Hg) 29.66
STATIC PRESSURE ("H2O) ~~-4.4~~ -4.2"
ASSUMED MOISTURE (%) ½
ASSUMED O2 (%) 20.9
ASSUMED CO2 (%) 0.0
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O)	ORIFICE dH (in. H2O) DESIRED	ORIFICE dH (in. H2O) ACTUAL	TEMPERATURES (F) 1 STACK	2 PROBE	FILTER	3 RESIN Aux	4 IMPGR	PUMP VAC (in. Hg)
START	0	640.66	~~0.44~~								
H-1	12	650.17	0.49	1.8	1.8	59	59		57	50	7
2	24	659.9	0.51,49	1.90	1.90	58	59		56	44	7.
3	36	669.84	0.57	2.1	2.1	58	59		58	44	7½
4	48	680.63	0.66	2.4	2.4	60	60		61	45	8
5	60	691.40	0.65	2.4	2.4	60	60		61	44	8
6	72	703.88	0.94	3.4	3.4	61	61		63	43	12½
7	84	715.59	0.74	2.7	2.7	61	61		62	43	10
8	96	726.90	0.75	2.7	2.7	61	60		62	43	10
9	108	737.30	0.62	2.2	2.2	62	62		63	44	8
10	120	749.03	0.78	2.8	2.8	62	62		64	45	9.5
11	132	758.99	0.79 .74	2.7	2.7	62	62		63	44	9
12	144	770.34	0.78	2.8	2.8	62	63		62	43	9½
13	156	782.35	0.88	3.2	3.2	63	63		61	44	9
14	168	795.07	0.98	3.6	3.6	63	63		63	44	13
15	180	807.88	0.98.99	3.6	3.6	64	64		63	44	13
16	192	821.27	1.1	4.0	4.0	65	65		67	45	14½
17 204	204	835.24	1.2	4.3 (max)	4.3 (max)	66	66		66	45	16
18	216	849.02	1.2	4.3 (max)	4.3 (max)	64	66		65	45	16
19	228	863.1	1.2	4.3	4.3	65	66		64	44	16½
20	240	876.9	1.2	4.3	4.3	66	66		63	45	~~16½~~
21	252	890.74	1.2	4.3	4.3	66	66		65	45	16½
22 264	264	905.0	1.2	4.3	4.3	66	66		63	45	16½
23 276	276	919.1	1.2	4.3	4.3	66	66		64	45	16½
24 288	288	932.50	1.2 1.23	4.3	4.3	66 1.5	66		66	45	16½
	Theta: 288	Vm: 291.84	avg dP: 0.906		avg dH: 3.158	avg Ts 65.167			62 1.5		

HEPA Prefilter problems? NO, magnehelic changed! yes, prefilters changed - sampling suspended. Prefilter downstream of Meter. Demister downstream of Inlet sampling Shows in Loss-free

A-Hr: S: 00563 F: 05197

FIELD DATA RECORD

PAGE 1 of 1

RUN NO. ST-07 make
LOCATION Outlet (No In)
DATE 1/17/07
OPERATOR DTodd
METER BOX NO. 4206
LOCAL TIME
START/STOP 0805/

STACK DIAMETER 13 1/2
Ym: 1.107
H@: 1.536

PITOT TUBE FACTOR 0.84
NOZZLE DIAMETER 0.25 in.
PROBE LENGTH 4 ft.
ΔH = 3.6 = 3.6
ΔP 1.0

SAMPLE TRAIN LEAK TEST
BEFORE 15" in. H_2O ok
AFTER 19 1/2" in. H_2O ok
PITOT TUBE LEAK TEST
BEFORE 6.8 ok AFTER 6.6 ok

PROJECT NO. 01-71a
PLANT NAME Sigma
AMBIENT TEMP (F) 64
METER TEMP (F) 60
BAR. PRESS ("Hg) 29.64
STATIC PRESSURE ("H2O) -4.4
ASSUMED MOISTURE (%) 1
ASSUMED O2 (%) 20.9
ASSUMED CO2 (%) 0.00
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

ΔH may 1" H_2O less than should be.

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O) 25.42	ORIFICE dH (in. H2O) $(+\sqrt{}-\sqrt{})^2 = \text{calc}$ DESIRED	ORIFICE dH ACTUAL 77.3	TEMPERATURES (F) STACK 1597	PROBE	FILTER above	RESIN very h. 154	IMPGR	PUMP VAC (in. Hg)
START	0	599.81	—	—	—	—	—	—	—	—	—
~~1~~ 1-2	5" 7	606.47	0.73	2.1	2.7 +.07	60	54		54	51	14
2 5	1/2 14	613.24	0.75	2.7	2.7	60	55		54	44	14
3	21	620.52	0.97	3.5	max 3.2 -.10	61	58		56	42	18
4	28	627.78	~~1.0~~ 0.95	3.4	3.2 -.06	62	59		57	40	18
5	35	635.08	0.98	3.5	3.2 -.08	61	60		56	40	18
6	42	642.20	0.96	3.5	3.2 -.08	62	62		58	40	18
7	49 49	649.40	1.2	4.3	3.2 -.28	62	62		59	40	18
8	56 56	656.62	0.88	~~3.2 0.88~~	3.2 —	64	63		59	40	18
9	63	664.1	0.97	3.5	3.2 -.08	64	64		62	40	18
10	70	671.06	0.93	3.3	3.2 -.01	66	65		64	41	18
11	77	678.27	0.85	3.1	3.2 +.04 -.11	67	65		64	41	18
12	84 84	685.5	0.87	3.1	3.2 +.02 -.07	67	66		65	42	18
13	91 91	692.63	0.98	~~1.0~~ 3.5	3.2 -.18	68	67		66	42	18
14	98 98	700.1	1.0	3.6	3.2 -.11	68	68		67	42	18
15	105 105	707.00	1.1	3.9	3.3 -.20	69	69		68	43	18
16	112 112	714.15	1.2	4.3	3.2 -.29	69	70		69	43	18
17	119 "	721.29	1.2	4.3	3.3 -.29	69	70		69	43	18
18	126	728.43	1.2	4.3	3.3 -.29	70	70		69	43	18
19	133 133	735.58	1.2	4.3	3.3 -.29	70	72		69	44	18
20	140	742.72	1.3	4.7	3.4 -.37	71	72		70	43	18
21	147	749.83	1.3	4.7	3.4 -.37	71	72		70	43	18
22	154 154	756.97	1.3	4.7	3.4 -.37	72	74		71	44	18
23	161 161	764.13	1.3	4.7	3.4	72	75		72	44	18
24 5	12" 168 168	771.16	1.3 25.42	4.7	3.4	72	75		74	43	18
	Theta: 168	Vm: 171.35	avg dP: 1.089 $\sqrt{dP}_{avg}$ = 1.029		avg dH: 77.30 3.22	avg Ts 66.54			1,1,12 61.25		

California Air Resources Board
Monitoring & Laboratory Division

Sample Train Setup Sheet

(Use with Nozzle Measurement Sheet)

Project: Sigma — Page #: 1 of 1

Project #: I-01-071a — Proj. Lead: D. Todd

	Date	Train #	Filter #	Nozzle S/N	Nozzle Dia., in.	Probe S/N	Probe Cp		Impingers, ml	Silica Gel, grams	Moisture Total, ml	Imp. pH
1	1/07/03	W-I WATER TRAIN INLET		N/A	N/A	N/A	N/A	Final:	100.9 99.3	1126.8		
								Tare:	100.0 100.9	1123.3		
								Diff:	0.7	3.5	4.2	
2	1/07/03	W-O WATER		N/A	N/A	N/A	N/A	Final:	103.3 101.5	1146.1		
								Tare:	101.5 101.5	1142.3		
								Diff:	1.8	3.8	5.6	
3	1/08/03	SI-01		SI-01	.250	100.0 ml	0.84	Final:	158.0 68.0	1192.0		9.0/9.0/10.
								Tare:	100.5 100.0	1147.3		9.0
								Diff:	1.8	44.7	46.5	*
4	1/09/03	SI-02		SI-02	.250	125.0 ml	0.84	Final:	111.6 105.8	1177.6		10./10./9.
								Tare:	101.7 101.0	1130.2		9.0 *
								Diff:	14.7	47.4	62.1	
5	1/10/03	SI-03		SI-03	.250	Hex spike in Train #2	0.84	Final:	107.9 110.1	1174.5		10/10/9
	Put spike in Imp #2 and added enough MeBicarb sol for 100ml total in Imp #2			Spike =	1000 ng	Hex Cr.		Tare:	100.1 103.0	1128.4		9.0 *
								Diff:	14.9	46.1	61.0	
6								Final:				
								Tare:				
								Diff:				
7								Final:				
								Tare:				
								Diff:				
8								Final:				
								Tare:				
								Diff:				
9								Final:				
								Tare:				
								Diff:				
0								Final:				
								Tare:				
								Diff:				

* 1 PROBE RINSE WAS INVALIDATED DUE TO EXCESSIVE BUILD UP OF PLASTIC SOLUTION THAT RAN DOWN PROBE INTO RINSE JAR DURING RECOVERY.

California Air Resources Board
Monitoring & Laboratory Division

Method 425 Recovery Field Data Sheet

Project: **Sigma** Page: 1 of 1

Project #: T-01-071a Project Lead: **D.Todd**

	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
Run #: SI-01 pH	10.0	9.0	9.0
NOTE! PROBE RINSE WAS CONTAMINATED WITH RUN ORE OF PLATING SOLUTION FROM pitot tube. Tare (gm)	—	100.5	100.0
Final (gm)	100.0	158.0	68.0
Diff (gm)		57.5	-32.0
Run #: SI-02 pH	9.0	10.0	10.0
Tare (gm)	—	101.7	101.0
Final (gm)	125.0	111.6	105.8
Diff (gm)		9.9	4.8
Run #: SI-03 pH	9.0	10.0 ~~109.7~~	10.0 ~~110.1~~
NOTE! IMPINGER #2 SPIKED WITH HEX CHROME. Tare (gm)	—	101.1	103.0
Final (gm)	126.2	107.7	110.1
Diff (gm)		6.6	7.1
Run #: pH			
Tare (gm)			
Final (gm)			
Diff (gm)			
Run #: pH			
Tare (gm)			
Final (gm)			
Diff (gm)			

NOTES: (CONT. SI-01) EXTERIOR SURFACE OF PROBE.

APPENDIX B

Test Results and Data Sheets
for
Mist Eliminator Control Efficiency

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-01-071a
PROJECT NAME: Sigma Plating
RUN NO.: SI-04

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	214.09	cubic feet
Vm Meter Cal. Factor	1.103	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.66	inches Hg
Avg. delta H Orifice Press. (dH avg):	1.188	inches H2O
Pb + dH avg:	29.75	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	1.04	/(inches H2O)
Stack Temperature (Ts)	529	deg. R
Static Pressure	-4.40	inches H2O
Absolute Stack Pressure (Ps)	29.34	inches Hg
Stack Dimensions	13.5	inches dia.
Stack Area (As)	0.994	square feet
H2O in Impingers and Silica Gel (Vlc):	50.2	milliliters
Sampling Time (t):	360	minutes
Nozzle Diameter (Dn):	0.188	inches
Total Chromium Mass Collected (Mn):	2.06E+06	nanograms
Hexavalent Cr. Mass Collected (Mn):	9.50E+05	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	238.39	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.0	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.73	lb/lbmole
Stack Gas Velocity (Vs):	59.09	feet/second
Stack Gas Flow Rate (Qs):	3414	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	100.1	percent
Total Cr Mass Conc. (Cs):	8.64E+03	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	3.99E+03	nanograms/dscf
Total Cr Mass Conc:	3.05E+05	nanograms/dscm
Hex. Cr. Mass Conc:	1.41E+05	nanograms/dscm
Total Cr. Emission Rate (Wm):	1.77E+03	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	8.17E+02	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-01-071a
PROJECT NAME: Sigma Plating
RUN NO.: SO-04

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	258.6	cubic feet
Vm Meter Cal. Factor	1.072	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.66	inches Hg
Avg. delta H Orifice Press. (dH avg):	1.743	inches H2O
Pb + dH avg:	29.79	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	1.15	/(inches H2O)
Stack Temperature (Ts)	527	deg. R
Static Pressure	-7.40	inches H2O
Absolute Stack Pressure (Ps)	29.12	inches Hg
Stack Dimensions	13.5	inches dia.
Stack Area (As)	0.994	square feet
H2O in Impingers and Silica Gel (Vlc):	58.9	milliliters
Sampling Time (t):	360	minutes
Nozzle Diameter (Dn):	0.188	inches
Total Chromium Mass Collected (Mn):	2.44E+03	nanograms
Hexavalent Cr. Mass Collected (Mn):	2.54E+03	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	280.24	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.0	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.73	lb/lbmole
Stack Gas Velocity (Vs):	65.58	feet/second
Stack Gas Flow Rate (Qs):	3774	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	106.4	percent
Total Cr Mass Conc. (Cs):	8.71E+00	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	9.06E+00	nanograms/dscf
Total Cr Mass Conc:	3.07E+02	nanograms/dscm
Hex. Cr. Mass Conc:	3.20E+02	nanograms/dscm
Total Cr. Emission Rate (Wm):	1.97E+00	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	2.05E+00	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-01-071a
PROJECT NAME: Sigma Plating
RUN NO.: SI-05

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	227.84	cubic feet
Vm Meter Cal. Factor	1.103	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.64	inches Hg
Avg. delta H Orifice Press. (dH avg):	1.266	inches H2O
Pb + dH avg:	29.73	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	1.04	/(inches H2O)
Stack Temperature (Ts)	532	deg. R
Static Pressure	-4.40	inches H2O
Absolute Stack Pressure (Ps)	29.32	inches Hg
Stack Dimensions	13.5	inches dia.
Stack Area (As)	0.994	square feet
H2O in Impingers and Silica Gel (Vlc):	34.1	milliliters
Sampling Time (t):	360	minutes
Nozzle Diameter (Dn):	0.188	inches
Total Chromium Mass Collected (Mn):	4.20E+04	nanograms
Hexavalent Cr. Mass Collected (Mn):	2.91E+04	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	253.58	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.6	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.77	lb/lbmole
Stack Gas Velocity (Vs):	59.40	feet/second
Stack Gas Flow Rate (Qs):	3424	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	106.1	percent
Total Cr Mass Conc. (Cs):	1.66E+02	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	1.15E+02	nanograms/dscf
Total Cr Mass Conc:	5.85E+03	nanograms/dscm
Hex. Cr. Mass Conc:	4.05E+03	nanograms/dscm
Total Cr. Emission Rate (Wm):	3.40E+01	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	2.36E+01	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-01-071a
PROJECT NAME: Sigma Plating
RUN NO.: SO-05

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	252.78	cubic feet
Vm Meter Cal. Factor	1.072	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.66	inches Hg
Avg. delta H Orifice Press. (dH avg):	1.604	inches H2O
Pb + dH avg:	29.78	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	1.14	/(inches H2O)
Stack Temperature (Ts)	532	deg. R
Static Pressure	-7.40	inches H2O
Absolute Stack Pressure (Ps)	29.12	inches Hg
Stack Dimensions	13.5	inches dia.
Stack Area (As)	0.994	square feet
H2O in Impingers and Silica Gel (Vlc):	45.7	milliliters
Sampling Time (t):	360	minutes
Nozzle Diameter (Dn):	0.188	inches
Total Chromium Mass Collected (Mn):	7.00E+03	nanograms
Hexavalent Cr. Mass Collected (Mn):	5.57E+03	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	273.84	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.8	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.75	lb/lbmole
Stack Gas Velocity (Vs):	65.16	feet/second
Stack Gas Flow Rate (Qs):	3726	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	105.3	percent
Total Cr Mass Conc. (Cs):	2.56E+01	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	2.03E+01	nanograms/dscf
Total Cr Mass Conc:	9.03E+02	nanograms/dscm
Hex. Cr. Mass Conc:	7.18E+02	nanograms/dscm
Total Cr. Emission Rate (Wm):	5.71E+00	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	4.55E+00	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-01-071a
PROJECT NAME: Sigma Plating
RUN NO.: SI-06

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	223.63	cubic feet
Vm Meter Cal. Factor	1.103	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.72	inches Hg
Avg. delta H Orifice Press. (dH avg):	1.234	inches H2O
Pb + dH avg:	29.81	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	1.03	/(inches H2O)
Stack Temperature (Ts)	536	deg. R
Static Pressure	-4.40	inches H2O
Absolute Stack Pressure (Ps)	29.40	inches Hg
Stack Dimensions	13.5	inches dia.
Stack Area (As)	0.994	square feet
H2O in Impingers and Silica Gel (Vlc):	12.3	milliliters
Sampling Time (t):	360	minutes
Nozzle Diameter (Dn):	0.188	inches
Total Chromium Mass Collected (Mn):	5.91E+03	nanograms
Hexavalent Cr. Mass Collected (Mn):	3.22E+03	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	249.54	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.2	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.81	lb/lbmole
Stack Gas Velocity (Vs):	58.97	feet/second
Stack Gas Flow Rate (Qs):	3395	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	105.3	percent
Total Cr Mass Conc. (Cs):	2.37E+01	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	1.29E+01	nanograms/dscf
Total Cr Mass Conc:	8.36E+02	nanograms/dscm
Hex. Cr. Mass Conc:	4.56E+02	nanograms/dscm
Total Cr. Emission Rate (Wm):	4.82E+00	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	2.63E+00	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-01-071a
PROJECT NAME: Sigma Plating
RUN NO.: SO-06

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	237.45	cubic feet
Vm Meter Cal. Factor	1.072	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.7	inches Hg
Avg. delta H Orifice Press. (dH avg):	1.405	inches H2O
Pb + dH avg:	29.80	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	1.07	/(inches H2O)
Stack Temperature (Ts)	532	deg. R
Static Pressure	-7.40	inches H2O
Absolute Stack Pressure (Ps)	29.16	inches Hg
Stack Dimensions	13.5	inches dia.
Stack Area (As)	0.994	square feet
H2O in Impingers and Silica Gel (Vlc):	27.9	milliliters
Sampling Time (t):	360	minutes
Nozzle Diameter (Dn):	0.188	inches
Total Chromium Mass Collected (Mn):	5.45E+03	nanograms
Hexavalent Cr. Mass Collected (Mn):	4.23E+03	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	257.45	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.5	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.78	lb/lbmole
Stack Gas Velocity (Vs):	61.25	feet/second
Stack Gas Flow Rate (Qs):	3514	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	105.0	percent
Total Cr Mass Conc. (Cs):	2.12E+01	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	1.64E+01	nanograms/dscf
Total Cr Mass Conc:	7.48E+02	nanograms/dscm
Hex. Cr. Mass Conc:	5.80E+02	nanograms/dscm
Total Cr. Emission Rate (Wm):	4.46E+00	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	3.46E+00	milligrams/hr Hex. Cr.

Plating Tank Data

Project: Sigma Hoist Line Plating Tank Page: 2 of 2

Project #: 01-071a By: D.Todd

	Date	Volts	Amps	Temp.	Totalizer, amp-hrs	Comments
1	14-Jan	Run 04			12,585	start
2					18,644	stop
3					**6,059**	diff
4	Run 04: Hoist line down. Sampling stopped ~11:00 and restarted 1:00. Host line restarted 3:00					
5	15-Jan	Run 05			36,718	start
6					45,792	stop
7					200	less - port change
8					**8,874**	diff
9	Run 05: Hoist line down. Sampling stopped 30-45 min later at 9:40 and restarted 10:05.					
	16-Jan	Run 06			68,093	start
10					77,260	stop
11					165	less - port change
12					**9,002**	diff
13						
14	Totalizer amp-hours and other tank parameters collected by SSD staff.					
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						

A-Hrs: I: 812585 F: 818644

Moist: 50 2nd

FIELD DATA RECORD

8hr = 20 min/pt.

PAGE 1 of 1

RUN NO.	SI-04
LOCATION	Inlet
DATE	1/14/03
OPERATOR	Todd
METER BOX NO.	4206
LOCAL TIME	
START/STOP	0920/
STACK DIAMETER	13½"
Ym:	1.103
H@:	1.526
PITOT TUBE FACTOR	0.84
NOZZLE DIAMETER	3/16 (0.188) in.
PROBE LENGTH	4 ft.
ΔH/ΔP	1.1/1.0 : 1.1
SAMPLE TRAIN LEAK TEST	
BEFORE	16 in. H_2O ok
AFTER	0 in. H_2O ok
PITOT TUBE LEAK TEST	
BEFORE	6.4" AFTER 5.8" ok
PROJECT NO.	01-071a
PLANT NAME	Sigma
AMBIENT TEMP (F)	68
METER TEMP (F)	60
BAR. PRESS ("Hg)	29.66
STATIC PRESSURE ("H2O)	~~29.68~~ -7.4
ASSUMED MOISTURE (%)	0.5
ASSUMED O2 (%)	20.9
ASSUMED CO2 (%)	0.00
ASSUMED MW (WET, %)	
ASSUMED MW (DRY, %)	

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O)	ORIFICE dH (in. H2O) DESIRED	ORIFICE dH (in. H2O) ACTUAL	TEMPERATURES (F) STACK	PROBE	~~FILTER~~	~~RESIN~~ IMPGR	IMPGR	PUMP VAC (in. Hg)
START	0	933.58	26.28 — .24	.24 — .70	2.8,51 —	1459 —	—	None	Amb —	—	—
1	15	940.6	0.54	0.60	0.60	62	60		~~69~~	52	3
2	30	947.92	0.84	0.93	0.93	63	63		65	51	4
3	45	956.9	0.95	1.1 ~~0.95~~	1.1	65	64		64	51	4½
4	60	965.3	0.84	0.93	0.93	66	67		65	51	4
5	15 75	973.27	0.80	0.88	0.88	65	67		66	51	4
6	90	~~981~~.25	0.74	0.87	0.87	67	69		67	52	4
7	105	990.55	1.2	1.3	1.3	71	71		69	56	5
8	120	1000.51	1.3	1.4	1.4	74	78		71	58	5½
9	135 15	011.0	1.4	1.5	1.5	73	78		71	58	5½
10 10	150 150	021.40	1.5	1.6	1.6	~~74~~	77		72	58	6
11 15	165 165	032.5	1.5	1.6 1.7	1.6 1.7	74	76		71	58	6
12 12	180 180	1042.91	1.4	1.6 1.5	1.5	73	76		72	57	5½
1-1	195	051.72	0.98	1.1	1.1	73	75		70	57	4½
2	210	1062.02	1.4	1.5	1.5	72	75		70	57	5½
3	225	1071.38	1.1	1.2	1.2	71	75		69	53	5
4	240	1079.65	0.84	~~0.92~~ 0.92	~~0.92~~ 0.92	72	74		70	54	4
5	255	1088.09	0.90	1.0	1.0	71	73		68	54	4½
6	270	1096.11	0.80	0.88	0.88	70	74		68	55	4
7	285	1104.53	1.0	1.1	1.1	70	74		68	55	4½
8	300 300	1113.02	1.1	1.0 1.2	1.0	68	73		67	54	4½
9	315	1122.15	1.2	1.3	1.3	67	71		66	54	5
10	330	1130.68	1.3	1.4	1.4	66	70		64	53	5½
11	345	1139.17	1.3 2.6	1.4	1.4	66	69		64	52	5½
12	360	1147.67	1.3 2.6	1.4	1.4 2.8,51	66	68		63	50	5½
	Theta: 360	Vm: 214.09	avg dP: 1.09 $\sqrt{\text{avg}}$ = 1.046		avg dH: 1.189 $\sqrt{\text{avg dH}}$: 1.09	avg Ts 69.1			68 1624		

stopped 93:20 (11:00 line down) 1:20 restart pumping out Tank. Tank restarted 2:00 pump restarted 1:20 after using provided in duct.

moisture: 58.9% C

FIELD DATA RECORD

PAGE 1 of 1

RUN NO. SO-04
LOCATION OUTLET
DATE 1/14/03 TUES
OPERATOR CURTICE
METER BOX NO. ~~20070041~~ 20004204
LOCAL TIME
START/STOP 0922/

PITOT TUBE FACTOR 0.84
NOZZLE DIAMETER 3/16, 0.19 in.
PROBE LENGTH 4 ft.

SAMPLE TRAIN LEAK TEST
BEFORE 17 in. H_2O OK
AFTER 14.5 in. H_2O OK
PITOT TUBE LEAK TEST
BEFORE 5" OK AFTER 5" OK

PROJECT NO. 01-071a
PLANT NAME SIGMA
AMBIENT TEMP (F) 68
METER TEMP (F) 60
BAR. PRESS ("Hg) 29.68
STATIC PRESSURE ("H2O) -.74
ASSUMED MOISTURE (%) 0.5%
ASSUMED O2 (%) 20.9
ASSUMED CO2 (%)
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

STACK DIAMETER 13½
Ym: 1.072 ~~1.058~~ ~~1.604~~
H@: ~~1.596~~ 1.604

$\frac{\Delta H}{\Delta P} = \frac{1.25}{1.25}$ ~~1.20~~

POINT	CLOCK TIME (Min)	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O) 33.33 pt	ORIFICE dH (in. H2O) DESIRED	ORIFICE dH (in. H2O) ACTUAL (41.82)	TEMPERATURES (F) STACK 1614	PROBE 2	FILTER	RESIN 3 AMBIENT	IMPGR 4	PUMP VAC (in. Hg)
START	0	994.43 (2)	1.8" (1)	2.25	2.25	61	61		~~64~~	46	7.0
SS-1	15:00	1007.60	3.2	4.00	4.00	62	63		68	47	13.0
2	30:00	1023.23	2.15	2.69	2.70	62	66		74	42	8.5
3	45:00	1037.00	3.05	3.81	3.80	64	69		69	42	12.0
4	60:00	1052.90	1.55	1.94	1.95	64	70		69	42	6.0
5	75:00	1064.83	1.20	1.50	1.50	65	71		68	43	5.0
⑥ 6	90:15	1075.14	~~1.20~~ 0.79	~~1.50~~ 0.99	~~1.50~~ 0.99	~~65~~ 71	~~71~~ 79		~~68~~ 72	~~43~~ 44	~~5.0~~ 3.5
⑦ 7	105	1083.30	~~0.79~~ 0.67	~~0.99~~ 0.84	~~0.99~~ 0.84	~~67~~ 71	~~74~~ 75		~~70~~ 72	~~46~~ 46	~~3.5~~ 2.0
8	120	1090.90	0.67	0.84	0.84	71	78		72	46	2.1
9	135	1098.61	0.69	0.86	0.86	71	77		74	46	2.3
10	150	1106.38	0.73	0.91	0.91	71	75		73	46	2.5
11	165	114.41	0.74 (12)	~~0.94~~ 0.93	0.93	71	74		72	46	2.5
12	180	122.49 5/2	—	—	—	—	—		—	—	—
WS-1	195	133.93 (1)	~~1.55~~ (1)	~~1.94~~ (1)	1.95 (1)	70 (1)	73 (1)		72	44	6.0
2	210	145.46	1.45	1.81	1.8	67	73		71	44	5.5
3	225	156.66	1.45	1.81	1.8	69	72		73	45	5.5
4	240	168.62	1.5	1.9	1.9	69	72		72	45	6.0
5	255	180.66	1.7	2.1	2.1	69	71		73	45	6.5
6	270	189.80	~~0.96~~ .94	1.2	1.2	69	71		70	45	4.0
7	285	199.76	1.1	1.4	1.4	68	71		71	46	4.5
8	300	209.94	1.2	1.5	1.5	67	71		70	46	5.0
9	315	220.51	1.3	1.6	1.6	66	70		69	46	5.0
10	330	231.29	1.4	1.75	1.8	66	69		67	45	5.5
11	345	242.02	1.40	~~1.81~~ 1.75	1.8	65	68		68	45	5.5
12	360:01	1253.03	~~1.1~~ 1.35	~~1.4~~ 1.4	1.4	~~65~~	~~66~~		~~67~~	~~44~~	~~4.5~~
	Theta: 360	Vm: 258.60	avg dP: 1.38 Ndp min = 1.17		avg dH: 41.82 1.7425	avg Ts 1,614 67.25					

STOP @ 90:15 → 11:00 LOCAL
FIRST BACK UP @ 11:20 LOCAL
TOP #2 @ 11:24
FIRST @ 13:00

DT-CONVENTION

1.25 1.45
1.20 1.44
1.25 1.44

Amp hr: S: 36718 F: 45792 ~~[illegible]~~ 200 for missed Chrome Sch

Spike in ~~S4~~ S1-Ø5 - Imp 2, Then brought up to 100 ml. (other train today)

FIELD DATA RECORD

PAGE 1 of 1

RUN NO.	S1-Ø5
LOCATION	Inlet
DATE	1/15/03
OPERATOR	[illegible]
METER BOX NO.	4206
LOCAL TIME START/STOP	0830/1515
STACK DIAMETER	13½
Ym:	1.103
H@:	1.526

PITOT TUBE FACTOR	0.84
NOZZLE DIAMETER	3/16 = 0.188 in.
PROBE LENGTH	4 ft.

$\Delta H / \Delta P = 1.15 / 1.0 = 1.15$

SAMPLE TRAIN LEAK TEST
BEFORE 15½ in. H_2O ok
AFTER 15½" in. H_2O ok
PITOT TUBE LEAK TEST
BEFORE 5.8" ok AFTER 6.2" ok

PROJECT NO.	T-01-071a
PLANT NAME	Soguna
AMBIENT TEMP (F)	69
METER TEMP (F)	60
BAR. PRESS ("Hg)	29.64
STATIC PRESSURE ("H2O)	-4.4
ASSUMED MOISTURE (%)	0.5-1.0
ASSUMED O2 (%)	20.9
ASSUMED CO2 (%)	0.0
ASSUMED MW (WET, %)	
ASSUMED MW (DRY, %)	

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O)	ORIFICE dH (in. H2O) DESIRED	ACTUAL	TEMPERATURES (F) STACK	PROBE	FILTER	RESIN	IMPGR	PUMP VAC (in. Hg)
			26.36		~~28.59~~ 30.37	1726		None	Amb		
START	0	147.82	—	—	—	—	—	—	—	—	—
V-1	15	155.16	0.60	0.69	0.69	57	53		51	44	3½
2	30	163.53	0.78	0.90	0.90	59	55		55	44	4
3	45	172.23	0.84	0.97	0.97	62	58		59	45	4½
4	60	181.65	1.0	1.2	1.2	62	60		60	45	5
5	75	190.01	0.78	0.90	0.90	64	61		61	46	4
6	90	198.31	0.80	0.92	0.92	66	66		63	47	4
7	105	208.24	1.2	1.4	1.4	68	67		63	47	6
8	120	218.8	1.3	1.5	1.5	69	68		66	47	6
9	135	229.02	1.3	1.5	1.5	69	70		67	48	6
10	150	239.69	1.4	~~1.4~~ 1.6	1.6	71	73		69	51	6½
11	165	250.67	1.5	1.7	1.7	72	75		71	51	6½
12	180 180	261.39	1.4	~~1.4~~ 1.6	1.6	74	76		72	49	6
H-1	195	270.5	0.98	1.1	1.1	76	78		74	51	4½
2	210 210	280.10	1.2	1.4	1.4	76	79		73	52	5½
3	225 225	290.38	1.3	1.5	1.5	77	79		74	52	6
4	240	299.67	1.0	1.2	1.2	77	79		75	52	5
5	255	308.80	1.1	1.2	1.2	79	80		76	53	5
6	270	316.90	0.79	0.91	0.91	78	80		76	53	4
7	285	325.72	0.99	1.1	1.1	77	80		77	53	4½
8	300	335.25	1.1	1.3	1.3	78	80		78	55	5
9	315	346.2	1.2	1.4	1.4	79	81		78	54	5½
10	330	355.44	1.3	1.5	1.5	79	82		78	53	6
11	345	365.75	1.3	1.5	1.5	79	83		78	50	6
12	360	375.66	1.2 26.36	1.4	1.4 30.37	78 1726	85		78	50	6
	Theta: 360	Vm:	avg dP: 1.098 √dPavg = 1.048		avg dH: 30.37 1.2663	avg Ts 71.91			1692 1969		

@ 68:43 (9:40 Am) shutdown for hoist Problems. restart ~10:05. hoist down 30-45 min before stop

FIELD DATA RECORD

PAGE 1 of 1

RUN NO. 50 - 05
LOCATION OUTLET
DATE 1/15/03 WED
OPERATOR CLANCE
METER BOX NO. 4204
LOCAL TIME START/STOP 0830/1515

STACK DIAMETER 13½'
Ym: 1.072
H@: 1.604

PITOT TUBE FACTOR 0.84
NOZZLE DIAMETER 3/16 0.188 in.
PROBE LENGTH 4' ft.

SAMPLE TRAIN LEAK TEST
BEFORE 18 in. H_2O - OK
AFTER 12 in. H_2O - OK
PITOT TUBE LEAK TEST
BEFORE 5.5" - OK AFTER 5" - OK

PROJECT NO. 01-0716
PLANT NAME SIGMA
AMBIENT TEMP (F) 55 69
METER TEMP (F) 60
BAR. PRESS ("Hg) 29.69
STATIC PRESSURE ("H2O) -7.4
ASSUMED MOISTURE (%) 0.5%
ASSUMED O2 (%) 20.9
ASSUMED CO2 (%)
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

ΔH/ΔP = 1.20

POINT	CLOCK TIME (MIN @ END)	DRY GAS METER (cu. ft.) (@ END)	VELOCITY dP (in. H2O) 32.07	ORIFICE dH (in. H2O) dH/dP = 1.20 38.49 dP		TEMPERATURES (F) 1222 1686 AMBO					PUMP VAC (in. Hg)
				DESIRED (CALC)	ACTUAL (READ)	STACK 1	PROBE 2	FILTER	RESIN 3	IMPGR 4	
START	0	253.054 (1)	—	—	—	—	—		—	—	—
WEST PORT → SW-1	15:00	265.75	1.75 (6)	2.10	2.10	56	56		55	41	7.5
2	30	278.70	1.90	2.29	2.30	59	59		59	40	8.5
3	45	290.84	1.65	1.98	2.00	62	62		61	41	7.2
4	60	303.12	1.80	~~1.54~~	~~1.6~~ 1.6	63	65		62	41	7.5
5	75	311.80	1.00	1.20	1.20	65	69		63	42	5.0
6	90	322.93	1.45	1.74	1.75	70	79		65	42	6.5
7	105	332.94	1.15	1.38	1.40	70	79		65	43	5.5
8	120	342.93	1.2	1.4	1.4	71	80		68	45	5.5
9	135	352.89	~~1.2~~ 1.2	~~1.4~~ 1.4	~~1.4~~ 1.4	70	83		69	46	5.5
10	150	363.12	1.3	1.6	1.6	76	86		72	46	5.5
11	165	374.19	1.5	1.8	1.8	77	88		72	45	6.5
12	180	385.26	1.5 (12)	1.8	1.8	79	88		73	45	6.5
SOUTH PORT → SS-1	195	398.19	2.1	2.5	2.5	76	84		73	46	9.0
2	210	411.15	1.6	1.9	1.9	76	81		73	41	8.5
3	225	422.94	1.7	2.0	2.0	77	81		75	42	7.0
4	240	436.66	2.3	2.8	2.8	78	82		76	42	9.5
5	255	448.45	1.7	2.0	2.0	79	83		76	43	7.0
6	270	459.19	1.4	1.7	1.7	77	82		76	45	6.0
7	285	486.29	0.76	0.91	0.90 = .91	75	79		76	46	4.0
8	300	474.96	0.70	0.84	0.84	76	79		77	47	3.5
9	315	482.79	0.73	0.88	0.88	76	78		79	47	3.5
10	330	490.65	0.73	0.88	0.88	76	79		78	47	3.5
11	345	498.54	0.73	0.88	0.88	76	77		78	47	3.5
12	360	506.32	~~0.67~~ 0.72	0.86	0.86	63	78		76	47	3.5
	Theta: 360	Vm: 252.78	avg dP: 1.33 1.156		avg dH: 38.49 1.604	avg Ts 71.75			1629 69		

70:57 IN VIDEOS @ 4:40 LOCKOUT LOST PROB. RESTART @ 0:02 SAME T

1.20
1.22
1.20

Ampl Hr: S: 08093 F: 77260
F - S - 165 = A-H total

Demister: Midwest Air Products Co, Inc (MAPCO)
2 stage, water rinse: 20 sec, every 2 hrs return to Cn tank
Stage 1 - lower
Stage 2 - upper
water from DI (Plating prep) tank

No face velocity of tank vents, nozzle(?) & nozzle hangers too close to vent faces for monitor. Smoke test shows all fumes going to tank.

FIELD DATA RECORD

RUN NO.	SI-06
LOCATION	Demister Inlet
DATE	1/16/03
OPERATOR	W Todd
METER BOX NO.	4206
LOCAL TIME	
START/STOP	0820/
STACK DIAMETER	13½"
Ym:	1.103
H@:	1.526

PITOT TUBE FACTOR	0.84
NOZZLE DIAMETER	0.188 in.
PROBE LENGTH	4 ft.
$\Delta H / \Delta P$	= 1.15
SAMPLE TRAIN LEAK TEST	
BEFORE	15½ in. H_2O
AFTER	15 in. H_2O
PITOT TUBE LEAK TEST BEFORE	5.3" ok
AFTER	5.2" ok

PAGE	1 of 1
PROJECT NO.	01-071a
PLANT NAME	Sigma
AMBIENT TEMP (F)	75
METER TEMP (F)	60
BAR. PRESS ("Hg)	29.72
STATIC PRESSURE ("H2O)	-4.4
ASSUMED MOISTURE (%)	½-1
ASSUMED O2 (%)	20.9
ASSUMED CO2 (%)	0.0
ASSUMED MW (WET, %)	
ASSUMED MW (DRY, %)	

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O)	ORIFICE dH (in. H2O) DESIRED	ACTUAL	TEMPERATURES (F) STACK	PROBE	FILTER	RESIN	IMPGR	PUMP VAC (in. Hg)
			25.97		29.61	1827		None	Amb. 1792		
START	0	376.00	—	—	—	—	—	—	—	—	—
V-1	15	383.97	0.72	0.83	0.83	62	55		53	45	3½
2	30	392.4	0.78	0.90	0.90	65	58		58	45	4
3	45	401.16	0.89	1.0	1.0	65	59		61	45	4
4	60	409.67	0.81	0.93	0.93	69	63		66	48	4
5	75	418	0.81	0.93	0.93	71	67		68	50	4
6	90	426.40	0.80	0.91	0.91	72	71		76	51	3½
7	105	435.34	1.1	1.2	1.2	74	74		75	50	4½
8	120	445.59	1.3	1.5	1.5	74	75		74	49	5
9	135	456.10	1.4	1.6	1.6	75	76		74	49	5½
10	150	467.04	1.5	1.7	1.7	76	76		74	48	6
11	165	477.98	1.5	1.7	1.7	77	77		74	47	6
12	180	488.90	1.5	1.7	1.7	77	79		75	46	6
H-1	195	496.77	0.76	0.87	0.87	78	81		76	48	3½
2	210	504.88	0.79	0.90	0.90	79	82		79	50	4
3	225	513.87	1.1	1.2	1.2	79	83		79	50	4½
4	240	523.63	1.2	1.4	1.4	80	84		79	50	5
5	255	531.76	0.80	0.91	0.91	80	84		81	51	3½
6	270	539.86	0.81	0.93	0.93	81	85		81	52	4
7	285	548.80	1.0	1.1	1.1	81	86		84	54	4
8	300	558.55	1.2	1.4	1.4	82	86		81	53	5
9	315	568.80	1.3	1.5	1.5	82	86		81	53	5
10	330	579.04	1.3	1.5	1.5	83	86		82	53	5
11	345	589.28	1.3	1.5	1.5	83	86		82	54	5
12	360	599.63	1.3 25.97	1.5	1.5 29.61	82 1827	84		80	55	5
	Theta: 360	Vm: 223.36	avg dP: 1.082; √dP avg = 1.040		avg dH: 1.234	avg Ts 76.125			74.67		

FIELD DATA RECORD

RUN NO. 50-06
LOCATION demister Outlet
DATE 1/16/03
OPERATOR C Clarke
METER BOX NO. 4204
LOCAL TIME
START/STOP 0813/

STACK DIAMETER 13 1/2
Ym: 1.072
H@: 1.604

PITOT TUBE FACTOR 0.84
NOZZLE DIAMETER 0.188 in.
PROBE LENGTH 4 ft.

SAMPLE TRAIN LEAK TEST
BEFORE 17.5 in. H_2O OK
AFTER 10.5 in. H_2O OK
PITOT TUBE LEAK TEST
BEFORE 5.2" ok AFTER 5.2" OK

PAGE 1 of 1
PROJECT NO. 01-71a
PLANT NAME Sigma
AMBIENT TEMP (F)
METER TEMP (F) 60
BAR. PRESS ("Hg) 29.70
STATIC PRESSURE ("H2O) - 7.4
ASSUMED MOISTURE (%) 1
ASSUMED O2 (%) 20.9
ASSUMED CO2 (%) 0.0
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

$\frac{dH}{dP} = 1.20$

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O)	ORIFICE dH (in. H2O) DESIRED	ORIFICE dH (in. H2O) ACTUAL	TEMPERATURES (F) STACK	PROBE	FILTER	RESIN AMB	IMPGR	PUMP VAC (in. Hg)
START	0	506.48									
S-1	15:00	518.08	~~1.7~~ 1.5	~~2.0~~ 1.8	1.8	59	61		56	50	5.0
2	30	529.93	1.6	1.9	1.9	61	58		60	40	5.5
3	45	541.80	1.6	1.9	1.9	64	60		63	40	5.5
4	60	552.85	1.3	1.6	1.6	66	63		67	41	5.0
5	75	563.70	1.3	1.6	1.6	68	66		69	42	5.0
6	90	573.82	1.2	1.4	1.4	70	69		71	42	4.5
7	105	581.71	0.71	0.85	0.85	70	72		82	42	3.0
8	120	589.23	0.65	0.78	0.78	69	74		75	43	3.0
9	135	597.11	0.72	0.87	0.87	71	76		73	43	3.0
10	150	604.91	0.70	0.84	0.84	73	80		72	43	3.0
11	165	612.89	0.73	0.88	0.88	74	80		74	45	3.0
12	180	620.29	0.66	0.79	0.79	76	81		76	47	3.0
W-1	195	630.60	1.3	1.6	1.6	75	84		74	43	4.5
2	210	641.53	1.5	1.8	1.8	76	89		77	46	5.0
3	225	651.03	1.1	1.3	1.3	73	91		79	46	4.0
4	240	660.89	1.2	1.4	1.4	76	92		78	46	4.0
5	255	670.59	1.1	1.3	1.3	76	92		79	45	4.0
6	270	679.24	0.93	1.1	1.1	77	92		78	46	3.5
7	285	689.20	1.2	1.4	1.4	77	92		81	47	4.0
8	300	699.59	1.3	1.6	1.6	77	93		80	47	4.5
9	315	710.55	1.4	1.7	1.7	78	93		80	46	4.5
10	330	721.73	1.5	1.8	1.8	79	92		80	46	5.0
11	345	732.90	1.5	1.8	1.8	74	90		80	46	5.0
12	360	743.93	1.4	1.7	1.7	76	89		80	46	4.9
	Theta: 360	Vm: 237.45	avg dP: 1.17 $\sqrt{dP}_{avg}$ = 1.082		avg dH: 1.404	avg Ts 72.13					

CORRECTED COPY

California Air Resources Board
Monitoring & Laboratory Division

Hex. Cr. Sample Train Setup Sheet

(Use with Nozzle Measurement Sheet & Hex Cr Recovery Sheet)

Project: Sigma Plating — Page #: 1 of 1

Project #: T-01-071a — Proj. Lead: D. Todd

	Date	Train #	Filter #	Nozzle S/N	Nozzle Dia., in.	Probe S/N	Probe Cp	Impingers, ml		Silica Gel, grams	Moisture Total, ml	Impingers No.	Impingers pH
1	1/14/03	SI.04	N/A		.190	SI.04	0.84	Final:	110.8 220.6 107.8	1152.8	1373.4		9.0
								Tare:	100.2 200.2 100.0	1123.0	-1323.2		
								Diff:	20.40	29.80	50.2 ✓	3	
2	1/14/03	SO.04	N/A		.190	SO.04	0.84	Final:	158.6 271.1	1189.9	1419.6	1	
								Tare:	101.9 201.9 100.1	1159.6	-1360.7	2	
								Diff:	28.60	30.3	58.9 ✓	3	
3	1/15/03	SI.05	N/A		.190	SI.05	0.84	Final:	103.2 211.0 107.8	1165.0	1376.0	1	8.5
								Tare:	100.9 200.9 100.0	1141.0	-1341.9	2	
								Diff:	10.1	24.0	34.1 ✓	3	
4	1/15/03	SO.05	N/A		.190	SO.05	0.84	Final:	108.5 217.0 110.5	1177.8	1396.8	1	
								Tare:	99.2 201.6 102.4	1149.3	-1351.1	2	
								Diff:	17.2	28.5	45.7 ✓	3	
5	1/16/03	SI.06	N/A		.190	SI.06	0.84	Final:	88.0 193.3 104.3	1126.5	1319.8	1	8.5
								Tare:	101.1 201.1 100.0	1106.4	-1307.5	2	
								Diff:	-7.8	20.1	12.3 ✓	3	
6	1/16/03	SO.06	N/A		.190	SO.06	0.84	Final:	94.5 201.5 107.0	1190.3	1391.8	1	
								Tare:	100.0 200.4 100.4	1163.5	-1363.9	2	
								Diff:	1.1	26.8	27.9 ✓	3	
7	1/17/03	SI.07	N/A		.250	SI.07	0.84	Final:	1789 87.9 91.0	1156.0	1334.9	1	8.5
								Tare:	101.2 201.6 100.3	1128.7	1330.1	2	
								Diff:	-22.5	27.3	4.8 ✓	3	

California Air Resources Board
Monitoring & Laboratory Division

Method 425 Recovery Field Data Sheet

Project: Sigma
Project #: V F01-071a
Page: 1 of 2
Project Lead: D. Todd

Run #: SI.06	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
pH	9.0	10.0	10.0
Tare (gm)	—	101.1	100.0
Final (gm)	129.4	89.0	104.3
Diff (gm)	129.4	-12.1	4.3

Run #: SO.06	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
pH	9.0	10.0	10.0
Tare (gm)	—	100.0	100.4
Final (gm)	128.3	94.5	107.0
Diff (gm)	128.3	5.5	6.6

Run #: SI.07	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
pH	9.0	10.0	10.0
Tare (gm)	—	101.2	100.2
Final (gm)	116.6	89.9	91.0
Diff (gm)	116.6	-13.3	-9.2

Run #:	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
pH			
Tare (gm)			
Final (gm)			
Diff (gm)			

Run #:	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
pH			
Tare (gm)			
Final (gm)			
Diff (gm)			

California Air Resources Board
Monitoring & Laboratory Division

Method 425 Recovery Field Data Sheet

Project: Sigma Page: 2 of 2
Project #: F01-071a Project Lead: D. Todd

Run #: SI-04	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
pH	8.5	9.0	9.0
Tare (gm)	—	100.2	100.0
Final (gm)	121.6	110.8	109.8
Diff (gm)	121.6	10.6	9.8

Run #: SO-04	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
pH	9.0	9.0	9.0
Tare (gm)	—	101.0	100.1
Final (gm)	105.8	158.6	71.1
Diff (gm)	105.3	57.6	-29.0

Run #: SI-05	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
* Imp. #2 SPIKED w/ 10mL. pH	9.0	10.0	10.0
Tare (gm)	—	100.9	100.0
Final (gm)	129.0	103.2	107.8
Diff (gm)	129.0	2.3	7.8

Run #: SO-05	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
pH	9.0	10.0	10.0
Tare (gm)	—	99.2	102.6
Final (gm)	110.3	108.5	110.5
Diff (gm)	110.3	9.3	7.9

Run #:	Container No.1 (Probe Rinse)	Container No. 2 (Impinger 1)	Container No. 3 (Impinger 2)
pH			
Tare (gm)			
Final (gm)			
Diff (gm)			

APPENDIX C

ARB Laboratory Results

MEMORANDUM

TO: Dean Bloudoff, Manager
Testing Section

FROM: Cliff Popejoy, Manager
Inorganic Laboratory Section

DATE: January 30, 2003

SUBJECT: Chromium Results—Sigma Plating

Attached are the results of analysis for both total and hexavalent chromium of the samples from Sigma Plating that your staff provided to us.

We analyzed 11 samples (of which two were blanks) from the first week of sampling (January 6-10, 2003), and 22 samples (of which one was a blank) from the second week (January 13-17, 2003). Total chromium was determined using an atomic absorption/ graphite furnace technique. To deal with the high carbonate fixative concentrations, we used a variation of Method MLD005. Hexavalent chromium (hex chrome or Cr(VI)) was measured using ion chromatography, Method MLD039. For both methods, we employed standard laboratory quality control practices (multipoint calibrations, lab blanks and spikes, and control checks). Quality control data will be provided upon your request.

As would be expected, the samples from the probes showed hexavalent chromium recoveries equal to or less than the corresponding total chromium recoveries. For the impinger solutions, in some cases, the reported values of hexavalent chromium are higher than the corresponding total chromium. This may be an artifact of both samples being diluted substantially, producing some analytical imprecision.

If you have any questions, please call me at 322-6202.

Attachment

Total and Hexavalent Chromium (Cr) Results for Sigma Plating Samples, Set #1, January 2003

Container #	Sample ID	*ml of sample collected*	*Total Cr, ng/ml*	**Total Cr, ng recovered**	% of Sample	*Cr(VI), ng/ml*	**Cr(VI), ng recovered**	% of Sample	Hex/Total %
1	**Trip Spike, Solvent**	*110.1*	*8.8*	**969**		9.6	**1000**		103.2%
2	**Field Blank, Solvent**	*100.3*	*< 1.0*	**< 100**		*<0.2*	**<20**		
3	**SI-01 Probe**	*100.0*	*3.4E+05*	**3.4E+07**	100.0%	*1.2E+05*	**1.2E+07**	100.0%	35.3%
4	**SI-01 IMP#1**	*158.0*	*12.3*	**1943**	0.0%	*14.3*	**2300**	0.0%	118.3%
5	**SI-01 IMP#2**	*68.0*	*3.8*	**258**	0.0%	*2.8*	**190**	0.0%	73.5%
	SI-01 Totals			**3.40E+07**			**1.20E+07**		35.3%
9	**SI-02 Probe**	*125.0*	*2.8E+04*	**3.5E+06**	99.9%	*1.1E+04*	**1.4E+06**	99.9%	40.0%
10	**SI-02 IMP#1**	*111.6*	*17.6*	**1954**	0.1%	*12.0*	**1300**	0.1%	66.5%
11	**SI-02 IMP#2**	*105.8*	*1.1*	**116**	0.0%	*0.9*	**96**	0.0%	82.5%
	SI-02 Totals			**3.50E+06**			**1.40E+06**		40.0%
12	**SI-03 Probe**	*126.2*	*2.2E+04*	**2.8E+06**	98.8%	*5.2E+03*	**6.5E+05**	95.5%	23.4%
13	**SI-03 IMP#1**	*107.7*	*310.0*	**3.3E+04**	1.2%	*2.8E+02*	**3.0E+04**	4.4%	89.9%
14	SI-03 IMP#2	*110.1*	*9.5*	1046		*14.1*	1600		153.0%
	Less Hex Cr spike			1000			1000		
	True SI-03 IMP#2			**46**	0.0%		**600**	0.1%	1304.3%
	SI-03 Totals			**2.81E+06**			**6.81E+05**		24.2%

The Limit of Detection (LOD) for Cr by GFAA is 1.0 ng/ml. The LOD for Cr(VI) by IC is 0.2 ng/ml.

Total and Hexavalent Chromium (Cr) Results for Sigma Plating Samples, Set #2, January 2003

Container #	Sample ID	*ml of sample collected*	*Total Cr, ng/ml*	**Total Cr, ng recovered**	*% of Sample*	*Cr(VI), ng/ml*	**Cr(VI), ng recovered**	*% of Sample*	Hex/Total %
39	**Field Blank, Solvent**	*152.2*	*< 1.0*	**< 152**		*<0.2*	**<30**		
17	**SI-04 Probe**	*121.6*	*1.7E+04*	**2.0E+06**	*99.0%*	*7.6E+03*	**9.3E+05**	*97.9%*	*45.6%*
18	**SI-04 IMP#1**	*110.8*	*1.8E+02*	**2.0E+04**	*1.0%*	*1.8E+02*	**2.0E+04**	*2.1%*	*101.0%*
19	**SI-04 IMP#2**	*109.8*	*< 1.0*	**< 110**		*0.2*	**24**	*0.0%*	
		SI-04 Totals		**2.06E+06**			**9.50E+05**		46.1%
20	**SO-04 Probe**	*105.3*	*2.0E+01*	**2.1E+03**	*86.3%*	*1.3E+01*	**1.3E+03**	*51.2%*	*61.7%*
21	**SO-04 IMP#1**	*158.6*	*2.1*	**333**	*13.7%*	*6.8*	**1100**	*43.3%*	*330.3%*
22	**SO-04 IMP#2**	*71.1*	*< 1.0*	**< 71**		*1.9*	**140**	*5.5%*	
		SO-04 Totals		**2.44E+03**			**2.54E+03**		104.1%
24	**SI-05 Probe**	*129.0*	*3.3E+02*	**4.2E+04**	*100.0%*	*2.2E+02*	**2.8E+04**	*96.3%*	*66.4%*
25	**SI-05 IMP#1**	*103.2*	*< 1.0*	**< 103**		*7.7*	**790**	*2.7%*	
26	**SI-05 IMP#2**	*107.8*	*2.9*	313		*11.8*	1300		*415.8%*
	Less Hex Cr spike			1000			1000		
	True SI-05 IMP#2			**<107**			**300**	1.0%	
		SI-05 Totals		**4.2E+04**			**2.91E+04**		69.0%
27	**SO-05 Probe**	*110.3*	*6.2E+01*	**6.8E+03**	*97.7%*	*4.2E+01*	**4.6E+03**	*82.6%*	*67.3%*
28	**SO-05 IMP#1**	*108.5*	*1.5*	**163**	*2.3%*	*7.5*	**810**	*14.5%*	*497.7%*
29	**SO-05 IMP#2**	*110.5*	*< 1.0*	**< 111**		*1.5*	**160**	*2.9%*	
		SO-05 Totals		**7.00E+03**			**5.57E+03**		79.6%
36	**SI-06 Probe**	*129.4*	*4.5E+01*	**5.8E+03**	*98.5%*	*2.1E+01*	**2.8E+03**	*87.0%*	*48.1%*
37	**SI-06 IMP#1**	*89.0*	*1.0*	**89**	*1.5%*	*3.8*	**330**	*10.2%*	*370.8%*
38	**SI-06 IMP#2**	*104.3*	*< 1.0*	**< 104**		*0.3*	**90**	*2.8%*	
		SI-06 Totals		**5.91E+03**			**3.22E+03**		54.5%
33	**SO-06 Probe**	*128.3*	*3.8E+01*	**4.9E+03**	*89.4%*	*2.6E+01*	**3.4E+03**	*80.4%*	*69.7%*
34	**SO-06 IMP#1**	*94.5*	*6.1*	**576**	*10.6%*	*7.8*	**740**	*17.5%*	*128.4%*
35	**SO-06 IMP#2**	*107.0*	*< 1.0*	**< 107**		*0.8*	**90**	*2.1%*	
		SO-06 Totals		**5.45E+03**			**4.23E+03**		77.6%
40	**SI-07 Probe**	*116.6*	*1.6E+03*	**1.9E+05**	*100.0%*	*6.7E+02*	**7.8E+04**	*99.7%*	*40.6%*
41	**SI-07 IMP#1**	*87.9*	*< 1.0*	**< 88**		*3.0E+00*	**2.4E+02**	*0.3%*	
42	**SI-07 IMP#2**	*91.0*	*< 1.0*	**< 91**		*<0.2*	**<18**		
		SI-07 Totals		**1.92E+05**			**7.82E+04**		40.7%

The Limit of Detection (LOD) for Cr by GFAA is 1.0 ng/ml. The LOD for Cr(VI) by IC is 0.2 ng/ml.

SSD Chrome ATCM Support Project

Sigma Electroplating Facility Sampled in January 2003

Metal Results by ICP-MS

All Results Have Been Approved by the Inorganic Laboratory Section

Element-Isotope	Detection Limit	Result	Units	Blank Comp, ng/ml	Site Name	Sampling Date	Duration Hours	Std Sampled Volume (m3)
Arsenic-075	1	1.1	ng/m3	0.3	Sigma	1/8/2003	7.5	4.47
Cobalt-059	1	1.8	ng/m3	0.5	Sigma	1/8/2003	7.5	4.47
Chromium-052	1	1836	ng/m3	512.9	Sigma	1/8/2003	7.5	4.47
Copper-063	1	253	ng/m3	70.7	Sigma	1/8/2003	7.5	4.47
Iron-057	5	10430	ng/m3	2913.9	Sigma	1/8/2003	7.5	4.47
Manganese-055	1	68	ng/m3	19.0	Sigma	1/8/2003	7.5	4.47
Molybdenum-098	1	1.8	ng/m3	0.5	Sigma	1/8/2003	7.5	4.47
Nickel-058	1	3090	ng/m3	863.3	Sigma	1/8/2003	7.5	4.47
Lead-208	1	811	ng/m3	226.6	Sigma	1/8/2003	7.5	4.47
Antimony-121	1	7.2	ng/m3	2.0	Sigma	1/8/2003	7.5	4.47
Tin-120	1	44	ng/m3	12.3	Sigma	1/8/2003	7.5	4.47
Strontium-088	1	23	ng/m3	6.4	Sigma	1/8/2003	7.5	4.47
Zinc-064	1	472	ng/m3	131.9	Sigma	1/8/2003	7.5	4.47
Arsenic-075	0	0	ng/ml		Blank	1/8/2003	none	none
Cobalt-059	0	0	ng/ml		Blank	1/8/2003	none	none
Chromium-052	0	1.9	ng/ml		Blank	1/8/2003	none	none
Copper-063	0	0.6	ng/ml		Blank	1/8/2003	none	none
Iron-057	0	11	ng/ml		Blank	1/8/2003	none	none
Manganese-055	0	0.2	ng/ml		Blank	1/8/2003	none	none
Molybdenum-098	0	0	ng/ml		Blank	1/8/2003	none	none
Nickel-058	0	0.2	ng/ml		Blank	1/8/2003	none	none
Lead-208	0	0.3	ng/ml		Blank	1/8/2003	none	none
Antimony-121	0	0	ng/ml		Blank	1/8/2003	none	none
Tin-120	0	0	ng/ml		Blank	1/8/2003	none	none
Strontium-088	0	0	ng/ml		Blank	1/8/2003	none	none
Zinc-064	0	0.2	ng/ml		Blank	1/8/2003	none	none
Arsenic-075	1	<1.0	ng/m3	#VALUE!	Sigma	1/9/2003	7.5	4.5
Cobalt-059	1	<1.0	ng/m3	#VALUE!	Sigma	1/9/2003	7.5	4.5
Chromium-052	1	131	ng/m3	36.8	Sigma	1/9/2003	7.5	4.5
Copper-063	1	55	ng/m3	15.5	Sigma	1/9/2003	7.5	4.5
Iron-057	5	2153	ng/m3	605.5	Sigma	1/9/2003	7.5	4.5
Manganese-055	1	19	ng/m3	5.3	Sigma	1/9/2003	7.5	4.5
Molybdenum-098	1	<1.0	ng/m3	#VALUE!	Sigma	1/9/2003	7.5	4.5
Nickel-058	1	271	ng/m3	76.2	Sigma	1/9/2003	7.5	4.5
Lead-208	1	42	ng/m3	11.8	Sigma	1/9/2003	7.5	4.5
Antimony-121	1	1.8	ng/m3	0.5	Sigma	1/9/2003	7.5	4.5
Tin-120	1	5.3	ng/m3	1.5	Sigma	1/9/2003	7.5	4.5
Strontium-088	1	5.3	ng/m3	1.5	Sigma	1/9/2003	7.5	4.5
Zinc-064	1	80	ng/m3	22.5	Sigma	1/9/2003	7.5	4.5

Arsenic-075	1	<1.0 ng/m3	#VALUE!	Sigma	1/10/2003	5	2.98
Cobalt-059	1	1.6 ng/m3	0.3	Sigma	1/10/2003	5	2.98
Chromium-052	1	391 ng/m3	72.8	Sigma	1/10/2003	5	2.98
Copper-063	1	155 ng/m3	28.9	Sigma	1/10/2003	5	2.98
Iron-057	5	4164 ng/m3	775.5	Sigma	1/10/2003	5	2.98
Manganese-055	1	52 ng/m3	9.7	Sigma	1/10/2003	5	2.98
Molybdenum-098	1	2.1 ng/m3	0.4	Sigma	1/10/2003	5	2.98
Nickel-058	1	695 ng/m3	129.4	Sigma	1/10/2003	5	2.98
Lead-208	1	122 ng/m3	22.7	Sigma	1/10/2003	5	2.98
Antimony-121	1	7.5 ng/m3	1.4	Sigma	1/10/2003	5	2.98
Tin-120	1	11 ng/m3	2.0	Sigma	1/10/2003	5	2.98
Strontium-088	1	19 ng/m3	3.5	Sigma	1/10/2003	5	2.98
Zinc-064	1	231 ng/m3	43.0	Sigma	1/10/2003	5	2.98
Arsenic-075	1	2.2 ng/m3	0.8	Sigma	1/14/2003	9.6	5.73
Cobalt-059	1	2 ng/m3	0.7	Sigma	1/14/2003	9.6	5.73
Chromium-052	1	346 ng/m3	123.9	Sigma	1/14/2003	9.6	5.73
Copper-063	1	268 ng/m3	96.0	Sigma	1/14/2003	9.6	5.73
Iron-057	5	7099 ng/m3	2542.3	Sigma	1/14/2003	9.6	5.73
Manganese-055	1	71 ng/m3	25.4	Sigma	1/14/2003	9.6	5.73
Molybdenum-098	1	3.9 ng/m3	1.4	Sigma	1/14/2003	9.6	5.73
Nickel-058	1	1010 ng/m3	361.7	Sigma	1/14/2003	9.6	5.73
Lead-208	1	126 ng/m3	45.1	Sigma	1/14/2003	9.6	5.73
Antimony-121	1	11 ng/m3	3.9	Sigma	1/14/2003	9.6	5.73
Tin-120	1	16 ng/m3	5.7	Sigma	1/14/2003	9.6	5.73
Strontium-088	1	22 ng/m3	7.9	Sigma	1/14/2003	9.6	5.73
Zinc-064	1	395 ng/m3	141.5	Sigma	1/14/2003	9.6	5.73
Arsenic-075	1	1.9 ng/m3	0.5	Sigma	1/15/2003	7	4.22
Cobalt-059	1	1.9 ng/m3	0.5	Sigma	1/15/2003	7	4.22
Chromium-052	1	285 ng/m3	75.2	Sigma	1/15/2003	7	4.22
Copper-063	1	192 ng/m3	50.6	Sigma	1/15/2003	7	4.22
Iron-057	5	15127 ng/m3	3989.7	Sigma	1/15/2003	7	4.22
Manganese-055	1	110 ng/m3	29.0	Sigma	1/15/2003	7	4.22
Molybdenum-098	1	25 ng/m3	6.6	Sigma	1/15/2003	7	4.22
Nickel-058	1	1243 ng/m3	327.8	Sigma	1/15/2003	7	4.22
Lead-208	1	67 ng/m3	17.7	Sigma	1/15/2003	7	4.22
Antimony-121	1	15 ng/m3	4.0	Sigma	1/15/2003	7	4.22
Tin-120	1	11 ng/m3	2.9	Sigma	1/15/2003	7	4.22
Strontium-088	1	23 ng/m3	6.1	Sigma	1/15/2003	7	4.22
Zinc-064	1	320 ng/m3	84.4	Sigma	1/15/2003	7	4.22
Arsenic-075	1	<1.0 ng/m3	#VALUE!	Sigma	1/16/2003	6.7	4.02
Cobalt-059	1	1.2 ng/m3	0.3	Sigma	1/16/2003	6.7	4.02
Chromium-052	1	157 ng/m3	39.4	Sigma	1/16/2003	6.7	4.02
Copper-063	1	125 ng/m3	31.4	Sigma	1/16/2003	6.7	4.02
Iron-057	5	3134 ng/m3	787.4	Sigma	1/16/2003	6.7	4.02
Manganese-055	1	45 ng/m3	11.3	Sigma	1/16/2003	6.7	4.02
Molybdenum-098	1	3.2 ng/m3	0.8	Sigma	1/16/2003	6.7	4.02
Nickel-058	1	430 ng/m3	108.0	Sigma	1/16/2003	6.7	4.02
Lead-208	1	47 ng/m3	11.8	Sigma	1/16/2003	6.7	4.02
Antimony-121	1	8 ng/m3	2.0	Sigma	1/16/2003	6.7	4.02
Tin-120	1	30 ng/m3	7.5	Sigma	1/16/2003	6.7	4.02
Strontium-088	1	14 ng/m3	3.5	Sigma	1/16/2003	6.7	4.02
Zinc-064	1	146 ng/m3	36.7	Sigma	1/16/2003	6.7	4.02

Arsenic-075	0	0 ng/ml		Blank	1/17/2003	none	none
Cobalt-059	0	0 ng/ml		Blank	1/17/2003	none	none
Chromium-052	0	1.9 ng/ml		Blank	1/17/2003	none	none
Copper-063	0	1.6 ng/ml		Blank	1/17/2003	none	none
Iron-057	0	5.2 ng/ml		Blank	1/17/2003	none	none
Manganese-055	0	0.1 ng/ml		Blank	1/17/2003	none	none
Molybdenum-098	0	0.1 ng/ml		Blank	1/17/2003	none	none
Nickel-058	0	0.3 ng/ml		Blank	1/17/2003	none	none
Lead-208	0	0 ng/ml		Blank	1/17/2003	none	none
Antimony-121	0	0 ng/ml		Blank	1/17/2003	none	none
Tin-120	0	0.2 ng/ml		Blank	1/17/2003	none	none
Strontium-088	0	0 ng/ml		Blank	1/17/2003	none	none
Zinc-064	0	0 ng/ml		Blank	1/17/2003	none	none

APPENDIX D

Samples of
Chain of Custody Log
and
Chain of Custody Sheets

CALIFORNIA AIR RESOURCES BOARD
MONITORING & LABORATORY DIVISION
P.O. Box 2815, Sacramento, CA 95812

CHAIN OF CUSTODY LOG

Facility: Sigma Plating Co. Inc. Proj. No.: T-01-071a

Proj. Lead: D.Todd Page No.: 1 of 2

	Log #	Sample ID	Date	Time	Comments	Given By	Taken By
1	1	HB-1	1/8/03	1000	Hex Blank (trip) fm D.Taylor	DTodd	D.Taylor
2	2	SB-1	"	"	Sodium Bicarb (trip) blank (outside)	DTodd	
3	3	SI-Ø1-P	1/8/03	1600	First Run-Inlet-Rinses	DTodd	
4	4	SI-Ø1-I1	"	1600	" " " Imp #1	DTodd	
5	5	SI-Ø1-I2	"	1600	" " " Imp #2 & 3	DTodd	↓
6	6	~~PQ~~ #1	1/8/03	1600	PQ-100 Indoor Sample filter	C Clarke	DTodd
7	7	#2	1/8/03	1600	PQ100 Trip Blank	C Clarke	DTodd
8	8	Batt #2	1/8/03	1630	Chrome Tank Sol. to SCAQMD	Shahnia	—
9	9	SI-Ø2-P	1/9/03	1600	2nd Run-Inlet-Rinses	DTodd	D.Taylor
10	10	SI-Ø2-I1	"	"	" " " Imp #1	DTodd	
11	11	SI-Ø2-I2	"	"	" " " Imp #2 & 3	DTodd	
12	12	SI-Ø3-P	1/10/03	1500	3rd Run Inlet-Rinses	DTodd	
13	13	SI-Ø3-I1	1/10/03	"	" " " -Imp #1	"	
14	14	SI-Ø3-I2	"	"	" " " -Imp #2+3 (w/spike)	"	↓
15	15	#3	1/10/03	1600	PQ 100 - 1/9 Sample	C Clarke	D.Todd → D.Taylor
16	16	#4	1/10/03	1600	" " 1/10 "	e clarke	"
17	17	SI-Ø4-P	1/14/03	1730	4th Run Inlet - Rinses	DTodd	DTaylor
18	18	SI-Ø4-I1	"	1730	" " " - Imp #1	"	
19	19	SI-Ø4-I2	"	1730	" " " - Imp #2&3	DTodd	
20	20	SO-Ø4-P	1/14/03	1730	4th Run - Outlet - Rinses	DTodd	
21	21	SO-Ø4-I1	"	"	" " " -Imp #1	"	
22	22	SO-Ø4-I2	"	"	" " " - Imp #2&3	"	↓
23	23	#5	1/14/03	1715	PQ 100 - 1/14/03 Sample #4	Ron H →	D.Todd-B.Rousse
24	24	SI-Ø5-P	1/15/03	1530	5th Run - Inlet - Rinses	DTodd	D.Taylor
25	25	SI-Ø5-I1	"	"	" " " Imp #1	"	
26	26	SI-Ø5-I2	"	"	" " " Imp 2&3	"	
27	27	SO-Ø5-P	1/15/03	1537	5th Run - Outlet - Rinses	DTodd	
28	28	SO-Ø5-I1	"	"	" " " Imp #1	"	
29	29	SO-Ø5-I2	"	"	" " " Imp #2 (spiked) #3	"	↓
30	30	#6	"	1600	PQ 100 Filter Sample # 5	Chris ~~Todd~~	D Todd → B Rousse

CALIFORNIA AIR RESOURCES BOARD
MONITORING & LABORATORY DIVISION
P.O. Box 2815, Sacramento, CA 95812

CHAIN OF CUSTODY LOG

Facility: Sigma Plating Co. Inc. Proj. No.: T-01-071a

Proj. Lead: D.Todd Page No.: 2 of 2

	Log #	Sample ID	Date	Time	Comments	Given By	Taken By
1	31	Filter#7	4/16	1500	Filter #7 PQ100 Run 6	Roth	DTodd → D.Rose
2	32	Filter#8	4/16	1500	Filter #8 Trip Blank PQ100	Roth	"
3	33	SO-06-P	4/16	1500	Run 6 - outlet - Rinses	DTodd	D.Taylor
4	34	SO-06-I1	"	"	" " Imp #1	DTodd	
5	35	SO-06-I2	"	"	" " Imp #2+3	"	
6	36	SI-06-P	4/16/03	1500	Run 6 - Inlet - Rinses	DTodd	
7	37	SI-06-I1	"	"	" " Imp #1	"	
8	38	SI-06-I2	"	"	" " Imp #2+3	"	
9	39	SB-2	4/16/03	1500	Sodium Bicarb Trip Blank week 2	DTodd	
10	40	SI-07-P	4/17/03	1130	Run 7 - Inlet only - Rinses	DTodd	
11	41	SI-07-I1	"	"	" " " Imp #1	"	
12	42	SI-07-I2	"	"	" " " Imp #2+3	"	↓
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

CALIFORNIA AIR RESOURCES BOARD
MONITORING & LABORATORY DIVISION
P.O. Box 2815, Sacramento, CA 95812

CHAIN OF CUSTODY
Hex. Chrome Samples

Proj #: T-01-071a Date: 1/9/03 Time: ~~1000~~ 0945 – 1600
Facility: Sigma Plating
Sample/Run #: SI-02
Log #: _____ Initials: D Todd

SI = Sigma Inlet

ACTION	DATE	TIME	GIVEN BY	TAKEN BY	COMMENTS
Sample Collected	1/9/03	1630	--------	D Todd	
Transfer					
Transfer					
Transfer					
Transfer for Analysis	1/13/03	0600	D Todd	D Taylor	

Log Number	Add'l Sample Numbers	Description	pH Field	pH Lab	Lab Number
9	SI-02 -P	Probe, nozzle, & line rinses (Container 1)	9.0		
10	SI-02-I1	1st Impinger (Container 2)	10.0		
11	SI-02-I2	Remaining Impingers (Container 3)	10.0		

aboratory, return this form to: David Todd, Project Leader

If there are questions call: 916-322-8915

Appendix E

Summary of Observations

Test 1 & 2
Sigma Plating

Dates Tested: 1/9/03, 1/10/03 and 1/14/03 – 1/17/03

Table 1: Freeboard Space, Chromic Acid Concentration and Average Temperature for the Decorative Chromium Plating Tank During Testing

Date	Run	Freeboard (inches)	Chromic Acid Concentration (oz/gal)	Temperature (°F)
1/09/03	SI-O2	3.0 – 3.0	34.4	112-113
1/10/03	SI-O3	3.0 - 2.75	33.96	112
1/17/03	SI-O7	5.0 - 4.9	33.07	109
1/14/03	SI-O4 & SO-O4	5.0 - 5.2	34.18	110
1/15/03	SI-O5 & SO-O5	4.2 – 4.5	32.85	109
1/16/03	SI-O6 & SO-O6	4.5 – 4.5	32.63	109-110

Note:
- Freeboard space was measured at the beginning and end of day
- Chromic acid concentration samples were taken once a day
- Temperature was measured throughout the day

Table 2: Average Amperes & Volts During Plating and Total Ampere-Hours for the Decorative Chromium Plating Tank Tested

Date	Run	Amperes	Volts	Ampere-Hours
1/09/03	SI-O2	5,200 – 6,600	6.75 – 7.5	12,468
1/10/03	SI-O3	5,000 – 6,200	6.5 – 7.5	9,080
1/17/03	SI-O7	2,800 – 6,700	5.4 – 6.8	4,634
1/14/03	SI-O4 & SO-O4	3,400 – 6,200	5.2 – 7.2	6,059
1/15/03	SI-O5 & SO-O5	4,000 – 5,800	6.0 – 6.6	8,874
1/16/03	SI-O6 & SO-O6	3,500 – 6,200	5.8 – 6.2	9,002

Note: Plating amperes varied at the beginning and end of plating as well as with plating of different parts

Table 3: Surface Tension (dynes/cm) Readings at the Beginning and End of Each Day

Date	Sample	Operator Stalagmometer Reading	SCAQMD Stalagmometer Reading	SCAQMD Tensiometer Reading
1/09/03	SI-O2	34.7 - 41.5	40.0 – 43.2	28.4 – 29.5
1/10/03	SI-O3	30.7 - 31.3	29.0 – 32.6	23.6 – 24.9
1/17/03	SI-O7	41.5 - 35.5	40.1 – 40.2	28.5 – 27.6
1/14/03	SI-O4 & SO-O4	32.4 - 35.5	34.8 – 35.5	25.3 – 26.0
1/15/03	SI-O5 & SO-O5	38.7 - 37.8	39.9 – 40.2	27.9 – 28.7
1/16/03	SI-O6 & SO-O6	42.6 - 43.7	43.5 – 44.6	29.7 – 29.0

Additions to the plating solution:

Chromic Acid:
1 barrel (100 lbs) on 1/8/03 evening and air agitated for 45 minutes to mix.
1 barrel (100 lbs) on 1/15/03 morning and air agitated for 45 minutes to mix.
1 barrel (100 lbs) on 1/15/03 evening and air agitated for 45 minutes to mix.

Fume suppressant (Cr 1700):
2000 ml on 1/9/03 evening
1000 ml on 1/15/03 evening
1000 ml on 1/17/03 morning

Surface tension samples were taken from the plating tank using a PVC pipe. The solution was collected in a beaker and brought back to their lab area for surface tension analysis. The specific gravity of the solution was taken once during the source test period on 1/8/03.

The stalagmometer is kept in the lab on a stand. Each time the surface tension readings were taken, the instrument was first cleaned out with de-ionized water.

Changed pre-filters for the HEPA filter on morning of 1/10/03.

According to the facility operator, the pre-filters are changed once a month on a normal basis and sometimes twice a month.

The composite mesh pad sprays every two hours.

Periodically, the operator rinses the plated parts with a hose. Also, the chrome plating line contains 2 chromic acid dip tanks and two chromic acid rinse tanks that are air sparged.

Table 4: Samples Collected for SCAQMD Were Labeled As Follows:

Date	Time of Day	Sample Bottle Labled
1/09/03	Beginning	1-3
1/09/03	End	1-4
1/10/03	Beginning	1-5
1/10/03	End	1-6
1/17/03	Beginning	2-7
1/17/03	End	2-8
1/14/03	Beginning	2-1
1/14/03	End	2-2
1/15/03	Beginning	2-3
1/15/03	End	2-4
1/16/03	Beginning	2-5
1/16/03	End	2-6

Appendix F

Independent Laboratory Surface Tension Results

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 E. Copley Dr., Diamond Bar, CA 91765-4182
MONITORING & ANALYSIS
REPORT OF LABORATORY ANALYSIS

TO Shobna Pandhoh
CARB

LABORATORY NO . 03014-04

REFERENCE NO JM-13-56, 61-65

SAMPLE(S) DESCRIBED AS
-001 bottled labelled 1-1
-002 bottled labelled 1-2
-003 bottled labelled 1-3
-004 bottled labelled 1-4
-005 bottled labelled 1-5
-006 bottled labelled 1-6

DATE SAMPLED 1/10/2003

ANALYSIS ENDED 2/11/2003

SOURCE ID NO unk

REQUESTED BY C Willoughby

PROJECT CARB Surface Tension

SAMPLE SOURCE Unknown

Surface tension in dynes per centimeter by EPA Method 306B,
Fisher Model 20 Surface Tensiometer
Labglass Stalagmometer, 5ml

Samples	Tensiometer	Stalagmometer
1-1	25.5	34.9
1-2	26.8	36.1
1-3	28.4	40.0
1-4	29.5	43.2
1-5	23.6	29.0
1-6	24.9	32.6

Date 6/5/03

Approved by

Rudy Eden, Senior Manager
Laboratory Services
909-396-2391

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 E. Copley Dr., Diamond Bar, CA 91765-4182
MONITORING & ANALYSIS
REPORT OF LABORATORY ANALYSIS

TO Shobna Pandhoh
CARB

LABORATORY NO . 03017-03

REFERENCE NO JM-13-64

SAMPLE(S) DESCRIBED AS
-001 bottled labelled 2-1
-002 bottled labelled 2-2
-003 bottled labelled 2-3
-004 bottled labelled 2-4
-005 bottled labelled 2-5
-006 bottled labelled 2-6
-007 bottled labelled 2-7
-008 bottled labelled 2-8

DATE SAMPLED 1/17/2003

ANALYSIS ENDED 2/11/2003

SOURCE ID NO unk

REQUESTED BY Ron Lem

PROJECT CARB Surface Tension

SAMPLE SOURCE Unknown

Surface tension in dynes per centimeter by EPA Method 306B,
Fisher Model 20 Surface Tensiometer
Labglass Stalagmometer, 5ml

Samples	Tensiometer	Stalagmometer
2-1	25.3	34.8
2-2	26.0	35.5
2-3	27.9	39.9
2-4	28.7	40.2
2-5	29.7	43.5
2-6	29.0	44.6
2-7	28.5	40.1
2-8	27.6	40.2

Date 6/5/03

Approved by

Rudy Eden, Senior Manager
Laboratory Services
909-396-2391

California Environmental Protection Agency

Air Resources Board

SOURCE TEST REPORT

Total and Hexavalent Chromium Emissions
Excello Plating Company, Inc.
Decorative Chromium Plating Tank

MONITORING AND LABORATORY DIVISION
STATIONARY SOURCE TESTING BRANCH

FILE NO: T-03-011

DATE: August 28, 2003

APPROVED:

Christopher Clarke, Project Engineer
Engineering Development and Testing Section

Pat Bennett, Manager
Engineering Development and Testing Section

Manjit Ahuja, Chief
Stationary Source Testing Branch

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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California Environmental Protection Agency
AIR RESOURCES BOARD
Monitoring and Laboratory Division

Total and Hexavalent Chromium Emissions from Excello Plating Co., Inc. Decorative Chromium Plating Tank

I. INTRODUCTION

At the request of the Air Resources Board (ARB) Stationary Source Division (SSD), staff of the Monitoring and Laboratory Division (MLD) performed emissions testing of a decorative chrome electroplating tank operated by Excello Plating Company, Inc. located at 5047 Goodwin Avenue in Los Angeles, California. Emissions tests for total and hexavalent chromium were conducted at the facility over a four-day period from March 4 through March 7, 2003.

II. PROCESS DESCRIPTION

The Excello Plating Company performs decorative chromium plating on a variety of small parts. Excello's decorative chrome plating tank has a capacity of 337 gallons and dimensions of 72 inches in length, 30 inches in width, and 40 inches in depth. The tank is generally operated with a 4-inch freeboard. The plating tank is equipped with its own rectifier and amperage and voltage into the tank varies with the type and area of the parts to be plated. Plating bath temperature is controlled and maintained at approximately 111° F during normal operations. SSD staff periodically collected voltage, amperage, bath temperature, and amp-hour readings for the plating tank during the source test.

The tank is equipped with an independent vent and fan, emitting directly to the atmosphere from a 12-inch diameter stack on the roof.

Emissions from the plating tank are controlled through the use of polyballs and a chemical fume suppressant. The polyballs (ping-pong-sized, hollow, plastic balls) are employed on the surface of the plating solution as a mist control device. The chemical fume suppressant is used in the bath to change the surface tension and reduce chromic acid mist that is generated during plating operations. In addition, the tank is equipped with a collection system comprised of an independent vent and fan. The collection system is used to capture emissions escaping from the surface of the plating tank and direct them out of the facility through 12-inch diameter duct. A smoke test was performed and indicated 100% collection efficiency. No additional controls are used on the exhaust duct.

As specified in the Permit to Operate, electrical usage for the decorative chromium plating tank may not exceed 222,154 ampere-hours per year and the chromic acid concentration of that tank must not exceed 15.3% by weight. The permit also requires daily recording of the amp-hour totalizer meter readings and chromic acid concentration of the tank.

III. EXCELLO PLATING COMPANY CHROMIUM SOURCE TEST

The source test consisted of three individual sample runs collected from the Excello Plating Company's decorative chrome plating tank from March 4 through 7, 2003. ARB Method 425 was used to determine hexavalent and total chromium emissions collected during the source tests. On each of the three days of testing, sampling was conducted continuously over a five to six hour period. During this period, "dummy" parts were placed in the tank and amperage was applied in an on/off cycle to simulate normal plating activities.

The plating tank fumes are collected into a ventilation duct located along one length of the tank. The ventilation duct leads directly to a vent stack located on the roof of the building. Samples were collected from two, 2.5 inch holes cut 90 degrees apart into the vent stack, approximately 2 feet up from the surface of the roof. Each of the three days consisted of one, six hour run using a single sample train. Each sample train was recovered in 3 containers:

- Container 1 - rinses from the nozzle, sample probe, and transfer line;
- Container 2 – first impinger catch;
- Container 3 – second and third impinger catch.

Indoor ambient samples were also collected concurrently during the source test. Staff used a PQ100 sampler set up approximately ten feet from the decorative chrome tank. The samples were collected and analyzed for hexavalent chromium only.

IV. TEST METHODS

A. Source Sampling Procedure

Stack and duct flows were determined by ARB Stationary Source Test Method 1 (velocity traverse), Method 2 (stack velocity and flow rate), Method 3 (stack gas dry molecular weight), and Method 4 (moisture content). For Method 3, atmospheric concentrations of carbon dioxide, nitrogen, and oxygen were used to determine dry molecular weight.

In accordance with Method 1, sampling from each sampling location was conducted at 12 traverse points using 6 sampling points on each diagonal. The sample collection times for each test was approximately 6 hours. However, Run 1

was shortened to coordinate the end of the test with the facility's working normal business hours.

Hexavalent and total chromium samples were collected isokineticaly in accordance with ARB Method 425 (adopted January 22, 1987 and amended August 27, 2002), "Determination of Total Chromium and Hexavalent Chromium Emissions from Stationary Sources." The sampling train configuration consisted of a glass nozzle, a Teflon union, a 48 inch glass-lined stainless steel probe (with attached Pitot tube and thermocouple), a ten-foot Teflon™ line from the probe to the first of two Greenburg-Smith impingers, each containing 100 milliliters of 0.1 normal (N) sodium bicarbonate solution, an empty impinger, a silica gel holder, a 50 foot umbilical line, a vacuum pump, a dry gas meter, and a calibrated orifice connected to an inclined oil manometer. The draft method does not include the use of a filter or heater(s).

Type S pitot tubes bundled with the sampling probes were used to determine stack velocity in accordance with Method 2. The weight of the impinger solution and silica gel were recorded before and after each test in order to obtain the moisture content of the stack gas as required by Method 4. In addition, stack temperature, ambient temperature, and barometric pressure were measured and recorded during each test. Leak checks were performed on each sample train and Pitot tube setup before and after each sample collection.

ARB Method 425 (amended 8/27/2002) incorporates several approved modifications. These include the use of unheated sample lines and probes, the use of 0.1 N sodium bicarbonate impinger solution in place of 0.1 N sodium hydroxide, and the deletion of the post impinger sampling train filter and heater.

The amperage and voltage supplied by the rectifier was monitored and recorded by SSD staff during the source tests. SSD staff also recorded parameters, such as, tank temperature, freeboard space, additons to the tank and totalizer amp-hours. In addition, SSD staff collected samples of the plating bath solution during the source tests. The samples were then analyzed by an independent laboratory to determine plating bath surface tension and chromic acid content.

After sampling, rinses of the sampling train nozzle, probe and transfer line, as well as the catch from the impingers, were recovered into three, 500-ml glass sample jars as previously described. All sample jars were pre-cleaned and tested to ensure the absence of chromium prior to the source test

The pH of the sodium bicarbonate solution used for the probe rinse and impingers was maintained at ≥ 8.0. Additionally, the impinger solution was chilled with ice to 4 °C (39 °F) or less during sample collection. All samples were chilled with ice to 4 °C (39 °F) or less during transport and storage prior to analysis to reduce the conversion of hexavalent chromium to trivalent chromium. During sample retrieval, disposable vinyl gloves were worn to help prevent contamination. At the

conclusion of each sampling week, staff transported the collected samples to the laboratory for analyses.

B. Indoor Ambient Sampling

Indoor ambient samples were collected on 47 mm filters using a PQ100 ambient sampler. The filters were specially treated with sodium bicarbonate in order to preserve sample for analysis of hexavalent chromium. Where possible, indoor ambient samples were collected in parallel with the plating source test. After sampling, the filters were placed back into their storage cassettes using sterile gloves. The filters were then placed back in their original container and returned to the laboratory for analysis with the other samples.

C. Analytical Procedures

The plating tank vent stack emissions were analyzed for both hexavalent and total chromium. The indoor filters were analyzed for hexavalent chromium only. Laboratory analyses for hexavalent and total chromium of the collected source test samples was performed by ARB's Northern Laboratory Branch. Hexavalent chromium (also known as hex chrome, Cr(VI), or Cr^{+6}) was measured using ion chromatography (IC), Method MLD039. The limit of detection (LOD) of the analytical procedure for hexavalent chromium is 0.2 nanograms per milliliter (ng/ml). Total chromium was determined using an atomic absorption/ graphite furnace (GFAA) technique. To deal with the high carbonate fixative concentrations, staff used a variation of Method MLD005. The LOD of the analytical procedure for total chromium is 1.0 ng/ml.

V. QUALITY ASSURANCE / QUALITY CONTROL

To ensure that data collected are consistent, relevant, and defensible, appropriate field and laboratory Quality Assurance (QA) procedures were followed throughout the source test. A detailed explanation of the ARB's standard field and laboratory QA procedures are contained in ARB Quality Assurance manuals, Stationary Source Test Methods, and laboratory SOPs.

As required by ARB Method 425, all surfaces that came into contact with a sample were either glass or Teflon™ and were pre-cleaned using the following procedure:

- the glassware was first washed with detergent;
- soaked with a 10% solution of nitric acid for several hours;
- flushed with liberal amounts of tap water;
- rinsed with de-ionized water;
- rinsed with 0.1 N sodium bicarbonate solution.

To ensure that the sampling equipment was clean and free of chromium contamination, a sample of the final sodium bicarbonate rinse was analyzed for total

chromium (Cr). If any Cr was detected in the final rinse, all sampling equipment were re-cleaned until a sample of the final rinse contained no detectable Cr. In addition, extra pre-cleaned equipment was deployed to ensure that no equipment needed to be re-cleaned or re-used during field sampling.

The sampling console used during the source test was recently calibrated and the Type S pitot tubes used for stack velocity determinations met the required specifications for a baseline coefficient of 0.84 as specified in ARB Method 2. The console assembly, including pitot tubes, passed leak checks before and after each velocity determination. In addition, all sampling train assemblies passed leak checks before and after each test.

Prior to deploying to the field, a blank of the sodium bicarbonate solution used for rinses and impinger solutions was collected and given to the laboratory staff for analysis and correction of field sample results. During the test week, staff collected a field blank of the same sodium bicarbonate solution for analysis with the samples. These blanks are not used to correct laboratory results, but indicate any contamination. In addition, the laboratory created a hexavalent chromium spike in sodium bicarbonate solution that was taken into the field and returned for analysis with the week's samples. The laboratory also created a spike that was added to the second impinger solution of sampling train. Results have been reported with the spiked chromium subtracted out. All spikes were 1000 nanograms from standards developed in accordance with Method MLD039.

All test samples were collected using an iced impinger set. After recovery, samples were stored on ice to maintain their temperature at or below 4 °C (39 °F) as required by ARB Method 425. Collected and recovered samples remained on ice while on site and during transport to the laboratory for analyses. Staff of the Northern Laboratory Branch ensured that the samples were maintained at or below 4 °C (39 °F) while awaiting analysis.

During sample collection and transport, the pH of the sodium bicarbonate solution used for the probe rinse and impinger charging was maintained at $\geq$ 8.0 as required by Method 425. This is necessary to ensure that any collected hexavalent chromium is not reduced to trivalent chromium. The pH of the impinger solutions was checked before sampling, after sample recovery, and during transfer to the laboratory.

Chain of custody was maintained for all collected samples. A chain of custody sheet was prepared for each sample train and a copy of the sheet for run number one is included in Appendix C as an example.

VI. TEST RESULTS

Results of the ARB Method 425 source tests for the Excello Plating Company decorative chromium plating tank are presented in Table VI-1. Indoor Ambient results are presented in Table VI-2.

It should be noted that the isokinetic rates shown in Table VI-I are low. Specifically, run #1 is invalid because the reported isokinetic rate is below 90%. During field testing, the isokinetic rates were determined to be 98%, 101%, and 101% for runs E-1, E-2, and E-3, respectively (see Appendix A). However, during a standard post-test calibration of the sampling system, the dry gas meter was determined to have a significantly lower meter coefficient (originally Ym=1.103, post-test Ym=1.007). Thus, according to Section 5.3.3 of ARB Method 5 (which is the basis for Draft Method 425), "the calculations for the test series shall be performed using whichever meter coefficient value (i.e. before or after) gives the lower of the total sample volume". Thus, the post-test meter coefficient, which provided the lower sample volume, was used. This resulted in lower isokinetic ratios for the final calculated results. Consequently, sample E-1 is not used in the calculation of the average emission factor.

As shown in the results, the measured emission rates averaged 0.89 milligrams per hour for total chromium and 0.85 for hexavalent chromium. Based on the amp-hour totals for each day of testing, these rates resulted in an average emission factor of 3.57E-03 milligrams per amp-hour for total chromium and 3.40E-03 milligrams per amp-hour for hexavalent chromium.

Tables VI-3 presents a summary of the plating tank observations by SSD staff. A further summary of these observations is included in Appendix D. Table VI-4 presents a summary of surface tension data. The surface tension data from the independent lab is included in Appendix E.

Table VI-1

ARB METHOD 425 TEST RESULTS

Excello Plating Company, Inc. Decorative Chrome Plating Tank

Sampling Location	Plating Tank Exhaust			
Sample Number	E-1	E-2	E-3	
Sampling date	03/05/03	03/06/03	03/07/03	
Plating Tank Data				
Totalizer, amp-hours	786	1515	1452	
Production Rate (amp-hrs/hr)	151	252	242	
Stack Data				
Temperature (deg.F)	70.0	70.5	71.3	
Velocity (ft/sec)	23.1	23.1	23.1	
Static Pressure ("H2O)	0.05	0.05	0.05	
Stack Area (sq.ft.)	0.785	0.785	0.785	
Flow Rate (DSCFM)	1064	1068	1064	
Moisture (% of v/v)	0.46	0.23	0.43	
Sampling Data				
Sampling Time (minutes)	312	360	360	
Sample Volume (DSCF)	298.79	356.31	356.11	
Isokinetic Rate (%)	89.8	92.4	92.8	
Chromium Data (ng/sample)				
Total Chromium	4062	6366	3504	
Hexavalent Chromium	3508	6701	2740	
EMISSIONS				Average of Runs E-2 and E-3 *
Concentration (ng/DSCF)				
Total Chromium	13.59	17.866	9.840	**13.85**
Hexavalent Chromium	11.74	18.808	7.693	**13.25**
Emission Rate (mg/hr)				
Total Chromium	0.868	1.145	0.628	**0.887**
Hexavalent Chromium	0.750	1.205	0.491	**0.848**
Emission Factors (mg/amp-hr)				
Total Chromium	**5.74E-03**	**4.54E-03**	**2.60E-03**	**3.57E-03**
Hexavalent Chromium	**4.96E-03**	**4.77E-03**	**2.03E-03**	**3.40E-03**

* Notes: Isokinetic rate for run E-1 was less than 90%.
DSCF = Dry Standard Cubic Feet: DSCFM = DSCF per Minute.

Table VI-2 Excello Plating Company, Inc. Indoor, Ambient Hexavalent Chromium Levels			
Sample Number	E-1-A	E-2-A	E-3-A
Sample Date	3/5/2003	3/6/2003	3/7/2003
Sampling Time (minutes)	405	400	396
Volume Collected (Liters)	4042.2	4012.1	3972.0
Cr (VI) collected (nanograms)	888.6	790.7	421.0
Concentration (ng/m^3)	219.8	197.1	106.0

Table VI-3 Parameters Measured During Testing				
	Date	3/05/03	3/06/03	3/07/03
	Run	E1	E2	E3
Freeboard (inches)		3.75 - 4.25	3.75 - 3.50	4.0 – 4.0
Chromic Acid Concentration (oz/gal)		43.0	45.9	45.3
Temperature (°F)		111.2	110.6	112
Amperes		150	250	250
Volts		3	3	3
Ampere-Hours		786	1,515	1,452

Note:

- Freeboard space was measured at the beginning and end of the day.
- Chromic acid concentration samples were taken once a day.
- Temperature was measured throughout the day.
- Plating amperes varied at the beginning and end of plating as well as with plating of different parts.

Table VI-4 Surface Tension (dynes/cm) Readings Beginning and End of Each Day				
Date	Run	Anachem Lab Reading	SCAQMD Stalagmometer Reading	SCAQMD Tensiometer Reading
3/05/03	E1	26.6	31.5 – 33.8	23.5 – 24.0
3/06/03	E2	26.8	31.3 – 34.9	23.1 – 24.2
3/07/03	E3	25.7	33.9 – 34.0	23.9 – 24.5

Appendix A

Calculated Results and Field Data Sheets

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.:	T-03-011
PROJECT NAME:	Excello Plating
RUN NO.:	1

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	294.17	cubic feet
Vm Meter Cal. Factor	**1.007**	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.5	inches Hg
Avg. delta H Orifice Press. (dH avg):	3.008	inches H2O
Pb + dH avg:	29.72	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.41	/(inches H2O)
Stack Temperature (Ts)	530	deg. R
Static Pressure	0.05	inches H2O
Absolute Stack Pressure (Ps)	29.50	inches Hg
Stack Dimensions	12	inches dia.
Stack Area (As)	0.785	square feet
H2O in Impingers and Silica Gel (Vlc):	29.4	milliliters
Sampling Time (t):	312	minutes
Nozzle Diameter (Dn):	0.38	inches
Total Chromium Mass Collected (Mn):	4062	nanograms
Hexavalent Cr. Mass Collected (Mn):	3508	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	298.79	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.5	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.79	lb/lbmole
Stack Gas Velocity (Vs):	23.09	feet/second
Stack Gas Flow Rate (Qs):	1064	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	**89.8**	**percent**
Total Cr Mass Conc. (Cs):	13.595	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	11.740	nanograms/dscf
Total Cr. Emission Rate (Wm):	0.868	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	0.750	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-03-011
PROJECT NAME: Excello Plating
RUN NO.: 2

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	349.79	cubic feet
Vm Meter Cal. Factor	**1.007**	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.58	inches Hg
Avg. delta H Orifice Press. (dH avg):	3.096	inches H2O
Pb + dH avg:	29.81	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.41	/(inches H2O)
Stack Temperature (Ts)	530	deg. R
Static Pressure	0.05	inches H2O
Absolute Stack Pressure (Ps)	29.58	inches Hg
Stack Dimensions	12	inches dia.
Stack Area (As)	0.785	square feet
H2O in Impingers and Silica Gel (Vlc):	17.4	milliliters
Sampling Time (t):	360.15	minutes
Nozzle Diameter (Dn):	0.38	inches
Total Chromium Mass Collected (Mn):	6366	nanograms
Hexavalent Cr. Mass Collected (Mn):	6701	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	356.31	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.2	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.81	lb/lbmole
Stack Gas Velocity (Vs):	23.08	feet/second
Stack Gas Flow Rate (Qs):	1068	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	**92.4**	**percent**
Total Cr Mass Conc. (Cs):	17.866	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	18.808	nanograms/dscf
Total Cr. Emission Rate (Wm):	1.14	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	1.21	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-03-011
PROJECT NAME: Excello Plating
RUN NO.: 3

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	350.68	cubic feet
Vm Meter Cal. Factor	**1.007**	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.49	inches Hg
Avg. delta H Orifice Press. (dH avg):	3.058	inches H2O
Pb + dH avg:	29.71	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.41	/(inches H2O)
Stack Temperature (Ts)	531	deg. R
Static Pressure	0.05	inches H2O
Absolute Stack Pressure (Ps)	29.49	inches Hg
Stack Dimensions	12	inches dia.
Stack Area (As)	0.785	square feet
H2O in Impingers and Silica Gel (Vlc):	32.5	milliliters
Sampling Time (t):	360	minutes
Nozzle Diameter (Dn):	0.38	inches
Total Chromium Mass Collected (Mn):	3504	nanograms
Hexavalent Cr. Mass Collected (Mn):	2740	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	356.11	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.4	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.79	lb/lbmole
Stack Gas Velocity (Vs):	23.15	feet/second
Stack Gas Flow Rate (Qs):	1064	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	**92.8**	**percent**
Total Cr Mass Conc. (Cs):	9.840	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	7.693	nanograms/dscf
Total Cr. Emission Rate (Wm):	0.628	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	0.491	milligrams/hr Hex. Cr.

FIELD DATA RECORD

PAGE 6 of 9

RUN NO. 1
LOCATION ROOF / DEC CR TANK 1A
DATE 3/5/03
OPERATOR CLARKE / [illegible]
METER BOX NO: 4206
LOCAL TIME 0800
START/STOP 0830

STACK DIAMETER 12 "
Ym: 1.103
H@: 1.526

~150 amps ~30 lb ~110°F

PITOT TUBE FACTOR .84
NOZZLE DIAMETER ~~.375~~ .38 in.
PROBE LENGTH 4 ft.

SAMPLE TRAIN LEAK TEST OK
BEFORE 18.5 in. H_2O -OK
AFTER 15.5 in. H_2O -OK
PITOT TUBE LEAK TEST
BEFORE @ 6.2" -OK AFTER 7.2" -OK

PROJECT NO. T-03-011
PLANT NAME EXCELLO PLATING
AMBIENT TEMP (F) 50°F @ START
METER TEMP (F) 60°F
BAR. PRESS ("Hg) 29.5
STATIC PRESSURE ("H2O) .05 "
ASSUMED MOISTURE (%) ~~0.5~~ 20.5 %
ASSUMED O2 (%) 20.9 %
ASSUMED CO2 (%) 0%
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

Tank Dimensions 72"L x 48"D x 30"W Freeboard = 4" Vol: 72"x(48"-4")x30"

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O)	ORIFICE dH (in. H2O) DESIRED	ORIFICE dH (in. H2O) ACTUAL	TEMPERATURES (F) STACK	PROBE	FILTER AMB	RESIN	IMPGR	PUMP VAC (in. Hg)
START	0	771.75	—	—	—		—	—		—	—
1	13	781.13	0.10	1.8	1.8	65	72	59		56	5.0
1	26	790.90	0.10	1.8	1.8	65	74	61		50	5.0
2	39	801.87	0.14	2.5	2.5	65	72	73		43	6.5
2	52	813.53	0.15	2.7	2.7	66	74	70		44	7.0
3	65	826.11	0.17	3.1	3.1	67	75	76		45	8.0
3	78	838.66	0.17	3.1	3.1	67	79	76		45	8.0
4	91	851.70	0.19	3.4	3.4	66	81	74		46	8.5
4	104	864.88	0.19	3.4	3.4	67	82	75		48	8.5
5	117	—	0.19	3.4	3.4	68	84	73		49	8.5
5	130	891.12	0.20	3.6	3.6	69	83	70		49	9.5
6	143	904.56	0.19	3.4	3.4	70	84	68 ← shade		49	9.0
6	156	917.93	0.19	3.4	3.4	72	86	70		52	9.0
1	169	926.77	0.13	2.4	2.4	72	~~88~~ 85	70		52	4+060
1	182	935.80	0.13	2.4	2.4	72	85	68		52	4+060
2	195	947.98	0.16	2.9	2.9	72	84	69		51	~~7+075~~
2	208	961.42	0.16	2.9	2.9	72	83	70		50	7.5
3	221	973.93	0.16	2.9	2.9	73	86	69		50	7½
3	234	986.28	0.16	2.9	2.9	73	85	71		50	7½
4	247	999.86	0.19	3.4	3.4	73	85	71		50	9
4	260	1012.77	0.18	3.2	3.2	74	86	71		50	8.5
5	273	1026.03	0.19	3.4	3.4	73	85	71		49	8.5
5	286	1039.33	0.19	3.4	3.4	73	85	71		49	8.5
6	299	—	0.19	3.4	3.4	73	84	71		49	8.5
6	312	1065.92	0.19	3.4	3.4	73	84	71		49	8.5
	Theta: 312:04	Vm: 294.17	avg dP: [illegible]		avg dH:	avg Ts					

$\frac{\Delta H}{\Delta P} = 18$

FIELD DATA RECORD

PAGE 1 of 7

RUN NO. 2
LOCATION ROOF / DEC Cr TANK
DATE 3/6/03
OPERATOR CLARKE / Todd
METER BOX NO. 4206
LOCAL TIME 0715
START/STOP 0815/

STACK DIAMETER 12"
Ym: 1.103
H@: 1.526

PITOT TUBE FACTOR .84
NOZZLE DIAMETER ~~.34~~ .38 in.
PROBE LENGTH 4 ft.

SAMPLE TRAIN LEAK TEST
BEFORE 13" in. H_2O - OK
AFTER 16" in. H_2O - OK
PITOT TUBE LEAK TEST
BEFORE 6" - OK AFTER 6" - OK

PROJECT NO. 03-011
PLANT NAME EXCELLO
AMBIENT TEMP (F)
METER TEMP (F) 60F
BAR. PRESS ("Hg) 29.56
STATIC PRESSURE ("H2O) .05
ASSUMED MOISTURE (%) 2.5%
ASSUMED O2 (%) ~~20.9~~ 20.9
ASSUMED CO2 (%) 0
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

NOTE: IMP. #2 HAD SPIKE

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O)	ORIFICE dH (in. H2O) DESIRED	ORIFICE dH (in. H2O) ACTUAL	TEMPERATURES (F) STACK	PROBE	FILTER / AMBIENT	RESIN	IMPGR	PUMP VAC (in. Hg)
START	0	66.21	—	—	—	—	—	—		—	—
1	15	78.05	0.12	1.9	1.9	67	79	62		45	5.5
1	30	89.66	0.14	1.9	1.9	67	79	62		45	5.5
2	45	103.—	0.14	2.5	2.5	67	79	62		45	9.0
2	60	11.6	0.14	2.5	2.5	67	79	62		45	9.0
3	75	131.00	0.16	2.96	3.0	67	80	65		45	10.5
3	90	145.51	0.16	2.96	3.0	67	83	69		44	11
4	105	161.03	0.19	3.5	3.5	67	86	76		45	13.5
4	120	176.54	0.19	2.5	3.5	68	83	80		43	13.5
5	135	193.8	0.20	3.7	3.7	68	84	81		44	14.0
5	150	208.04	0.20	3.7	3.7	69	87	76		44	14.0
6	165	223.90	0.20	3.7	3.7	68	87	76		44	14
6	180	239.53	0.19	3.6	3.6	69	88	74		44	13½
1	195	251.78	0.12	2.3	2.3	71	87	74		47	8
1	210	264.36	0.12	2.3	2.3	71	84	75		47	8½
2	225	278.26	0.15	2.8	2.8	71	83	74		47	10
2	240	292.26	0.15	2.8	2.8	72	83	73		46	10
3	255	306.60	0.16	3.0	3.0	73	84	73		49	11
3	270	320.92	0.16	3.0	3.0	73	85	72		50	11
4	285	336.44	0.19	3.5	3.5	74	86	74		50	14
4	300	352.11	0.19	3.5	3.5	74	88	73		50	14
5	315	368.10	0.20	3.7	3.7	74	88	76		50	15
5	330	384.25	0.20	3.7	3.7	75	86	75		50	15½
6	345	400.18	0.19	3.5	3.5	76	87	75		50	15
6	360	416.00	0.20	3.7	3.7	76	88	76		51	15
	Theta: 360:09	Vm:	avg dP:		avg dH:	avg Ts					

K = 17.5
K = 18.0
K = 18.5

$\frac{\Delta H}{\Delta P}$ = ~~17.5~~ = 18.5

FIELD DATA RECORD

PAGE 1 of 1

RUN NO. 3
LOCATION ROOF/DEC Cr TANK
DATE 3/7/03
OPERATOR CUNNE/TODD
METER BOX NO. 4206
LOCAL TIME 0720
START/STOP 0830/1440

STACK DIAMETER 12"
Ym: 1.103
H@: 1.526

PITOT TUBE FACTOR 0.84
NOZZLE DIAMETER 0.38 in.
PROBE LENGTH 4 ft.

SAMPLE TRAIN LEAK TEST
BEFORE 16.5 in. H_2O -OK
AFTER in. H_2O
PITOT TUBE LEAK TEST
BEFORE 6.5" - OK AFTER 6.6" ok

PROJECT NO. 03-011
PLANT NAME EXCELSIOR PLATING
AMBIENT TEMP (F) 52F @ 7:22
METER TEMP (F) 60F
BAR. PRESS. ("Hg) 29.49
STATIC PRESSURE ("H2O) .05"
ASSUMED MOISTURE (%) .4%
ASSUMED O2 (%) 20.9
ASSUMED CO2 (%) 0
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O)	ORIFICE dH (in. H2O) DESIRED	ORIFICE dH (in. H2O) ACTUAL	CHANNEL TEMPERATURES (F) 1 STACK	2 PROBE	3 ~~FILTER~~ AMBIENT	RESIN	4 IMPGR	PUMP VAC (in. Hg)
START	0	416.27	—	—	—	—	—	—		—	—
1	15	428.75	0.13	2.4	2.4	66	64	53		41	7½
1	30	441.62	0.12	2.2	2.2	67	69	56		41	7
2	45	455.61	0.15	2.8	2.8	67	73	57		40	8½
2	60	470.03	0.15	2.8	2.8	67	75	61		40	8½
3	75	485.15	0.17	3.2	3.2	67	78	63		40	10
3	90	500.38	0.17	3.2	3.2	67	82	65		41	10
4	105	516.00	0.19	3.5	3.5	68	83	69		41	11
4	120	531.72	0.19	3.5	3.5	69	85	71		43	11
5	135	547.41	0.19	3.5	3.5	70	85	75		43	11
5	150	563.10	0.19	3.5	3.5	70	85	76		44	11
6	165	578.7	0.18	3.3	3.3	69	87	20		45	10.5
6	180	594.04	0.19	3.5	3.5	71	88	75		45	11
1	195	606.57	0.12	2.2	2.2	73	88	76		47	7
1	210	619.00	0.12	2.2	2.2	73	87	77		48	7
2	225	632.94	0.15	2.8	2.8	73	87	75		48	8½
2	240	646.99	0.15	2.8	2.8	74	87	75		49	9
3	255	661.47	0.16	3.0	3.0	75	88	75		49	9½
3	270	676.02	0.16	3.0	3.0	75	87	75		49	9½
4	285	690.78	0.18	3.2	3.2	75	88	75		48	10
4	300	705.68	0.18	3.2	3.2	75	88	73		49	10
5	315	721.07	0.19	3.4	3.4	75	88	74		49	10½
5	330	736.36	0.19	3.4	3.4	75	87	75		49	10½
6	345	751.67	0.19	3.4	3.4	75	87	75		49	10½
6	360	766.95	0.20	3.4	3.4	76	87	74		49	10½
	Theta:	Vm:	avg dP:		avg dH:	avg Ts					

$\frac{\Delta H}{\Delta P} = 18.5$

$\frac{\Delta H}{\Delta P} = 18.$

Appendix B

ARB Laboratory Results

Excello Cr^{+6} Results

Sample	Results (ng/mL)	Volume (mL)	Total ng	
Solution Blank	0.000	1.0	0.000	
Trip Blank	0.000	100.7	0.000	
Trip Spike	9.962	109.1	1,086.821	
E-1-P	19.769	108.3	2,140.961	
E-1-1	12.987	101.2	1,314.254	
E-1-2	0.501	105.0	52.553	E1 total = **3507.768**
E-2-P	19.862	120.6	2,395.297	
E-2-1	37.482	105.7	3,961.847	
E-2-2	14.937	90.0	1,344.321	E2 total = **7701.465**
E-2-2 Dup	15.227	90.0	1,847.059	
E-3-P	8.390	121.3	908.605	
E-3-1	17.934	108.3	1,831.082	
E-3-2	0.000	102.1	0.000	E1 total = **2739.686**

AMBIENT	**FILTERS**		**(ng/Filter)**
WBLK031003	0.000	na	0.000
FBLK031003	0.000	na	0.000
SPK031003	0.660	na	9.900
M-5-A	1.015	na	15.224
M-5-B	1.443	na	21.645
M-5-C	1.207	na	18.105
E-1-A	59.562	na	893.430
E-1-A Dup	58.917	na	883.755
E-2-A	52.715	na	790.725
E-3-A	28.069	na	421.035
E-4-A	0.000	na	0.000

EXCELLO PLATING - LABORATORY RESULTS

Total Chromium (Cr) Results for Excello Plating Samples, Set #1, March 2003

Container #	Sample ID	*ml of sample collected*	*Total Cr, ng/ml*	Total Cr, ng recovered
17	**Field Blank**	*100.7*	*< 1.0*	**< 101**
18	**Trip Spike**	*103.8*	*9.3*	**965**
1	**E-01-P**	*108.3*	*22.6*	**2448**
2	**E-01-01**	*101.2*	*14.8*	**1498**
3	**E-01-02**	*105.0*	*1.1*	**116**
6	**E-02-P**	*120.6*	*24.7*	**2979**
7	**E-02-01**	*105.7*	*28.9*	**3055**
8	**E-02-02**	*90.0*	*14.8*	**1332**
11	**E-03-P**	*121.3*	*12.1*	**1468**
12	**E-03-01**	*108.3*	*18.8*	**2036**
13	**E-03-02**	*102.1*	*< 1.0*	**< 102**

The Limit of Detection (LOD) for Cr by GFAA is 1.0 ng/ml.

Matrix modifier for GFAA analyses: 0.05 mg $NH_4H_2PO_4$ + 0.003 mg $Mg(NO_2)_3$ per 5 ul aliquot.

For GFAA 4-point 2nd-coefficent calibration: r = 1.00; low standard = 5.0 ng/ml; high standard = 50.0 ng/ml.

Appendix C

Sample of Chain of Custody Sheets

CALIFORNIA AIR RESOURCES BOARD
MONITORING & LABORATORY DIVISION
P.O. Box 2815, Sacramento, CA 95812

CHAIN OF CUSTODY
Hex. Chrome Samples

Proj #: T-03-011 Date: 3/05/03 Time: _____
Facility: EXCELLO Plating
Sample/Run #: #1
Log #: 1, 2, 3 Initials: CLC

ACTION	DATE	TIME	GIVEN BY	TAKEN BY	COMMENTS
Sample Collected	3/5/03	3:30	———	C. Clarke	
Transfer	3/5/03	3:31	C Clarke	D Todd	
Transfer					
Transfer					
Transfer for Analysis	3/10	0740	D Todd	D Taylor	For Analysis

Log Number	Add'l Sample Numbers	Description	pH Field	pH Lab	Lab Number
01	E-1 -P	Probe, nozzle, & line rinses (Container 1)	9		
02	E-1 -1	1st Impinger (Container 2)	9-10		
03	E-1 -2	Remaining Impingers (Container 3)	9-10		

aboratory, return this form to: CHRIS CLARKE, Project Leader

If there are questions call: 916-322-2411

Appendix D

Summary of Plating Tank Observations

Test 3
Excello Plating

Dates Tested: 3/05/03 – 3/07/03

Table 1: Parameters Measured During Testing

	Date	3/05/03	3/06/03	3/07/03
	Run	E1	E2	E3
Freeboard (inches)		3.75 - 4.25	3.75 - 3.50	4.0 – 4.0
Chromic Acid Concentration (oz/gal)		43.0	45.9	45.3
Temperature (°F)		111.2	110.6	112
Amperes		150	250	250
Volts		3	3	3
Ampere-Hours		786	1,515	1,452

Note:

- Freeboard space was measured at the beginning and end of day
- Chromic acid concentration samples were taken once a day
- Temperature was measured throughout the day
- Plating amperes varied at the beginning and end of plating as well as with plating of different parts

Table 2: Surface Tension (dynes/cm) Readings Beginning and End of Each Day

Date	Run	Anachem Lab Reading	SCAQMD Stalagmometer Reading	SCAQMD Tensiometer Reading
3/05/03	E1	26.6	31.5 – 33.8	23.5 – 24.0
3/06/03	E2	26.8	31.3 – 34.9	23.1 – 24.2
3/07/03	E3	25.7	33.9 – 34.0	23.9 – 24.5

The abatement order requires the facility to have 100% polyball coverage. This was maintained throughout the source test period.

History:
In February 2003, the facility started plating again. They had temporarily shut down the plating operation due to a fire during the 4th of July weekend in 2002. The facility purchased a new tank at that time for their decorative chromium plating and is using the same plating solution. The last lab analysis shows the chromic acid concentration in June, 2002 to be 45 oz/gal and the surface tension of the solution to be 26.7 dynes/cm. In July, 2002 the chromic acid concentration was the same.

During the test, the first day 150 Amperes were used to plate the dummy parts. The second and third day of testing, 250 Amperes were used.

The dummy parts were provided by the facility and there were two rectangular parts measuring 34 inches in length and 3 inches in width.

During most of the test, the dummy parts were being plated. There were some parts that the facility operator plated during the source test.

The facility does not have a lab in house, an outside lab was contracted to perform chromic acid concentration and surface tension testing during the test.

Table 3: Samples Collected For SCAQMD Were Labeled As Follows:

Date	Time of Day	Sample Bottle Labled
3/05/03	Beginning	E1-1
3/05/03	End	E1-2
3/06/03	Beginning	E1-3
3/06/03	Beginning	E1-3
3/07/03	End	E1-4
3/07/03	End	E1-6

Appendix E

Independent Laboratory Surface Tension
&
Chromic Acid Concentration Results

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 E. Copley Dr., Diamond Bar, CA 91765-4182

MONITORING & ANALYSIS
REPORT OF LABORATORY ANALYSIS

TO Shobna Pandhoh
CARB

LABORATORY NO. 03084-09

REFERENCE NO JM-13-74

SAMPLE(S) DESCRIBED AS

DATE SAMPLED 3/21/2003

-001 bottled labelled E1-1
-002 bottled labelled E1-2
-003 bottled labelled E1-3
-004 bottled labelled E1-4
-005 bottled labelled E1-5
-006 bottled labelled E1-6

DATE ANALYZED 4/3/2003

SOURCE ID NO unknown

REPORT TO Carey Willoughby

SAMPLE SOURCE Unknown

Surface tension in dynes per centimeter by EPA Method 306B,
Fisher Model 20 Surface Tensiometer
Labglass Stalagmometer, 5ml

Samples	Tensiometer	Stalagmometer
-001	23.5	31.5
-002	24.0	33.8
-003	23.1	31.3
-004	24.2	34.9
-005	23.9	33.9
-006	24.5	34.0

Date 4/5/03

Approved by

Rudy Eden, Senior Manager
Laboratory Services
909-396-2391

ANACHEM LABORATORIES

Established 1948

130 Penn Street · El Segundo, California 90245.3907 · voice 310.322.4993 · fax 310 322.6681

EXCELLO PLATING
4057 Goodwin Ave.
Los Angeles, CA 90039

ATTN: Joyce

DATE March 18, 2003
LAB NO. A88091 pg.1
CUST P.O. MEMO/JOYCE
SAMPLE (S) Solutions
RECEIVED 3-12-03/74412

SAMPLE DATE: 3-5-03

DECORATIVE CHROMIUM: 430 GAL

Chromic Acid	43.0	oz/gal
Sulfate	0.32	oz/gal
Ratio	134/1	
Surface tension	26.6	dynes/cm

N. Krishnan, Ph.D.
Laboratory Director

ANACHEM LABORATORIES

Established 1948

130 Penn Street · El Segundo, California 90245.3907 · voice 310.322.4993 · fax 310 322.6681

EXCELLO PLATING
4057 Goodwin Ave.
Los Angeles, CA 90039

ATTN: Joyce

DATE March 18, 2003
LAB NO. A86091 pg.2
CUST P.O. MEMO/JOYCE
SAMPLE (S) Solutions
RECEIVED 3-12-03/74412

SAMPLE DATE: 3-6-03

DECORATIVE CHROMIUM: 430 GAL

Chromic Acid	45.9	oz/gal
Sulfate	0.32	oz/gal
Ratio	143/1	
Surface tension	26.8	dynes/cm

N. Krishnan, Ph.D.
Laboratory Director

ANACHEM LABORATORIES

Established 1948

130 Penn Street • El Segundo, California 90245.3907 • voice 310.322.4993 • fax 310 322.6681

EXCELLO PLATING
4057 Goodwin Ave.
Los Angeles, CA 90039

ATTN: Joyce

DATE March 18, 2003
LAB NO. A88091 pg.3
CUST P.O. MEMO/JOYCE
SAMPLE (S) Solutions
RECEIVED 3-12-03/74412

SAMPLE DATE: 3-7-03

DECORATIVE CHROMIUM: 430 GAL

Chromic Acid	45.3	oz/gal
Sulfate	0.33	oz/gal
Ratio	137/1	
Surface tension	25.7	dynes/cm

N. Krishnan, Ph.D.
Laboratory Director

California Environmental Protection Agency

Air Resources Board

SOURCE TEST REPORT

Total and Hexavalent Chromium Emissions
Van Nuys Plating, Inc.
Decorative Chromium Plating Tank

MONITORING AND LABORATORY DIVISION
STATIONARY SOURCE TESTING BRANCH

FILE NO: T-03-019

DATE: August 28, 2003

APPROVED:

Christopher Clarke, Project Engineer
Engineering Development and Testing Section

Pat Bennett, Manager
Engineering Development and Testing Section

Manjit Ahuja, Chief
Stationary Source Testing Branch

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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California Environmental Protection Agency
AIR RESOURCES BOARD
Monitoring and Laboratory Division

Total and Hexavalent Chromium Emissions from Van Nuys Plating, Inc. Decorative Chromium Plating Tank

I. INTRODUCTION

At the request of the Air Resources Board (ARB) Stationary Source Division (SSD), staff of the Monitoring and Laboratory Division (MLD) performed emissions testing of a decorative chrome electroplating tank operated by Van Nuys Plating, Inc. located at 6109 Vesper Avenue in Van Nuys, California. Emissions tests for total and hexavalent chromium were conducted at the facility over a four-day period from April 8 through April 11, 2003.

II. PROCESS DESCRIPTION

The Van Nuys Plating Company, Inc. performs decorative chromium plating on a variety of small parts. Van Nuys Plating's decorative chrome plating tank has a capacity of 400 gallons and dimensions of 70 inches in length, 29 inches in width, and 49 inches in depth. The tank is generally operated with a 3 to 3.5 inch freeboard. The plating tank is equipped with its own amp-hr totalizer. Amperage and voltage into the tank varies with the type and area of the parts to be plated. Plating bath temperature is controlled and maintained at approximately 81° F during normal operations. SSD staff periodically collected voltage, amperage, bath temperature, and amp-hour readings during the source test.

Emissions from the plating tank are controlled through the use of a chemical fume suppressant. The chemical fume suppressant is used in the bath to change the surface tension and reduce chromic acid mist that is generated during plating operations. The tank is equipped with a fume collection system, which connects to a 12 inch vertical, fiberglass vent stack which exits through the roof to the sample point. This stack then manifolds into a larger, horizontal duct that collects the vented emissions from other (non-chromic acid) tanks. The emissions are sent to a water scrubber before venting to atmosphere. Smoke tests conducted during the source test indicated that the collection efficiency was compromised by a swamp cooler blowing outdoor air down onto the tank surface. Using the smoke test, the collection efficiency was estimated to be about 60 to 70 percent efficient.

III. VAN NUYS PLATING, INC. CHROMIUM SOURCE TEST

The source test consisted of three individual sample runs collected from the Van Nuys Plating, Inc.'s decorative chrome plating tank from April 8 through 11, 2003. ARB Method 425 was used to determine hexavalent and total chromium emissions collected during the source tests. On each of the three days of testing, sampling was conducted continuously over a five to six hour period. During this period, "dummy" parts were placed in the tank and amperage was applied in an on/off cycle to simulate plating activities. This was done in addition to the normal plating production at the facility in order to ensure sufficient Amp-hours and hexavalent Chromium emissions for the laboratory to have adequate samples.

The plating tank fumes are collected into a ventilation duct located along one length of the tank. The ventilation duct leads directly to a vent stack located on the roof of the building. Samples were collected from two 3 inch holes cut 90 degrees apart into the vertical vent stack, approximately 12 inches up from the surface of the roof. Each of the three days consisted of one, five to six hour run using a single sample train. Each sample train was recovered in 3 containers:

- Container 1 - rinses from the nozzle, sample probe, and transfer line;
- Container 2 – first impinger catch;
- Container 3 – second and third impinger catch.

Indoor ambient samples were also collected concurrently during the source test. Staff used a PQ100 sampler set up 5 feet above and two feet behind the inlet to the chrome tank's ventilation hood. The samples were collected and analyzed for hexavalent chromium only.

IV. TEST METHODS

A. Source Sampling Procedure

Stack and duct flows were determined by ARB Stationary Source Test Method 1 (velocity traverse), Method 2 (stack velocity and flow rate), Method 3 (stack gas dry molecular weight), and Method 4 (moisture content). For Method 3, atmospheric concentrations of carbon dioxide, nitrogen, and oxygen were used to determine dry molecular weight.

In accordance with Method 1, sampling from each sampling location was conducted at 12 traverse points using 6 sampling points on each diagonal. The sample collection times for each test was approximately 6 hours. However, Run 1 was shortened to coordinate the end of the test with the facility's working normal business hours.

Hexavalent and total chromium samples were collected isokineticaly in accordance with ARB Method 425 (adopted January 22, 1987, amended August 27, 2002), "Determination of Total Chromium and Hexavalent Chromium Emissions from Stationary Sources." The sampling train configuration consisted of a glass nozzle, a Teflon union, a 48 inch glass-lined stainless steel probe (with attached Pitot tube and thermocouple), a ten-foot Teflon™ line from the probe to the first of two Greenburg-Smith impingers, each containing 100 milliliters of 0.1 normal (N) sodium bicarbonate solution, an empty impinger, a silica gel holder, a 50 foot umbilical line, a vacuum pump, a dry gas meter, and a calibrated orifice connected to an inclined oil manometer. The draft method does not include the use of a filter or heater(s).

Type S pitot tubes bundled with the sampling probes were used to determine stack velocity in accordance with Method 2. The weight of the impinger solution and silica gel were recorded before and after each test in order to obtain the moisture content of the stack gas as required by Method 4. In addition, stack temperature, ambient temperature, and barometric pressure were measured and recorded during each test. Leak checks were performed on each sample train and Pitot tube setup before and after each sample collection.

Several approved modifications in ARB Method 425 (amended 8/27/02) were implemented during this source test. These included the use of unheated sample lines and probes, the use of 0.1 N sodium bicarbonate impinger solution in place of 0.1 N sodium hydroxide, and the deletion of the post impinger sampling train filter and heater.

The amperage and voltage supplied by the rectifier was monitored and recorded by SSD staff during the source tests. SSD staff also recorded parameters, such as, tank temperature, freeboard space, additions to the tank and totalizer amp-hours. In addition, SSD staff collected samples of the plating bath solution during the source tests. The samples were then analyzed by an independent laboratory to determine plating bath surface tension and chromic acid content.

After sampling, rinses of the sampling train nozzle, probe and transfer line, as well as the catch from the impingers, were recovered into three, 500-ml glass sample jars as previously described. All sample jars were pre-cleaned and tested to ensure the absence of chromium prior to the source test.

The pH of the sodium bicarbonate solution used for the probe rinse and impingers was maintained at ≥ 8.0. Additionally, the impinger solution was chilled with ice to 4 °C (39 °F) or less during sample collection. All samples were chilled with ice to 4 °C (39 °F) or less during transport and storage prior to analysis to reduce the conversion of hexavalent chromium to trivalent chromium. During sample retrieval, disposable vinyl gloves were worn to help prevent contamination. At the conclusion of the sampling week, staff transported the

collected samples to the laboratory for analyses. The analytical results are presented in Table VI-I.

B. Indoor Ambient Sampling

Indoor ambient samples were collected on 47 mm filters using a PQ100 ambient sampler. The filters were specially treated with sodium bicarbonate in order to preserve sample for analysis of hexavalent chromium. Where possible, indoor ambient samples were collected in parallel with the plating source test. After sampling, the filters were placed back into their storage cassettes using sterile gloves. The filters were then placed back in their original container and returned to the laboratory for analysis with the other samples.

C. Analytical Procedures

The plating tank vent stack emissions were analyzed for both hexavalent and total chromium. The indoor filters were extracted into a solution and analyzed for hexavalent chromium only, using the same procedure as the stack samples. Laboratory analyses for hexavalent and total chromium of the collected source test samples was performed by ARB's Northern Laboratory Branch. Hexavalent chromium (also known as hex chrome, Cr(VI), or Cr^{+6}) was measured using ion chromatography (IC), Method MLD039. The limit of detection (LOD) of the analytical procedure for hexavalent chromium is 0.2 nanograms per milliliter (ng/ml). Total chromium was determined using an atomic absorption/ graphite furnace (GFAA) technique. To deal with the high carbonate fixative concentrations, staff used a variation of Method MLD005. The LOD of the analytical procedure for total chromium is 1.0 ng/ml.

V. QUALITY ASSURANCE / QUALITY CONTROL

To ensure that data collected are consistent, relevant, and defensible, appropriate field and laboratory Quality Assurance (QA) procedures were followed throughout the source test. A detailed explanation of the ARB's standard field and laboratory QA procedures are contained in ARB Quality Assurance manuals, Stationary Source Test Methods, and laboratory SOPs.

As required by ARB Method 425 (amended 8/27/02), all surfaces that came into contact with a sample were either glass or Teflon™ and were pre-cleaned using the following procedure:

- the glassware was first washed with detergent;
- soaked with a 10% solution of nitric acid for several hours;
- flushed with liberal amounts of tap water;
- rinsed with de-ionized water;
- finally, the glassware was rinsed with 0.1 N sodium bicarbonate solution.

To ensure that the sampling equipment was clean and free of chromium contamination, a sample of the final sodium bicarbonate rinse was analyzed for total chromium (Cr). If any Cr was detected in the final rinse, all sampling equipment were re-cleaned until a sample of the final rinse contained no detectable Cr. In addition, extra pre-cleaned equipment was deployed to ensure that no equipment needed to be re-cleaned or re-used during field sampling.

The sampling console used during the source test was calibrated the week prior to testing and the Type S pitot tubes used for stack velocity determinations met the required specifications for a baseline coefficient of 0.84 as specified in ARB Method 2. The console assembly, including pitot tubes, passed leak checks before and after each velocity determination. In addition, all sampling train assemblies passed leak checks before and after each test.

Prior to deploying to the field, a blank of the sodium bicarbonate solution used for rinses and impinger solutions was collected and given to the laboratory staff for analysis and correction of field sample results. During the test week, staff collected a field blank of the same sodium bicarbonate solution for analysis with the samples. These blanks are not used to correct laboratory results, but indicate any contamination. In addition, the laboratory created a hexavalent chromium spike in sodium bicarbonate solution that was taken into the field and returned for analysis with the week's samples. The laboratory also created a spike that was added to the second impinger solution of the sampling train used on run #V-3. Results have been reported with the spiked chromium subtracted out. All spikes were 1000 nanograms from standards developed in accordance with Method MLD039.

All test samples were collected using an iced impinger set. After recovery, samples were stored on ice to maintain their temperature at or below 4 °C (39 °F) as required by Method 425. Collected and recovered samples remained on ice while on site and during transport to the laboratory for analyses. Staff of the Northern Laboratory Branch ensured that the samples were maintained at or below 4 °C (39 °F) while awaiting analysis.

During sample collection and transport, the pH of the sodium bicarbonate solution used for the probe rinse and impinger charging was maintained at ≥ 8.0 as required by Method 425. This is necessary to ensure that any collected hexavalent chromium is not reduced to trivalent chromium. The pH of the impinger solutions was checked before sampling and after sample recovery using pH indicator strips.

Chain of custody was maintained for all collected samples. A chain of custody sheet was prepared for each sample train and a copy of the sheet for run #3 included in Appendix C, as an example.

VI. TEST RESULTS

Results of the ARB Method 425 source tests for the Van Nuys Plating decorative chrome plating tank are presented in Table VI-1. As shown in the results, the measured emission rates averaged 21.67 and 19.25 milligrams per hour for total chromium and hexavalent chromium, respectively. Based on the amp-hour totals for each day of testing, these rates resulted in an average emission factor of 0.178 milligrams per amp-hour for total chromium and 0.159 milligrams per amp-hour for hexavalent chromium.

Indoor Ambient results are presented in Table VI-2. Table VI-3 presents a summary of the plating tank observations by SSD staff. A further summary of these observations is included in Appendix D. Table VI-4 presents a summary of surface tension data. The surface tension data from the independent lab is included in Appendix E.

Table VI-1
ARB METHOD 425 TEST RESULTS
Van Nuys Plating Company - Decorative Chrome Plating Tank

Sampling Location	Plating Tank Exhaust			
Sample Number	V-1	V-2	V-3	
Sampling date	04/09/03	04/10/03	04/11/03	
Plating Tank Data				
Totalizer, amp-hours	669	819	781	
Production Rate (amp-hrs/hr)	112	123	130	
Stack Data				
Temperature (deg.F)	77.8	74.0	70.9	
Velocity (ft/sec)	16.3	16.5	16.5	
Static Pressure ("H2O)	-0.98	-0.98	-0.98	
Stack Area (sq.ft.)	0.785	0.785	0.785	
Flow Rate (DSCFM)	728	743	756	
Moisture (% of v/v)	0.69	1.05	1.42	
Sampling Data				
Sampling Time (minutes)	360	400	360	
Sample Volume (DSCF)	260.94	293.17	279.10	
Isokinetic Rate (%)	99.3	98.5	102.3	
Chromium Data (ng/sample)				
Total Chromium	1.10E+05	1.68E+05	1.30E+05	
Hexavalent Chromium	1.05E+05	1.46E+05	1.11E+05	
EMISSIONS				Averages
Concentration (ng/DSCF)				
Total Chromium	421.1	573.2	464.7	**486.3**
Hexavalent Chromium	402.2	497.0	397.4	**432.2**
Emission Rate (mg/hr)				
Total Chromium	18.40	25.54	21.08	**21.67**
Hexavalent Chromium	17.57	22.14	18.03	**19.25**
Emission Factors (mg/amp-hr)				
Total Chromium	**0.165**	**0.208**	**0.162**	**0.178**
Hexavalent Chromium	**0.158**	**0.180**	**0.139**	**0.159**

DSCF = Dry Standard Cubic Feet: DSCFM = DSCF per Minute.

Table VI-2 Van Nuys Plating Company, Inc. Indoor, Ambient Hexavalent Chromium Levels					
Sample Number	V-2A	V-3A	V-4A	V-5A	V-6A
Sample Date	4/9/2003	4/9/2003	4/10/2003	4/10/2003	4/11/2003
Sampling Time (minutes)	77	123	400	396	328
Volume Collected (Liters)	791.4	1264.1	4130.7	4128.6	3387.2
Cr (VI) collected (nanograms)	3.0	9.4	15.2	0.7	13.7
Concentration (ng/m^3)	3.8	7.4	3.7	0.7	4.1
Daily averages	5.6		2.2		4.1

Table VI-3 Parameters Measured During Testing				
	Date	3/05/03	3/06/03	3/07/03
	Run	E1	E2	E3
Freeboard (inches)		3.25 – 3.25	3.0 – 3.2	3.1 – 3.1
Chromic Acid Concentration (oz/gal)		21.7	21.3	21.1
Temperature (°F)		78.8 – 80.2	80.8 – 81.3	82.5 – 83.2
Amperes		850 – 250	850 – 250	850 – 250
Volts		12	12	12
Ampere-Hours		669	819	781

Note:

- Freeboard space was measured at the beginning and end of the day.
- Chromic acid concentration samples were taken once a day.
- Temperature was measured throughout the day.
- Plating amperes varied at the beginning and end of plating as well as with plating of different parts.

Table VI-4 Surface Tension (dynes/cm) Readings Beginning and End of Each Day				
Date	Run	Operator Stalagmometer Reading	SCAQMD Stalagmometer Reading	SCAQMD Tensiometer Reading
4/09/03	V1	37.12	54.6 – 56.1	31.0 – 31.8
4/10/03	V2	27.4 – 33.4	45.8 – 46.2	26.7 – 26.0
4/11/03	V3	32.12 – 33.4	43.6 – 41.2	27.3 – 28.3

Appendix A

Calculated Results and Field Data Sheets

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-03-019
PROJECT NAME: Van Nuys Plating
RUN NO.: 1

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	260.36	cubic feet
Vm Meter Cal. Factor	1.006	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.23	inches Hg
Avg. delta H Orifice Press. (dH avg):	1.722	inches H2O
Pb + dH avg:	29.36	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.28	/(inches H2O)
Stack Temperature (Ts)	538	deg. R
Static Pressure	-0.98	inches H2O
Absolute Stack Pressure (Ps)	29.16	inches Hg
Stack Dimensions	12	inches dia.
Stack Area (As)	0.785	square feet
H2O in Impingers and Silica Gel (Vlc):	38.7	milliliters
Sampling Time (t):	360	minutes
Nozzle Diameter (Dn):	0.38	inches
Total Chromium Mass Collected (Mn):	1.0989E+05	nanograms
Hexavalent Cr. Mass Collected (Mn):	1.0496E+05	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	260.94	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.7	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.76	lb/lbmole
Stack Gas Velocity (Vs):	16.26	feet/second
Stack Gas Flow Rate (Qs):	728	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	99.3	percent
Total Cr Mass Conc. (Cs):	421.124	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	402.214	nanograms/dscf
Total Cr. Emission Rate (Wm):	18.400	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	17.574	milligrams/hr Hex. Cr.

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-03-019
PROJECT NAME: Van Nuys Plating
RUN NO.: 2

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	292.44	cubic feet
Vm Meter Cal. Factor	1.006	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.24	inches Hg
Avg. delta H Orifice Press. (dH avg):	1.694	inches H2O
Pb + dH avg:	29.36	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.29	/(inches H2O)
Stack Temperature (Ts)	534	deg. R
Static Pressure	-0.98	inches H2O
Absolute Stack Pressure (Ps)	29.17	inches Hg
Stack Dimensions	12	inches dia.
Stack Area (As)	0.785	square feet
H2O in Impingers and Silica Gel (Vlc):	66	milliliters
Sampling Time (t):	400	minutes
Nozzle Diameter (Dn):	0.38	inches
Total Chromium Mass Collected (Mn):	1.6804E+05	nanograms
Hexavalent Cr. Mass Collected (Mn):	1.4572E+05	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	293.17	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.0	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.72	lb/lbmole
Stack Gas Velocity (Vs):	16.52	feet/second
Stack Gas Flow Rate (Qs):	743	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	98.5	percent
Total Cr Mass Conc. (Cs):	573.188	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	497.038	nanograms/dscf
Total Cr. Emission Rate (Wm):	25.538	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	22.145	milligrams/hr Hex. Cr.

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: T-03-019
PROJECT NAME: Van Nuys Plating
RUN NO.: 3

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	278.295	cubic feet
Vm Meter Cal. Factor	1.006	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.24	inches Hg
Avg. delta H Orifice Press. (dH avg):	1.840	inches H2O
Pb + dH avg:	29.38	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.29	/(inches H2O)
Stack Temperature (Ts)	531	deg. R
Static Pressure	-0.98	inches H2O
Absolute Stack Pressure (Ps)	29.17	inches Hg
Stack Dimensions	12	inches dia.
Stack Area (As)	0.785	square feet
H2O in Impingers and Silica Gel (Vlc):	85.4	milliliters
Sampling Time (t):	360	minutes
Nozzle Diameter (Dn):	0.38	inches
Total Chromium Mass Collected (Mn):	1.2968E+05	nanograms
Hexavalent Cr. Mass Collected (Mn):	1.1091E+05	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	279.10	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.4	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.68	lb/lbmole
Stack Gas Velocity (Vs):	16.79	feet/second
Stack Gas Flow Rate (Qs):	756	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	102.3	percent
Total Cr Mass Conc. (Cs):	464.654	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	397.406	nanograms/dscf
Total Cr. Emission Rate (Wm):	21.080	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	18.029	milligrams/hr Hex. Cr.

FIELD DATA RECORD

RUN NO. V-1
LOCATION [illegible] Tank Exh
DATE Apr 9, 2003
OPERATOR Don Ridgley/D [illegible]
METER BOX NO. 4204
LOCAL TIME 08:33
START/STOP

STACK DIAMETER 12.0"
Ym: 1.006
H@: 1.752

PITOT TUBE FACTOR 0.84
NOZZLE DIAMETER 0.380 in.
PROBE LENGTH 4 ft.

SAMPLE TRAIN LEAK TEST
BEFORE 15 in. H_2O OK
AFTER 15 in. H_2O OK
PITOT TUBE LEAK TEST
BEFORE 4.5" AFTER 4.2"

PAGE of
PROJECT NO. T-03-019
PLANT NAME Van Nuys Plating
AMBIENT TEMP (F)
METER TEMP (F) 60F
BAR. PRESS ("Hg) 29.27
STATIC PRESSURE ("H2O) -.98
ASSUMED MOISTURE (%) <1%
ASSUMED O2 (%) 20.9
ASSUMED CO2 (%) <1
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (In. H2O)	ORIFICE dH (In. H2O) DESIRED	ACTUAL	TEMPERATURES (F) STACK	PROBE	~~FILTER~~ Amb	RESIN	IMPGR	PUMP VAC (In. Hg)
START	0	800.05	—	—	—	—	—	—	—	—	—
NW 1	18	809.480	0.04	0.84	0.84	69	67	70		47	3.0
2	36	827.15	0.19	4.0	4.0	71	68	72		44	14.5
3	54	841.27	0.07	1.4	1.4	72	71	74		45	4.5
4	72	854.24	0.08	~~1.5~~ 1.7	~~1.5~~ 1.7	73	73	76		45	4.5
5	90	868.35	0.09	1.9	1.9	74	76	77		46	6.0
6	108	880.17	0.06	1.25	1.25	75	83	76		47	4.0
7	120	887.81	0.06	1.25	1.25	75	88	79		48	4.0
8	138	899.73	0.07	1.45	1.4	76	91	82		50	4.0
9	156	911.78	0.07	1.45	1.5	76	91	81		46	4.0
10	174	923.03	0.06	1.25	1.25	77	93	84		47	3.5
~~7~~	~~180~~	~~926.96~~	~~0.06~~	~~1.25~~	~~1.25~~	~~78~~	~~92~~	~~82~~	~~—~~	~~47~~	~~4.0~~
SW 1	198	940.10	0.10	2.1	2.1	80	87	83		47	6.0
2	216	954.29	0.08	1.7	1.7	81	89	84		48	5.0
3	234	968.67	0.10	2.1	2.1	80	90	85		50	6.0
4	252	982.34	0.09	1.9	1.9	81	90	84		49	5.5
5	270	993.72	0.06	1.25	1.25	82	90	85		51	4.0
6	288	1006.42	0.08	1.7	1.7	82	91	85		50	5.0
7	306	1019.31	0.08	1.7	1.7	83	91	84		50	5.0
8	324	1030.32	0.08	1.7	1.7	82	92	84		54	5
9	342	1046.80	0.09	1.9	1.9	82	90	86		50	5.5
10	360	1060.41	0.09	1.9	1.9	83	91	87		51	5.5

--- : NW Point 7 only 12 instead of 18 min. 6 min added after NW10 line — 7 — is 21st line of 20 count Averages. —— It's should not be used when determining averages for dP, dH or Ts

Theta: Vm: avg ✓dP: avg dH: avg Ts

FIELD DATA RECORD

PAGE 1 of 1

RUN NO. V-2
LOCATION Van Chrome Tank
DATE April 10, 2003
OPERATOR Don Ridgley & Dave Todd
METER BOX NO. 4204
LOCAL TIME
START/STOP 0800/14:49

STACK DIAMETER 12"
Ym: 1.006
H@: 1.752

PITOT TUBE FACTOR 0.84
NOZZLE DIAMETER 13/32 .38 in.
PROBE LENGTH 4' ft.

SAMPLE TRAIN LEAK TEST
BEFORE 14.5 in. ~~H2O~~ Hg
AFTER in. H_2O
PITOT TUBE LEAK TEST
BEFORE 4.1 AFTER 5.4

PROJECT NO. T-03-019
PLANT NAME Van Nuys Plating
AMBIENT TEMP (F)
METER TEMP (F) 60F
BAR. PRESS ("Hg) 29.24
STATIC PRESSURE ("H2O) -.98
ASSUMED MOISTURE (%) <1%
ASSUMED O2 (%) 20.9
ASSUMED CO2 (%) <1%
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (in. H2O)	ORIFICE dH (in. H2O) DESIRED	ORIFICE dH (in. H2O) ACTUAL	TEMPERATURES (F) STACK	PROBE	FILTER Amb	RESIN	IMPGR	PUMP VAC (in. Hg)
START SW	0	060.70	—	—	—	—	—			—	—
SW 1	20	068.89	0.09	1.9	1.9	68	63	63		44	6.0
2	40	085.53	0.10	2.1	2.1	70	66	66		41	7.0
3	60	103.59	0.12	2.5	2.5	69	66	66		41	8.0
4	80	120.15	0.10	2.1	2.1	70	67	66		42	7.0
5	100	134.12	~~0.08~~ 0.08	~~1.65~~ 1.65	1.7 ~~1.65~~	72	69	69		43	4.5
6	120	147.26	0.06	1.35	1.2	72	71	71		46	4.0
7	140	161.82	0.08	1.7	1.7	72	71	69		47	5.5
8	160	176.52	0.08	1.7	1.7	73	73	72		47	5.5
9	180	192.34	0.09	1.9	1.9	74	78	74		49	6
10	200	207.38	0.08	1.7	1.7	75	80	73		50	5.5
NW 1	220	221.45	0.07	1.45	1.5	76	87	73		53	5.0
2	240	235.40	0.08	1.7	1.7	76	88	75		53	5.5
3	260	251.74	0.09	1.9	1.9	76	88	75		54	6.0
4	280	265.54	0.07	1.5	1.5	77	89	74		56	5
5	300	~~279~~.97	0.08	1.7	1.7	77	90	77		57	6.0
6	320	294.40	0.08	1.7	1.7	76	90	75		57	6.0
7	340	309.28	0.08	1.7	1.7	77	88	75		56	6.0
8	360	324.64	0.09	1.9	1.9	77	88	76		54	7.0
9	380	339.90	0.08	1.7	1.7	76	88	73		54	6.5
10	400	353.14	0.07	1.45	1.5	77	87	75		54	5.5
			.28896								
					(35.3) 34.8 .1480						
	Theta:	Ym:	Avg dP:		dH:	Avg T:					

FIELD DATA RECORD

RUN NO. V-3
LOCATION Chrome Tank
DATE April 11, 2003
OPERATOR Don Rowley & Dave Todd
METER BOX NO. 4204
LOCAL TIME
START/STOP 8:04 /

STACK DIAMETER 12"
Ym: 1.006
H@: 1.752

PITOT TUBE FACTOR .84
NOZZLE DIAMETER .38 in.
PROBE LENGTH 4 ft.

SAMPLE TRAIN LEAK TEST OK
BEFORE 15 in. ~~H_2O~~ Hg
AFTER 15 in. H_2O Hg
PITOT TUBE LEAK TEST
BEFORE 5.1 AFTER 5.0

PAGE of
PROJECT NO. T-03-018
PLANT NAME Van Nuys Plating
AMBIENT TEMP (F)
METER TEMP (F) 60F
BAR. PRESS ("Hg) 29.33
STATIC PRESSURE ("H2O) -0.98
ASSUMED MOISTURE (%) < 1%
ASSUMED O2 (%)
ASSUMED CO2 (%)
ASSUMED MW (WET, %)
ASSUMED MW (DRY, %)

POINT	CLOCK TIME	DRY GAS METER (cu. ft.)	VELOCITY dP (In. H2O)	ORIFICE dH (In. H2O) DESIRED	ORIFICE dH (In. H2O) ACTUAL	TEMPERATURES (F) STACK	PROBE	FILTER Ambient	RESIN	IMPGR	PUMP VAC (In. Hg)
START	0	353.775	~~0.09~~	~~1.9~~	~~1.9~~	~~70~~	~~63~~	~~62~~		~~44~~	~~5.0~~
NW 1	18	368.14	0.09	1.9	1.9	70	63	62		44	5.0
2	36	382.415	0.09	1.9	1.9	70	64	62		44	5.0
3	54	396.535	0.06	1.25	1.3	69	64	60		44	3.5
4	72	411.16	0.13	2.7	2.7	69	65	60		44	6.5
5	90	425.27	0.08	1.7	1.7	70	66	61		44	4.5
6	108	438.39	0.08	~~1.7~~ 1.25	1.7	70	66	64		45	4.5
7	126	452.56	0.09	1.9	1.9	70	67	63		45	5.0
8	144	466.78	0.09	1.9	1.9	70	67	62		45	5.0
9	162	481.52	0.10	2.1	2.1	70	68	63		45	5.0
10	180	496.275	0.10	2.1	2.1	70	68	63		46	5.0
SW 1	198	509.66	0.08	1.7	1.7	69	68	66		49	4.5
2	216	525.0	0.10	2.1	2.1	70	68	66		49	5.5
3	234	537.28	0.06	1.3	1.3	72	69	68		49	3 1/2
4	252	549.24	0.06	1.3	1.3	71	70	67		49	3.5
5	270	560.74	0.06	~~0~~ 1.3	1.3	73	72	70		50	3.5
6	288	573.95	0.08	1.7	1.7	73	73	71		49	4.5
7	306	588.285	~~0.04~~ 0.10	2.1 ~~1.9~~	2.1	73	74	71		46	~~4.0~~ 5.0
8	324	602.44	0.10	2.1	2.1	73	74	72		46	5.5
9	342	617.82	0.10	2.1	2.1	73	77	69		46	5.0
10	360	632.07	~~0.09~~ 0.10	1.9 ~~2.1~~	1.9	73	77	70		46	5.0

Appendix B

ARB Laboratory Results

Total and Hexavalent Chromium (Cr) Results for Van Nuys Plating Samples

Probes and Impingers

Container #	Sample ID	*ml of sample collected*	*Total Cr, ng/ml*	Total Cr, ng recovered	*Cr(VI), ng/ml*	Cr(VI), ng recovered
15	**Trip Blank**	*100.2*	*< 1.0*	**< 100**	*< 0.2*	**< 20**
16	**Trip Spike**	*111.0*	*7.8*	**8.7E+02**	*7.9*	**8.7E+02**
1	**V-1-P**	*114.2*	*363*	**4.1E+04**	*360*	**4.1E+04**
2	**V-1-1**	*108.8*	*629*	**6.8E+04**	*586*	**6.4E+04**
3	**V-1-2**	*107.0*	*< 1.0*	**< 107**	*0.3*	**27**
V-1 total				**1.1E+05**		**1.0E+05**
6	**V-2-P**	*112.2*	*220*	**2.5E+04**	*144*	**1.6E+04**
7	**V-2-1**	*124.1*	*1154*	**1.4E+05**	*1044*	**1.3E+05**
8	**V-2-2**	*114.6*	*1.3*	**149**	*0.9*	**101**
V-2 total				**2.E+05**		**1.5E+05**
11	**V-3-P**	*124.6*	*761*	**9.5E+04**	*661*	**8.2E+04**
12	**V-3-1**	*144.6*	*234*	**3.4E+04**	*198*	**2.9E+04**
13	**V-3-2**	*112.8*	*9.1*	**1.0E+03**	*8.9*	**1.0E+03**
V-3-total *				**1.3E+05**		**1.1E+05**

The Limit of Detection (LOD) for Cr by GFAA is 1.0 ng/ml. The LOD for Cr(VI) by IC is 0.2 ng/ml.

* V-3 "spike" subtracted out for total.

Ambient Samples - Filters

Filter ID	Cr (IV) recovered (nanograms)
Blank	< 3 (nondetect)
Spike	14
V-2-A	< 3 (nondetect)
V-3-A	9
V-4-A	15
V-5-A	< 3 (nondetect)
V-6-A	14

Appendix C

Sample of Chain of Custody Sheets

CALIFORNIA AIR RESOURCES BOARD
MONITORING & LABORATORY DIVISION
P.O. Box 2815, Sacramento, CA 95812

CHAIN OF CUSTODY
Hex. Chrome Samples

Proj #: T-03-~~019~~ Date: 4/14/03 Time: 14:30
Facility: VAN NUYS Plating
Sample/Run #: 3
Log #: 11, 12, 13 Initials:

ACTION	DATE	TIME	GIVEN BY	TAKEN BY	COMMENTS
Sample Collected	4/14/03	14:30		RB	
Transfer	4/16/03	1500	RB	[illegible]	
Transfer			[illegible]		
Transfer					
Transfer for Analysis	4/14/03	0845	[illegible]	[illegible]	For Analysis

Log Number	Add'l Sample Numbers	Description	pH Field	pH Lab	Lab Number
11	V-3 -P	Probe, nozzle, & line rinses (Container 1)	9		
12	V-3 -1	1st Impinger (Container 2)	9		
13	V-3 - 2	Remaining Impingers (Container 3)	9		

aboratory, return this form to: CHRIS CLARKE, Project Leader

If there are questions call: 916-322-2411

Appendix D

Summary of Observations

Test 4
Van Nuys Plating

Dates Tested: 4/9/03 – 4/11/03

Table 1: Parameters Measured During Testing

	Date	3/05/03	3/06/03	3/07/03
	Run	E1	E2	E3
Freeboard (inches)		3.25 – 3.25	3.0 – 3.2	3.1 – 3.1
Chromic Acid Concentration (oz/gal)		21.7	21.3	21.1
Temperature (°F)		78.8 – 80.2	80.8 – 81.3	82.5 – 83.2
Amperes		850 – 250	850 – 250	850 – 250
Volts		12	12	12
Ampere-Hours		669	819	781

Note:

- Freeboard space was measured at the beginning and end of each day
- Chromic acid concentration samples were taken once a day
- Temperature was measured throughout the day
- Plating amperes varied at the beginning and end of plating as well as with plating of different parts

Table 2: Surface Tension (dynes/cm) Readings Beginning and End of Each Day

Date	Run	Operator Stalagmometer Reading	SCAQMD Stalagmometer Reading	SCAQMD Tensiometer Reading
4/09/03	V1	37.12	54.6 – 56.1	31.0 – 31.8
4/10/03	V2	27.4 – 33.4	45.8 – 46.2	26.7 – 26.0
4/11/03	V3	32.12 – 33.4	43.6 – 41.2	27.3 – 28.3

Job shop that is not automated (Manual line.) Types of parts plated – underwater pool light fixtures, motorcycle parts, spa parts, and cooking appliance parts.

The production of this facility was supplemented with "dummy" parts. These consisted of four steel flat rods with the following dimensions:

Length: 25, 25.4, 25.6, and 27 inches
Width: 1 ½ inches
Thickness: 0.25 inches

The "dummy" parts were plated according to their normal operation. There was an initial spike of current at 800 Amperes for a few seconds. Then the current was lowered to 250 Amperes for thirty seconds.

The facility uses Dis Mist-NP fume suppressant. The fume suppressant is added twice a day each addition being 1 quart and mixed in the tank. The addition is made in the morning before plating starts and in the afternoon around 1 P.M.

The smoke test was done twice during source testing (the first and the third day.) The smoke test showed an efficiency of 50-75%

The amp-hr meter was calibrated 1/10/03. The facility also pays for an industrial hygiene expert to come in every 6 months for personal monitoring and to do a smoke test.

There were no chromic acid additions made to the tank during the source testing period. The last addition was made over two years ago to the tank according to the facility operator. At that time, 25 pounds was added to the bath. The concentration checked last at the end of March 2003 was 32 oz/gal.

The facility maintains the chromic acid bath by turning on the pourous pot once/month. This stays in the tank at all times.

Table 3: Samples Collected for SCAQMD Were Labeled As Follows:

Date	Time of Day	Sample Bottle Labled
4/9/03	Beginning	V1-1
4/9/03	End	V1-2
4/10/03	Beginning	V1-3
4/10/03	Beginning	V1-3
4/10/03	End	V1-4
4/11/03	End	V1-6

Appendix E

Independent Laboratory Surface Tension
&
Chromic Acid Concentration Results

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 E. Copley Dr., Diamond Bar, CA 91765-4182
MONITORING & ANALYSIS
REPORT OF LABORATORY ANALYSIS

TO Shobna Pandhoh
CARB

LABORATORY NO 03101-04

REFERENCE NO JTH-30-42

SAMPLE(S) DESCRIBED AS
-001 bottled labelled VI-1
-002 bottled labelled VI-2
-003 bottled labelled VI-3
-004 bottled labelled VI-4
-005 bottled labelled VI-5
-006 bottled labelled VI-6

DATE SAMPLED 4/11/2003

ANALYSIS ENDED 5/1/2003

SOURCE ID NO unk

REQUESTED BY S Pandhoh

PROJECT CARB Surface Tension

SAMPLE SOURCE Van Nuys Plating

Surface tension in dynes per centimeter by EPA Method 306B,
Fisher Model 20 Surface Tensiometer
Labglass Stalagmometer, 5 ml

Samples	Tensiometer	Stalagmometer
VI-1	31.0	54.6
VI-2	31.8	56.1
VI-3	26.7	45.8
VI-4	26.9	46.2
VI-5	27.3	43.6
VI-6	28.3	41.2

Date 6/5/03

Approved by

Rudy Eden, Senior Manager
Laboratory Services
909-396-2391

ANACHEM LABORATORIES

Established 1968

130 Penn Street • El Segundo, California 90245.3907 • voice 310.322.4993 • fax 310.322.6681

VAN NUYS PLATING
14611 Bessemer Street
Van Nuys, CA 91411

ATTN: TIM ROMPH
FAXED TO : SHOBNA PANDHOH
(916-327-5621)

DATE April 15, 2003
LAB NO. A88507 pg.1
CUST P.O. MEMO
SAMPLE (S) Solutions
RECEIVED 4-11-03/74863

CHROMIC ACID SOLUTION - SAMPLE I.D. # 4-9-03 SAMPLE

Chromic Acid	21.7	oz/gal

CHROMIC ACID SOLUTION - SAMPLE I.D. # 4-10-03 SAMPLE

Chromic Acid	21.3	oz/gal

CHROMIC ACID SOLUTION - SAMPLE I.D. # 4-11-03 SAMPLE

Chromic Acid	21.1	oz/gal

N. Krishnan, Ph.D.
Laboratory Director