

California Environmental Protection Agency



SOURCE TEST REPORT

**Total and Hexavalent Chromium Emissions  
Clovis Specialty  
Decorative Chromium Plating Tank**

MONITORING AND LABORATORY DIVISION  
STATIONARY SOURCE TESTING BRANCH

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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.

The project leader was Shobna Sahni with ARB Stationary Source Division. The sampling team was led by David Todd and included Don Ridgley and Ron Barros with the ARB Monitoring and Laboratory Division. Betsy Ronsse, Peter Samra, and Roxana Walker with MLD Northern Laboratory Branch conducted the laboratory analysis. John Martin with Clovis Specialty, Fresno, Dominick Nole with Alta Plating, Sacramento, and Valley Plating, Fresno, provided chrome plating assistance and expertise. Paramo Hernandez of Alta Plating provided analyses for plating bath surface tension and chromic acid content. John Copp with San Joaquin Valley APCD in Fresno provided additional assistance.

This report presents results based on samples collected and analyzed by the Air Resources Board (ARB) staff using ARB test methods. The results have been reviewed by the staff and are believed to be accurate within the limits of the methods. However, data may have been affected by variables that were not known to staff during sampling and review.

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**Total and Hexavalent Chromium Emissions from  
Clovis Specialty  
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 Clovis Specialty located at 1366 N. Sierra Vista in Fresno, California. Total and hexavalent chromium emissions testing was conducted from May 24 through May 27, 2004.

Quality assurance measures indicated those results were questionable. Indoor concentrations increased instead of remaining the same or lowering during sample hood operation. (This sample hood also vented emission outside of the facility and normal plating vents emissions inside the facility.) Post test sampling of the hood and duct work indicated significant chromium emissions were retained within the ducts. As a result, the first test, Clovis 1, was invalidated by ARB staff and 3 additional tests were planned and completed.

Emissions testing for the second test, Clovis 2, were performed October 19-21, 2004. Clovis 3 emissions samples were collected on May 24-25, 2005. Clovis 4 emissions samples were collected on June 29-30, 2005. This report includes results from those emissions tests.

II. PROCESS DESCRIPTION

Clovis Specialty performs decorative chromium plating on a variety of small parts. Clovis Specialty's decorative chrome plating tank has a capacity of 800 gallons and is 108 inches long, 36 inches wide, and 48 inches deep. 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 maintained at approximately 100° - 110° F during plating operations. SSD staff periodically collected voltage, amperage, bath temperature, and amp-hour readings for the plating tank during the source test.

Emissions from the plating tank are controlled through the use of a chemical fume suppressant, Chemithon-Micel's Chrome Foam. 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. No plating tank ventilation system or additional

emissions controls are used (i.e. HEPA filter). Any emissions from the tank are vented into the building and subsequently through open doors, windows, and roof vents.

For Clovis 2, dummy parts for plating were prepared at Valley Plating, the plating room was cleaned, including sweeping the floor, and plated parts were no longer rinsed under the sampling hood. For Clovis 3, in addition to Clovis 2 changes, the old "contaminated" (high in impurities) plating bath was replaced by a new plating bath. And, for Clovis 4, the plating bath was "slightly contaminated" with appropriate metals so it would seem more like a "normal" plating bath.

### III. CLOVIS SPECIALTY SOURCE TEST

Each source test consisted of three individual sample runs. During Clovis 1, May 25-27, 2004, the surface tension of the plating solution was about 55 dynes/cm (measured 53.6 to 56.6) and bath temperature between 95° and 105° F. For Clovis 2, October 19-21, 2004, plating bath surface tension was 42 dynes/cm and bath temperature 105° to 110° F. For Clovis 3, plating bath surface tension was 36.6, 32.7, and 22.1 dynes/cm. (22.1 dynes/cm is the result of adding fume suppressant between the second and third runs.) For Clovis 4 "contaminates" were added to make the plating bath seem more like a "normal" plating bath than fresh plating bath. For Clovis 4, plating bath surface tension was averaged 31.5 dynes/cm and plating bath temperature was 105° to 110°F

ARB Method 425 was used to determine hexavalent and total chromium emissions collected during the source tests. Each sample was collected continuously over a two hour period. During sampling, production or "dummy" parts were plated in the tank. The dummy parts were necessary to obtain a target of about 300 or more amp-hours per run. Valley Plating, Fresno, stripped and prepared the dummy parts at their facility for plating in the same manner as production parts. Stripping and preparation was repeated the each time the dummy parts were to reenter the plating tank.

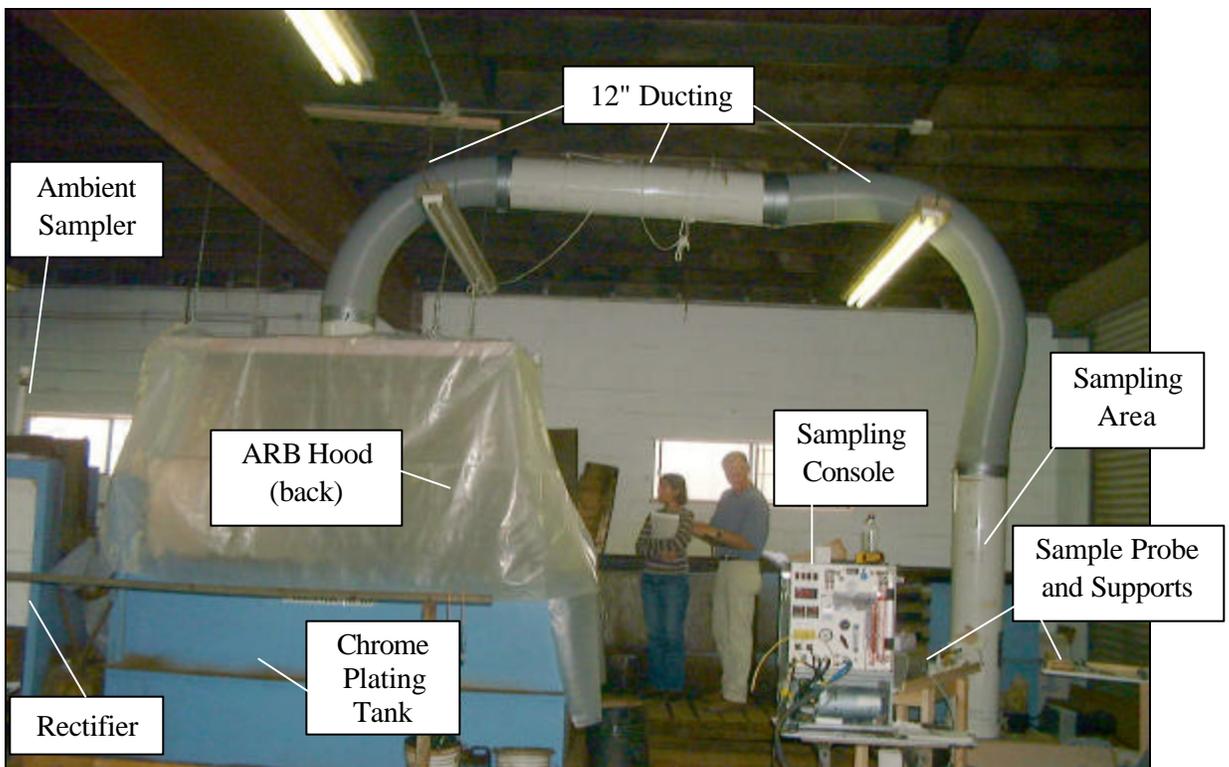
ARB staff built a ventilation system to carry any chromium emitted by the plating tank to the source sampling area. (See Figures III-1 and III-2.) This ventilation system consisted of a capture hood with an open bottom, open or plastic-sheeted sides, and a plastic-sheeted top. A 12-inch diameter exhaust duct near the top back center of the capture hood carried plating tank emissions from the tank and capture hood through a sample collection area and then out a nearby exit door. Surfaces of the hood and duct assembly were made of plastic sheeting and PVC flex hose and tubing. This system was designed to allow droplets to return to the tank but collect fumes that floated above the tank. Per South Coast AQMD's procedures for plating tanks and fume suppressant certification, the average "lift" velocity between the tank and the ventilation system was designed to be less than 50 feet/minute. Fifty feet per minute under the hood equaled 1,367 cubic feet per minute (cfm) at the sample collection site, a 12-inch diameter tube. Actual flow at the site during sampling was generally less than 1,000 cfm.

The capture hood was suspended above the plating tank from the ceiling. The open bottom of the capture hood was slightly larger than the open top of the plating tank.

When suspended and in use, the plastic sheeting along the sides and back hung below the top of the plating tank. The front of the tank was open so plating parts could still be placed in the tank without interference. Smoke tests prior to and during sampling were used to indicate no emissions escaped out of the capture hood.

Flexible and rigid (straight) 12-inch diameter PVC pipe directed tank emissions from the capture hood to the ARB Method 425 sample collection area. Method 425 samples were collected from a vertical (12-inch diameter, 67 inches long) PVC pipe sitting on the inlet to a fan box. Samples were collected from two, 3-inch diameter holes cut 90 degrees apart into the vent stack and located 18 inches (1½ diameters) above the fan box and 49 inches (4 diameters) below the flexible pipe connected to the capture hood. The fan box includes a variable flow controlled fan with a 5-foot, 12-inch diameter PVC rigid pipe to exhaust tank emissions through a door and out of the building.

Smoke tests were also conducted during each run to indicate no emissions “leakage” out of the hood. The smoke did not contain any chromium or other compounds that would interfere with chromium sampling and analysis.



**Fig III-1:** Clovis Specialty decorative chromium plating tank and rectifier with ARB capture hood, ducting, and ambient sampler (on rectifier top).



**Fig. III-2:** Clovis Specialty decorative chrome plating tank and rectifier without ARB sampling equipment.

Indoor ambient samples were collected concurrently with each source test run. Indoor ambient samples were collected on sodium bicarbonate-impregnated filters with a BGI, Inc. PQ100 ambient sampler sampling at 10 liters per minute. The sampler was set on top of the rectifier next to the decorative chrome tank (see Figure III-1), so the indoor ambient sampler was especially sensitive to emissions from the plating tank area. For Clovis 2, 3, and 4, a second indoor ambient sampler was setup near the sampling console where it is less sensitive to changes in or around the plating tank. For Clovis 4, a third sampler was “collocated” (within 1 meter) of the second (console) ambient sampler, but sampled at 1 liter per minute. Ten liters per minute is the ARB sampling rate for ambient hexavalent chrome samplers. One liter per minute is the OSHA indoor sampling rate for hexavalent chrome samples. Indoor ambient samples were analyzed for hexavalent chromium only for data quality assurance purposes only. No data or results were “corrected” based indoor ambient results.

#### IV. TEST METHODS

##### A. Source Sampling Procedures

Samples were collected and recovered by ARB Stationary Source Testing Branch. 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.

Hexavalent and total chromium samples were collected isokinetically in accordance with ARB draft Method 425, "Determination of Total Chromium and Hexavalent Chromium Emissions from Stationary Sources." ARB Method 425 was originally adopted January 22, 1987 and amended August 27, 2002. For chromium sampling at Clovis ARB Method 425 incorporated some 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 solution, and deletion of the sample train filter and filter heater.

The chromium sampling train consisted of a 48-inch glass-lined stainless steel probe with a 3/8-inch diameter glass nozzle, and attached Pitot tube and thermocouple for monitoring stack conditions. A ten-foot Teflon™ line connected the probe to three Greenburg-Smith impingers used to collect and stabilize any chromium sample. The first two impingers contained 100 milliliters each of 0.1 normal (N) sodium bicarbonate solution. A third, empty impinger was followed by a cylinder of silica gel (final moisture collection), and a 50 foot umbilical line connected to an isokinetic (Method 5) sampling console. The sampling console includes a vacuum pump, a dry gas meter, and additional monitors and controls for collecting a sample isokinetically.

In accordance with Method 1, the sampling location required 24 traverse points (12 sampling points on each diagonal ninety degrees apart).

In accordance with Method 2, thermocouples and Type S pitot tubes bundled with the sampling probes were used to determine stack velocity. The weight of the impinger solutions and silica gel were recorded before and after each test in order to obtain the moisture content of the stack gas in accordance to Method 4. In addition, stack temperature, ambient temperature, and barometric pressure were measured and recorded during each test. Leak checks in accordance with Method 5 were performed on each sample train and Pitot tube setup before and after each sample collection. Leak check results were documented on the Method 425 run sheets.

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 follows (all sample jars were pre-cleaned and tested to ensure the absence of chromium prior to the source test):

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

The pH of the sodium bicarbonate solution used for the probe rinse and impingers was maintained at  $\geq 8.0$ . Additionally, the impinger solution was chilled with ice to 4 °C (39 °F) or less during sample collection. All samples were also chilled with ice

and refrigeration to 4 °C (39 °F) or less during transport and storage prior to analysis to minimize the conversion of hexavalent chromium to trivalent chromium. At the conclusion of each sampling week, staff transported the recovered samples to ARB Northern Laboratory Branch in Sacramento for analyses. Northern Laboratory Branch also analyzes samples from the ARB ambient air network for hexavalent chromium and other pollutants.

Amperage and voltage supplied by the rectifier was monitored and recorded by ARB staff during the source tests runs. ARB staff also recorded tank temperature and totalizer amp-hours. In addition, plating bath samples were collected to determine plating bath surface tension and chromic acid content by Alta Plating and Chemical Corp.

#### 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 the sample for hexavalent chromium analysis. Indoor ambient samples were collected in conjunction with each plating tank sample run. Three additional 24-hour indoor ambient samples were collected during normal plating operations when ARB was not collecting Method 425 samples and with the ARB capture hood and ducting removed. After sampling, the filters were placed back into their storage cassettes using sterile gloves and returned to the laboratory for analysis.

#### C. Analytical Procedures

The plating tank 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 analytical procedure as the hexavalent chromium portion of the stack samples.

Laboratory analyses for hexavalent and total chromium of the collected stack samples was performed by ARB's Northern Laboratory Branch. Hexavalent chromium (also known as hex chrome, Cr (VI), or Cr<sup>+6</sup>) was measured using ion chromatography (IC) in accordance with ARB standard operating procedure (SOP) 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 graphite furnace atomic adsorption (GFAA) in accordance with ARB SOP MLD005. The LOD of the analytical procedure for total chromium is 1.0 ng/ml.

### V. QUALITY ASSURANCE / QUALITY CONTROL

To ensure that collected data 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; and
- 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 affected 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.

Also, blank source tests were performed on the ARB capture hood and ducting before and after sampling at Clovis Specialty. Clovis 1 pretest results indicated a possible contamination of about 0.14 ng/dscf of hexavalent chromium. Post test results indicate a contamination of 2.4 ng/dscf of total chromium and 2.2 ng/dscf of hexavalent chromium. Those results from the pre and post tests are less than 1 percent of 300 ng/dscf. All Clovis Specialty test runs were 300 ng/dscf to 400 ng/dscf for hexavalent or total chromium. Since the accuracy of the runs are +/- 10% at best, this contamination is usually considered to be within the accuracy (or "noise") of the method. However, those test run results seem high for Clovis Specialty, so source test staff is concerned about those post test results. See the Test Results section of the report for more discussion. No test data has been corrected, nor is any correction suggested or recommended, based upon this pre or post test data.

To insure and demonstrate the capture hood was effective in capturing emissions, smoke tests and an indoor ambient sampler were used. Sometime during each run titanium oxides "smoke" was released inside the capture hood at various locations to demonstrate no leaks. An indoor ambient sampler operated near the plating tank to help document this emission capture and determine the significance of background chromium relative to plating tank emissions. For Clovis 1, ambient results indicated an increase in indoor ambient concentrations, indicating a problem even though smoke tests indicated complete capture.

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 sample run.

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. Field blanks are not used to correct laboratory results, but would indicate any contamination beyond the original laboratory samples that might affect the results.

All test samples were collected using an iced impinger set. After recovery, samples were stored in a sample refrigerator or 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 waiting to be analyzed.

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, and after sample recovery.

Chain of custody was maintained for all collected samples. A chain of custody sheet was prepared for each sample run and post-test indoor ambient samples.

## VI. TEST RESULTS

Results of the ARB Method 425 source test for the Clovis Specialty decorative chromium plating tank is presented in Tables VI-1 (for Clovis 1), VI-2 (for Clovis 2), VI-3 (for Clovis 3) and VI-4 (for Clovis 4). Indoor ambient results, data summaries, and emissions calculations are in Appendix A. Laboratory results are presented in Appendix B. Additional plating tank information is in Appendix C. And, sampling run sheets are in Appendix D.

In Table VI-1, chromium emission rates ranged from 0.21 to 0.25 milligrams per amp-hour (mg/amp-hr) for total chromium and 0.20 to 0.21 mg/amp-hr for hexavalent chromium. These emissions are relatively high and there is concern they are not representative of the Clovis Specialty decorative chromium plating tank. For additional emissions information from decorative chrome plating tanks see the ARB source test reports for Alta Plating (project number T-03-048) and Sherm's Custom Plating (T-03-058).

First concern is that some chromium-laden rinse water, used to rinse chromium solution off the plated parts and back into the decorative chromium tank, was drawn into the ARB

ducting and sampled. This situation was not observed by the source test crew, nor reported by the platers. But, a post-test emission check of the ARB ventilation system indicated residual chromium from Clovis Specialty in the ARB ventilation system of 2.4 ng/dscf (0.14 mg/hr) of total chromium and 2.2 ng/dscf (0.13 mg/hr) of hexavalent chromium.

This ARB capture hood and ventilation system was also used earlier at Alta Plating (project number T-03-048) and Sherm's Custom Plating (T-03-058). Post test sampling results for Alta were "non-detects" (less than 0.04 ng/dscf and less than 0.00 mg/hr for hexavalent chromium). Post test sampling results for Sherm's were 0.14 ng/dscf and 0.01 mg/hr for hexavalent chromium.

Alta Plating "drag out" their parts to a nearby rinse tank to begin cleaning the plating solution off the plated parts. Sherm's uses a special, fine spray over the plating tank (and under the ARB capture hood) to begin removing plating solution from their plated parts. At Sherm's, the velocity of the spray is low enough the rinse water adheres to and flows down the plated part back into the tank. Overspray that may be collected by ARB capture hood was clean water. Clovis Specialty also started rinsing over their plating tank (and under the ARB capture hood), but they did not appear to use a low velocity spray like Sherm's. Some rinse spray during Clovis 1 may have bounced off the plated parts, picking up chrome solution, and was then drawn into the ARB capture hood and ventilation system. Without the ARB capture hood, this "overspray" would either fall back into the plating solution or, possibly onto the floor around the plating tank.

Another problem with Clovis 1 is the relatively high indoor ambient concentrations with the ARB capture hood in use. Smoke tests indicated no leaks from the ARB capture hood into the plating room. Normally that would be also be documented by the indoor ambient sampler near the plating tank during ARB plating tank emissions sampling. Ambient samples collected with the capture hood in use should be the same or lower than samples collected with the hood removed. (See the Alta Plating and Sherm's Custom Plating source test reports mentioned above.) However, Clovis 1 indoor ambient results are higher with the capture hood in operation than with it removed. Emissions in this report have not been corrected based on the indoor ambient sampler, nor does the source test staff suggest or recommend such a correction be made.

Additional test were scheduled for Clovis Specialty because of the questionable data and results from Clovis 1. For Clovis 2, the ARB capture hood and ducting was rebuilt with fresh ducting and plastic sheeting, the plating room at Clovis Specialty was cleaned up, dummy parts were prepared at Valley Plating away from Clovis Specialty, and plated parts were rinsed in another tank outside of the ARB capture hood. Earlier tests at Alta Plating and Sherm's did not indicate these would interfere with sampling results. For Clovis 3, another new capture hood and ducting assembly was used and the old plating bath was replaced with a fresh new plating bath. And, for Clovis 4, another new capture hood setup and the plating bath was "contaminated" to a more "normal" level. However, "contaminating" the Clovis 4 bath may not have worked as well as expected.

**Table VI-1  
Clovis Specialty Decorative Chromium Plating Tank Test Week 1 (Clovis 1)  
Sampling Dates – May 25 - 27, 2004**

<b>Sampling Location</b>			
Sample Number	C1	C2	C3
Sampling Date	5/25/04	5/26/04	5/27/04
<b>Plating Tank Data</b>			
Totalizer (amp-hours)	355	371	340
Production Rate (amp-hrs/hr)	88.75	92.75	85.00
Freeboard (inches to overflow)*	4.5	4.5	4.255
Surface Tension (dynes/cm)	56.6	55.3	53.6
Chromic Acid Conc. (oz/gal)	41.5	41.5	41.5
Bath Temperature (°F)	97.7	99.7	102.4
<b>Stack Data</b>			
Stack Temperature (°F)	80.3	82.0	86.9
Velocity (ft/sec)	21.3	21.0	21.1
Static Pressure ("H <sub>2</sub> O)	-0.24	-0.23	-0.25
Stack Area (sq. ft.)	0.785	0.785	0.785
Flow Rate (DSCFM)	959	946	940
Moisture (% of v/v)	1.1	1.0	1.1
<b>Sampling Data</b>			
Sampling Time (minutes)	240	240	240
Sample Volume (DSCF)	232.79	232.47	230.30
<b>Chromium Data (ng/sample)</b>			
Total Chromium	73,820***	93,250***	76,230***
Hexavalent Chromium	70,870***	81,770***	71,140***
Isokinetic Rate (%)	103.6	104.9	104.5
<b>EMISSIONS</b>			
<b>Concentration (ng/dscf)</b>			
Total Chromium	320***	400***	330***
Hexavalent Chromium	300***	350***	310***
<b>Emission Rate (mg/hr)</b>			
Total Chromium	18***	23***	19***
Hexavalent Chromium	18***	20***	17***
<b>Emissions Factors (mg/amp-hr)**</b>			
Total Chromium	<b>0.21***</b>	<b>0.25***</b>	<b>0.22***</b>
Hexavalent Chromium	<b>0.20***</b>	<b>0.22***</b>	<b>0.21***</b>

DSCF & DSCFM means dry standard cubic feet and dry standard cubic feet per minute at 68 F and 29.92 inches Hg.

\* Measured at the start of the plating day.

\*\* Emissions Factors (mg/amp-hr) = Emission Rate (mg/hr) / Plating Tank Production Rate (amp-hrs/hr)

\*\*\*Use these emission results with caution. They may not be representative. See the test report for details.

**Table VI-2  
Clovis Specialty Decorative Chromium Plating Tank Test Week 2 (Clovis2)  
Sampling Dates – October 19-21, 2004**

<b>Sampling Location</b>			
Sample Number	C21	C22	C23
Sampling Date	10/19/04	10/20/04	10/21/04
<b>Plating Tank Data</b>			
Totalizer (amp-hours)	331	382	360
Production Rate (amp-hrs/hr)	159	191	180
Freeboard (inches to overflow)*	4.375	4.875	4.375
Surface Tension (dynes/cm)	44.1	41.6	42.2
Chromic Acid Conc. (oz/gal)	30.2	30.2	30.2
Bath Temperature (°F)	106	110	112
<b>Stack Data</b>			
Stack Temperature (°F)	68	67	63
Velocity (ft/sec)	20.68	20.40	19.84
Static Pressure ("H <sub>2</sub> O)	-0.22	-0.22	-0.24
Stack Area (sq. ft.)	0.785	0.785	0.785
Flow Rate (DSCFM)	945	931	922
Moisture (% of v/v)	1.3	1.3	1.1
<b>Sampling Data</b>			
Sampling Time (minutes)	125	120	120
Sample Volume (DSCF)	118.65	111.03	111.23
<b>Chromium Data (ng/sample)</b>			
Total Chromium	20,990	12,960	18,670
Hexavalent Chromium	21,800	11,280	20,570
Isokinetic Rate (%)	102.9	101.9	103.1
<b>EMISSIONS</b>			
<b>Concentration (ng/dscf)</b>			
Total Chromium	177	117	168
Hexavalent Chromium	184	102	185
<b>Emission Rate (mg/hr)</b>			
Total Chromium	10.0	6.5	9.3
Hexavalent Chromium	10.4	5.7	10.2
<b>Emissions Factors (mg/amp-hr)**</b>			
Total Chromium	<b>0.063</b>	<b>0.034</b>	<b>0.052</b>
Hexavalent Chromium	<b>0.065</b>	<b>0.030</b>	<b>0.057</b>

**DSCF & DSCFM** means dry standard cubic feet and dry standard cubic feet per minute at 68 F and 29.92 inches Hg.

\* Measured at the start of the plating day.

\*\* **Emissions Factors** (mg/amp-hr) = Emission Rate (mg/hr) / Plating Tank Production Rate (amp-hrs/hr)

**Table VI-3  
Clovis Specialty Decorative Chromium Plating Tank Test Week 3 (Clovis 3)  
Sampling Dates – May 24-25, 2005**

<b>Sampling Location</b>			
Sample Number	C31	C32	C33
Sampling Date	5/24/05	5/25/05 AM	5/25/05 PM
<b>Plating Tank Data</b>			
Totalizer (amp-hours)	385	309	316
Production Rate (amp-hrs/hr)	192.5	154.5	158
Freeboard (inches to overflow)*	5 5/8	5 5/8	5 5/8
Surface Tension (dynes/cm)	36.6	32.7	22.1 (fume suppressant added before sampling)
Chromic Acid Conc. (oz/gal)	25.0	25.0	25.0
Bath Temperature (°F)	108	110	110
<b>Stack Data</b>			
Stack Temperature (°F)	91	86	92
Velocity (ft/sec)	19.8	18.6	18.9
Static Pressure ("H <sub>2</sub> O)	-0.20	-0.21	-0.20
Stack Area (sq. ft.)	0.785	0.785	0.785
Flow Rate (DSCFM)	871	828	836
Moisture (% of v/v)	1.2	1.0	0.7
<b>Sampling Data</b>			
Sampling Time (minutes)	120	120	120
Sample Volume (DSCF)	103	96.9	97.8
<b>Chromium Data (ng/sample)</b>			
Total Chromium	19,800	14,284	18,390
Hexavalent Chromium	19,690	13,284	18,100
Isokinetic Rate (%)	101.2	100.0	99.8
<b>EMISSIONS</b>			
<b>Concentration (ng/dscf)</b>			
Total Chromium	192	147	188
Hexavalent Chromium	191	137	185
<b>Emission Rate (mg/hr)</b>			
Total Chromium	10	7.3	9.4
Hexavalent Chromium	10	6.8	9.3
<b>Emissions Factors (mg/amp-hr)**</b>			
Total Chromium	<b>0.052</b>	<b>0.047</b>	<b>0.059</b>
Hexavalent Chromium	<b>0.052</b>	<b>0.044</b>	<b>0.059</b>

**DSCF & DSCFM** means dry standard cubic feet and dry standard cubic feet per minute at 68 F and 29.92 inches Hg.

\* Measured at the start of the plating day.

\*\* **Emissions Factors** (mg/amp-hr) = Emission Rate (mg/hr) / Plating Tank Production Rate (amp-hrs/hr)

**Table VI-4  
Clovis Specialty Decorative Chromium Plating Tank Test Week 4 (Clovis 4)  
Sampling Dates – June 29-30, 2005**

<b>Sampling Location</b>			
Sample Number	C41	C42	C43
Sampling Date	6/29/05	6/30/05	6/30/05
<b>Plating Tank Data</b>			
Totalizer (amp-hours)	356	299	345
Production Rate (amp-hrs/hr)	178	149.5	172.5
Freeboard (inches to overflow)*	4.5	4.0	4.0
Surface Tension (dynes/cm)	31.5	31.5	31.5
Chromic Acid Conc. (oz/gal)	28.2	28.2	28.2
Bath Temperature (°F)	105.6	108.6	107.6
<b>Stack Data</b>			
Stack Temperature (°F)	87.5	87.5	95
Velocity (ft/sec)	21.6	19.0	19.8
Static Pressure ("H <sub>2</sub> O)	-0.24	-0.17	-0.20
Stack Area (sq. ft.)	0.785	0.785	0.785
Flow Rate (DSCFM)	955	837	864
Moisture (% of v/v)	1.3	1.6	1.3
<b>Sampling Data</b>			
Sampling Time (minutes)	120	120	120
Sample Volume (DSCF)	111	100	102
<b>Chromium Data (ng/sample)</b>			
Total Chromium	40,860	14,900	29,290
Hexavalent Chromium	29,910	9,890	25,020
Isokinetic Rate (%)	99.3	102	101
<b>EMISSIONS</b>			
<b>Concentration (ng/dscf)</b>			
Total Chromium	368	149	287
Hexavalent Chromium	269	99	245
<b>Emission Rate (mg/hr)</b>			
Total Chromium	21	7.5	15
Hexavalent Chromium	15	5.0	13
<b>Emissions Factors (mg/amp-hr)**</b>			
Total Chromium	<b>0.12</b>	<b>0.050</b>	<b>0.086</b>
Hexavalent Chromium	<b>0.087</b>	<b>0.033</b>	<b>0.074</b>

**DSCF & DSCFM** means dry standard cubic feet and dry standard cubic feet per minute at 68 F and 29.92 inches Hg.

\* Measured at the start of the plating day.

\*\* **Emissions Factors** (mg/amp-hr) = Emission Rate (mg/hr) / Plating Tank Production Rate (amp-hrs/hr)

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## **Appendix A1**

### **Clovis 1 Calculated Results**

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**Table A1-1a**  
**Clovis Specialty**  
**Indoor Ambient Hexavalent Chromium**  
*(with Capture Hood over Plating Tank)*

Sample Number:	C1-A	C2-A	C3-A
Sample Date:	5/25/2004	5/26/2004	5/27/2004
Sampling Time (minutes)	262	1,413	1,394
Volume Collected (liters)	2,620	14,130	13,940
Plating Tank Amp-hours	355	372	340
Cr (VI) collected (nanograms)	6400	7500	5500
<b>Indoor Ambient Concentration (ng/m<sup>3</sup>)</b>	<b>2400*</b>	<b>530</b>	<b>400</b>

\* Run C1-A (2400 ng/m<sup>3</sup>) may not be comparable to the other runs due to its short sampling time.

**Table A1-1b**  
**Clovis Specialty**  
**Indoor Ambient Hexavalent Chromium**  
*(without Capture Hood)*

Sample Number:	C4-A	C5-A	C6-A	C7-A
Sample Date:	6/1/2004	6/2/2004	6/3/2004	6/4/2004
Sampling Time (minutes)	1,403	1,317	1,115	470
Volume Collected (liters)	14,030	13,068	11,150	4,653
Plating Tank Amp-hours	1	72	22	51
Cr (VI) collected (nanograms)	1700	3600	1500	2100
<b>Indoor Ambient Concentration (ng/m<sup>3</sup>)</b>	<b>120</b>	<b>280</b>	<b>130</b>	<b>460</b>

**Table A1-2a**  
**Chromium Source Testing Results**  
**Clovis Plating**

**Table A-3a - Tank Sample Runs**

Sample ID	ml of sample collected	Total Cr ng/ml	Total Cr ng recovered	Cr(VI) ng/ml	Cr(VI) ng recovered	Cr (VI) as % of Total Cr
CB	115	<1.0	<120	<0.2	<23	
C1-I2	111	3.8	420	4.2	470	111.9%
C1-I1	123	44	5400	44	5400	100.0%
C1-P	47	1400	68000	1400	65000	95.6%
<b>Totals:</b>			<b>73,820</b>		<b>70,870</b>	<b>96.0%</b>
C2-I1	113.8	42	4800	40	4600	95.8%
C2-I2	110.8	4.1	450	1.5	170	37.8%
C2-P	73.4	1200	88000	1000	77000	87.5%
<b>Totals:</b>			<b>93,250</b>		<b>81,770</b>	<b>87.7%</b>
C3-I1	117.3	40	4700	40	4700	100.0%
C3-I2	116.7	4.5	530	3.8	440	83.0%
C3-P	101.3	700	71000	650	66000	93.0%
<b>Totals:</b>			<b>76,230</b>		<b>71,140</b>	<b>93.3%</b>
CP-I1	107.4	1.6	170	1.4	150	88.2%
CP-I2	110.5	<1.0	<110	0.3	33	
CP-P	76.2	5.1	390	4.5	340	87.2%
<b>Totals:</b>			<b>&lt;670 but &gt;= 593*</b>		<b>523</b>	<b>88.2%</b>
SP-I1	88.8	<1.0	<89	0.2	18	
SP-I2	101.4	<1.0	<100	<0.2	<20	
SP-P	50.5	<1.0	<51	0.6	30	
<b>Totals:</b>			<b>&lt;240</b>		<b>&lt;68 but &gt;= 48</b>	

The limit of detection (LOD) for Cr by GFAA is 1.0 ng/ml. The LOD for Cr 6+ by IC is 0.2 ng/ml.

\* Run CP: Total Cr = 170+33(<110)+390 = 593. Sample CP-I2 Total Cr is <110 but, according to Cr(VI) analysis, >= to 33.

**Table A1-2b - Indoor Ambient Samples**

Filter ID	Air Volume liters	Cr(VI) ng/ml	Cr(VI) ng recovered	Cr(VI) ng/m3**	Plating Tank Total amp-hrs
C1A	2620	420	6400	2400	355
C2A	14130	500	7500	530	372
C3A	13940	370	5500	400	340
C4A	14030	110	1700	120	1
C5A	13068	240	3600	280	72
C6A	11150	100	1500	130	22
C7A	4653	140	2100	460	51

extraction volume = 15 ml.

\*\* NIOSH recommended worker indoor limit is 0.001 mg/m3 (1,000 ng/m3).

MONITORING & LABORATORY DIVISION  
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
(FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
PROJECT NAME: Clovis Specialty  
RUN NO.: C1

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	228.84 cubic feet
Vm Meter Cal. Factor (Y)	1.006
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.58 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.950 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):	0.37 /(inches H2O)
Stack Temperature (Ts)	540 deg. R
Static Pressure	-0.24 inches H2O
Absolute Stack Pressure (Ps)	29.56 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	56.4 milliliters
Sampling Time (t):	240 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mn):	73,820 nanograms
Hexavalent Cr. Mass Collected (Mn):	70,870 nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	232.79 DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.1 percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84 lb/lbmole
Stack Gas Molecular Wt, Wet	28.71 lb/lbmole
Stack Gas Velocity (Vs):	21.33 feet/second
Stack Gas Flow Rate (Qs):	959 DSCFM(68 deg.F)
Isokinetic Ratio (%I):	103.6 percent
Total Cr Mass Conc. (Cs):	317.10557 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	304.43338 nanograms/dscf
Total Cr Mass Conc:	11,198 nanograms/dscm
Hex. Cr. Mass Conc:	10,751 nanograms/dscm
Total Cr. Emission Rate (Wm):	18.25 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	17.52 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
(FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
PROJECT NAME: Clovis Specialty  
RUN NO.: C2

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	228.27 cubic feet
Vm Meter Cal. Factor (Y)	1.006
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.62 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.863 inches H2O
Pb + dH avg:	29.83 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):	0.37 /(inches H2O)
Stack Temperature (Ts)	542 deg. R
Static Pressure	-0.23 inches H2O
Absolute Stack Pressure (Ps)	29.60 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	47.6 milliliters
Sampling Time (t):	240 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mn):	93,250 nanograms
Hexavalent Cr. Mass Collected (Mn):	81,770 nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	232.47 DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.95 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):	21.02 feet/second
Stack Gas Flow Rate (Qs):	945.99 DSCFM(68 deg.F)
Isokinetic Ratio (%I):	104.91 percent
Total Cr Mass Conc. (Cs):	401.12 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	351.74 nanograms/dscf
Total Cr Mass Conc:	14,165.29 nanograms/dscm
Hex. Cr. Mass Conc:	12,421.41 nanograms/dscm
Total Cr. Emission Rate (Wm):	22.77 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	19.96 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
(FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
PROJECT NAME: Clovis Specialty  
RUN NO.: C3

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	226.13 cubic feet
Vm Meter Cal. Factor (Y)	1.006
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.62 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.867 inches H2O
Pb + dH avg:	29.83 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):	0.37 /(inches H2O)
Stack Temperature (Ts)	547 deg. R
Static Pressure	-0.25 inches H2O
Absolute Stack Pressure (Ps)	29.60 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	54.9 milliliters
Sampling Time (t):	240 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mn):	76,230 nanograms
Hexavalent Cr. Mass Collected (Mn):	71,140 nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	230.30 DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.11 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):	21.13 feet/second
Stack Gas Flow Rate (Qs):	940.48 DSCFM(68 deg.F)
Isokinetic Ratio (%I):	104.54 percent
Total Cr Mass Conc. (Cs):	331.01 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	308.90 nanograms/dscf
Total Cr Mass Conc:	11,689 nanograms/dscm
Hex. Cr. Mass Conc:	10,909 nanograms/dscm
Total Cr. Emission Rate (Wm):	18.68 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	17.43 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
 STATIONARY SOURCE TESTING BRANCH

TEST SUMMARY AND RESULTS

FILE NO.: T-03-058  
 PROJECT NAME: 14th & S WH  
 RUN NO. : SP

SUMMARY OF TEST DATA

-----			
Volume of Gas Sampled (Vm):		342.696	cubic feet
Vm Meter Cal. Factor		1.002	
Meter Temperature (Tm):		520	deg. R
Barometric Pressure (Pb):		30.03	inches Hg
Avg. delta H Orifice Press. (dH avg):		2.900	inches H2O
Pb + dH avg:		30.24	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):		0.38	/(inches H2O)
Stack Temperature (Ts)		530	deg. R
Static Pressure		-0.24	inches H2O
Absolute Stack Pressure (Ps)		30.01	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):		360	minutes
Nozzle Diameter (Dn):		0.375	inches
Total Chromium Mass Collected (Mn)	< 240	but >/=	48 nanograms*
Hexavalent Cr. Mass Collected (Mn):	< 68	but >/=	48 nanograms

CALCULATED RESULTS

-----			
Corrected Sample Volume (Vm std):		352.43	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):		21.56	feet/second
Stack Gas Flow Rate (Qs):		1012	DSCFM(68 deg.F)
Isokinetic Ratio (%I):		99.2	percent
Total Cr Mass Conc. (Cs):	< 0.6810	but >/=	0.13620 nanograms/dscf*
Hex. Cr. Mass Conc. (Cs):	< 0.1929	but >/=	0.13620 nanograms/dscf
Total Cr Mass Conc:	< 24.0486	but >/=	4.80972 nanograms/dscm*
Hex. Cr. Mass Conc:	< 6.8138	but >/=	4.80972 nanograms/dscm
Total Cr. Emission Rate (Wm):	< 0.0413	but >/=	0.00827 milligrams/hr Total Cr.*
Hex. Cr. Emission Rate (Wm):	< 0.0117	but >/=	0.00827 milligrams/hr Hex. Cr.

\* Total Cr < 100ng; therefore, used Hex. Cr for Total Cr

MONITORING & LABORATORY DIVISION  
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS

FILE NO.: T-04-014  
PROJECT NAME: Clovis Specialty  
RUN NO.: CP

SUMMARY OF TEST DATA

-----		
Volume of Gas Sampled (Vm):		237.1 cubic feet
Vm Meter Cal. Factor (Y)		1.001
Meter Temperature (Tm):		520 deg. R
Barometric Pressure (Pb):		29.90 inches Hg
Avg. delta H Orifice Press. (dH avg):		3.150 inches H2O
Pb + dH avg:		30.13 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):		0.37 /(inches H2O)
Stack Temperature (Ts)		533 deg. R
Static Pressure		-0.25 inches H2O
Absolute Stack Pressure (Ps)		29.88 inches Hg
Stack Dimensions		12 inches dia.
Stack Area (As)		0.785 square feet
H2O in Impingers and Silica Gel (Vlc):		46.9 milliliters
Sampling Time (t):		240 minutes
Nozzle Diameter (Dn):		0.375 inches
Total Chromium Mass Collected (M	< 670	but >/= 593 nanograms
Hexavalent Cr. Mass Collected (Mn):		523 nanograms

CALCULATED RESULTS

-----		
Corrected Sample Volume (Vm std):		242.69 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):		21.19 feet/second
Stack Gas Flow Rate (Qs):		979 DSCFM(68 deg.F)
Isokinetic Ratio (%I):		105.8 percent
Total Cr Mass Conc. (Cs):	< 2.7607	but >/= 2.4434 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):		2.1550 nanograms/dscf
Total Cr Mass Conc:	< 97.492	but >/= 86.2880 nanograms/dscm
Hex. Cr. Mass Conc:		76.1022 nanograms/dscm
Total Cr. Emission Rate (Wm):	< 0.1622	but >/= 0.14356 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):		0.12661 milligrams/hr Hex. Cr.

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## **Appendix A2**

### **Clovis 2 Calculated Results**

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**Table A2-1a**  
**Clovis Specialty Plating – Test Week 2**  
**Indoor (PQ-100) Ambient Hexavalent Chromium Sampling Results**

*(Ambient sampling on rectifier during source testing **with** capture hood in place.)*

Sample Number:	C20-RA	C21-RA	C22-RA	C23-RA
Sample Date:	10/18/04	10/19/04	10/20/04	10/21/04
Sampling Time (minutes)	196	308	143	132
Volume Sampled (liters)	1960	3080	1430	1320
Cr (VI) Collected (ng/sample)	300	5000	470	1800
Indoor Ambient Concentration (ng/m <sup>3</sup> )	150	1600	330	1300

This rectifier is next to the plating tank, but outside the source test capture hood.

**Table A2-1b**  
**Clovis Specialty Plating – Test Week 2**  
**Indoor (PQ-100) Ambient Hexavalent Chromium Sampling Results**

*(2<sup>nd</sup> parallel ambient sampling during source testing **with** capture hood in place.)*

Sample Number:	C20-CA	C21-CA	C22-CA	C23-CA
Sample Date:	10/18/04	10/19/04	10/20/04	10/21/04
Sampling Time (minutes)	188	308	139	**
Volume Sampled (liters)	1880	3050	1380	**
Cr (VI) Collected (ng/sample)	270	1700	700	810
Indoor Ambient Concentration (ng/m <sup>3</sup> )	150	560	510	**

CA samples parallel RA samples above - away from the tank and rectifier, but in the same room. RA samples were collected at the same location as Week 1 indoor samples.

\*\* Air Volume data not recorded. Indoor concentration can not be calculated.

**Chromium Source Testing Results**  
**Project: Clovis Plating**  
**Sample Collection: OCTOBER 2004 (Clovis 2)**

**Probes and Impingers**

Sample ID	ml of sample collected	Total Cr ng/ml	Total Cr ng recovered	Cr(VI) ng/ml	Cr(VI) ng recovered	Cr (VI) as % of Total Cr
C24-B	60.4	<1.0	<60	<0.2	<12	
C21-I1	108.4	6.1	660	5.0	540	81.8%
C21-I2	106.9	3.1	330	2.4	260	78.8%
C21-P	68.8	290	20,000	300	21,000	105.0%
<b>Totals:</b>			<b>20,990</b>		<b>21,800</b>	<b>103.9%</b>
C22-I1	106.8	7.5	800	1.6	170	21.3%
C22-I2	105.1	1.5	160	1.0	110	68.8%
C22-P	64.9	180	12,000	170	11,000	91.7%
<b>Totals:</b>			<b>12,960</b>		<b>11,280</b>	<b>87.0%</b>
C23-I1	105.2	4.4	460	3.9	410	89.1%
C23-I1	104.6	2.0	210	1.5	160	76.2%
C23-P	78.4	230	18,000	260	20000	111.1%
<b>Totals:</b>			<b>18,670</b>		<b>20,570</b>	<b>110.2%</b>
C2WBASE-I1	112.9	<1.0		<0.2		
C2WBASE-I2	106.4	<1.0		<0.2		
C2WBASE-P	142.2	1.1	160	1.1	160	100.0%
<b>Totals:</b>			<b>160</b>		<b>160</b>	<b>100.0%</b>
C2WPOST-I1	98.5	<1.0		0.4	39	
C2WPOST-I2	100.0	<1.0		<0.2		
C2WPOST-P	123.7	1.0	120	0.8	100	83.3%
<b>Totals:</b>			<b>120</b>		<b>139</b>	<b>115.8%</b>

The limit of detection (LOD) for Cr by GFAA is 1.0 ng/ml. The LOD for Cr 6+ by IC is 0.2 ng/ml.

**Indoor Ambient Filters**

Filter ID	Air Volume liters	Cr(VI) ng/ml	Cr(VI) ng recovered	Cr(VI) ng/m3	Plating Tank Total amp-hrs
C20-CA*	1880	18	270	150	0
C20-RA*	1960	20	300	150	"
C21-CA	3050	110	1700	560	331
C21-RA	3080	340	5000	1600	"
C22-CA	1380	47	700	510	382
C22-RA	1430	31	470	330	"
C23-CA**	**	54	810	**	360
C23-RA	1320	120	1800	1300	"
C24-BA	blank	<0.2	<3.0	blank	blank

extraction volume = ~15 ml.

\* Samples collected during test equipment setup. No plating occurred during sampling.

\*\* Air volume was not recorded. Final concentration data cannot be calculated

MONITORING & LABORATORY DIVISION  
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
(FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
PROJECT NAME: Clovis 2  
RUN NO.: C21

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	117.9 cubic feet
Vm Meter Cal. Factor (Y)	1.001
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.42 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.776 inches H2O
Pb + dH avg:	29.62 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):	0.36 /(inches H2O)
Stack Temperature (Ts)	528 deg. R
Static Pressure	-0.22 inches H2O
Absolute Stack Pressure (Ps)	29.40 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	33.7 milliliters
Sampling Time (t):	125 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mn):	20,990 nanograms
Hexavalent Cr. Mass Collected (Mn):	21,800 nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	118.65 DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.3 percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84 lb/lbmole
Stack Gas Molecular Wt, Wet	28.69 lb/lbmole
Stack Gas Velocity (Vs):	20.68 feet/second
Stack Gas Flow Rate (Qs):	945 DSCFM(68 deg.F)
Isokinetic Ratio (%I):	102.9 percent
Total Cr Mass Conc. (Cs):	176.909088 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	183.735975 nanograms/dscf
Total Cr Mass Conc:	6,247 nanograms/dscm
Hex. Cr. Mass Conc:	6,489 nanograms/dscm
Total Cr. Emission Rate (Wm):	10.03 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	10.41 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
(FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
PROJECT NAME: Clovis 2  
RUN NO.: C22

SUMMARY OF TEST DATA

-----  
Volume of Gas Sampled (Vm): 110.72 cubic feet  
Vm Meter Cal. Factor (Y) 1.001  
Meter Temperature (Tm): 520 deg. R  
Barometric Pressure (Pb): 29.32 inches Hg  
Avg. delta H Orifice Press. (dH avg): 2.704 inches H2O  
Pb + dH avg: 29.52 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): 0.36 /(inches H2O)  
Stack Temperature (Ts) 527 deg. R  
Static Pressure -0.22 inches H2O  
Absolute Stack Pressure (Ps) 29.30 inches Hg  
Stack Dimensions 12 inches dia.  
Stack Area (As) 0.785 square feet  
H2O in Impingers and Silica Gel (Vlc): 31.6 milliliters  
Sampling Time (t): 120 minutes  
Nozzle Diameter (Dn): 0.375 inches  
Total Chromium Mass Collected (Mn): 12,960 nanograms  
Hexavalent Cr. Mass Collected (Mn): 11,280 nanograms

CALCULATED RESULTS

-----  
Corrected Sample Volume (Vm std): 111.03 DSCF (68 deg.F)  
Water Vapor in Stack (Bws): 1.3 percent by volume  
Stack Gas Molecular Wt, Dry (Md): 28.84 lb/lbmole  
Stack Gas Molecular Wt, Wet 28.69 lb/lbmole  
Stack Gas Velocity (Vs): 20.40 feet/second  
Stack Gas Flow Rate (Qs): 931 DSCFM(68 deg.F)  
Isokinetic Ratio (%I): 101.9 percent  
Total Cr Mass Conc. (Cs): 116.728427 nanograms/dscf  
Hex. Cr. Mass Conc. (Cs): 101.596964 nanograms/dscf  
Total Cr Mass Conc: 4,122 nanograms/dscm  
Hex. Cr. Mass Conc: 3,588 nanograms/dscm  
Total Cr. Emission Rate (Wm): 6.52 milligrams/hr Total Cr.  
Hex. Cr. Emission Rate (Wm): 5.67 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
(FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
PROJECT NAME: Clovis 2  
RUN NO.: C23

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	110.18 cubic feet
Vm Meter Cal. Factor (Y)	1.001
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.54 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.604 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):	0.35 /(inches H2O)
Stack Temperature (Ts)	523 deg. R
Static Pressure	-0.24 inches H2O
Absolute Stack Pressure (Ps)	29.52 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	25.7 milliliters
Sampling Time (t):	120 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mn):	18,670 nanograms
Hexavalent Cr. Mass Collected (Mn):	20,570 nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	111.28 DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.1 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):	19.84 feet/second
Stack Gas Flow Rate (Qs):	922 DSCFM(68 deg.F)
Isokinetic Ratio (%I):	103.1 percent
Total Cr Mass Conc. (Cs):	167.772939 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	184.846779 nanograms/dscf
Total Cr Mass Conc:	5,925 nanograms/dscm
Hex. Cr. Mass Conc:	6,528 nanograms/dscm
Total Cr. Emission Rate (Wm):	9.28 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	10.22 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
 STATIO NARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
 (FOR FIELD DATA RECORD)

FILE NO. : T-04-014  
 PROJECT NAME: Clovis 2  
 RUN NO. : C2VB2 (Pre)

SUMMARY OF TEST DATA

-----

Volume of Gas Sample d (Vm):	207.05 cubic feet
Vm Meter Cal. Factor (Y)	1.001
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.91 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.329 inches H2O
Pb + dH avg:	30.08 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):	0.34 /(inches H2O)
Stack Temperature (Ts)	531 deg. R
Static Pressure	-0.22 inches H2O
Absolute Stack Pressure (Ps)	29.89 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vc):	44.1 milliliters
Sampling Time (t):	240 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mh):	160 nanograms
Hexavalent Cr. Mass Collected (Mh):	160 nanograms

CALCULATED RESULTS

-----

Corrected Sample Volume (Vm std):	211.58 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):	19.20 feet/second
Stack Gas Flow Rate (Qs):	890 DSCFM(68 deg.F)
Isokinetic Ratio (%I):	101.5 percent
Total Cr Mass Conc. (Cs):	0.7562156 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	0.7562156 nanograms/dscf
Total Cr Mass Conc:	26.705 nanograms/dscm
Hex. Cr. Mass Conc:	26.705 nanograms/dscm
Total Cr. Emission Rate (Wr):	0.04 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wr):	0.04 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
( FOR FIELD DATA RECORD)

FILE NO. : T-04-014  
PROJECT NAME: Clovis 2  
RUN NO. : C2WPost

SUMMARY OF TEST DATA

-----

Volume of Gas Sampled (Vm):	87.09 cubic feet
Vm Meter Cal. Factor (Y)	1.001
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	30.05 inches Hg
Avg. delta H Orifice Press. (dH avg):	1.683 inches H2O
Pb + dH avg:	30.17 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)	522 deg. R
Static Pressure	-0.15 inches H2O
Absolute Stack Pressure (Ps)	30.04 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	18.2 milliliters
Sampling Time (t):	120 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mh):	120 nanograms
Hexavalent Cr. Mass Collected (Mh):	139 nanograms

CALCULATED RESULTS

-----

Corrected Sample Volume (Vm std):	89.27 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):	16.00 feet/second
Stack Gas Flow Rate (Qs):	758 DSCFM(68 deg.F)
Isokinetic Ratio (%):	100.5 percent
Total Cr Mass Conc. (Cs):	1.3442506 nanograms/dscf*
Hex. Cr. Mass Conc. (Cs):	1.5570903 nanograms/dscf
Total Cr Mass Conc:	47 nanograms/dscm
Hex. Cr. Mass Conc:	55 nanograms/dscm
Total Cr. Emission Rate (Wr):	0.06 milligrams/hr Total Cr.*
Hex. Cr. Emission Rate (Wr):	0.07 milligrams/hr Hex. Cr.

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## **Appendix A3**

### **Clovis 3 Calculated Results**

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**Table A3-1a**  
**Clovis Specialty Plating – Test Week 3**  
**Indoor (PQ-100) Ambient Hexavalent Chromium Sampling Results**

*(Ambient indoor sampling on rectifier during source testing **with** capture hood in place.)*

Sample Number:	C30-RA	C31-RA	C32-RA	C33-RA
Sample Date:	5/24/05	5/24/05	5/25/05	5/25/05
Sampling Time (minutes)	264	122	128	125
Volume Sampled (liters)	2640	1220	1280	1250
Cr (VI) Collected (ng/sample)	5837	1964	646	1069
Indoor Ambient Concentration (ng/m <sup>3</sup> )	<b>2,200</b>	<b>1,600</b>	<b>510</b>	<b>860</b>

This rectifier is next to the plating tank, but outside the source test capture hood.

**Table A3-1b**  
**Clovis Specialty Plating – Test Week 3**  
**Indoor (PQ-100) Ambient Hexavalent Chromium Sampling Results**

*(Ambient indoor sampling during source testing **with** capture hood in place.)*

Sample Number:		C31-CA	C32-CA	C33-CA
Sample Date:		5/24/05	5/25/05	5/25/05
Sampling Time (minutes)		132	129	121
Volume Sampled (liters)		1320	1290	1210
Cr (VI) Collected (ng/sample)		1425	978	1067
Indoor Ambient Concentration (ng/m <sup>3</sup> )		1,100	760	880

CA samples parallel RA samples above - away from the tank and rectifier, but in the same room. RA samples were collected at the same location as Clovis 1 indoor samples.

## Chromium Source Testing Results

Project: Clovis Plating

Sample Collection: May 2005 (Clovis 3)

### Probes and Impingers

Sample ID	ml of sample collected	Total Cr ng/ml	Total Cr ng recovered	Cr(VI) ng/ml	Cr(VI) ng recovered	Cr (VI) as % of Total Cr
C34-Blank	101.9	<1.0	<100			
C31-I1	107.5	14.0	1500	14.0	1500	100.0%
C31-I2	104	2.9	300	1.8	190	63.3%
C31-P	105.5	170.0	18000	170.0	18000	100.0%
<b>Totals:</b>			<b>19,800</b>		<b>19,690</b>	<b>99.4%</b>
C32-I1	119.7	10.0	1200	10.0	1200	100.0%
C32-I2	84	1.0	84	1.0	84	100.0%
C32-P	133.6	100.0	13000	92.0	12000	92.3%
<b>Totals:</b>			<b>14,284</b>		<b>13,284</b>	<b>93.0%</b>
C33-I1	103.5	17.0	1800	16.0	1700	94.4%
C33-I2	98	6.0	590	4.1	400	67.8%
C33-P	134	120.0	16000	120.0	16000	100.0%
<b>Totals:</b>			<b>18,390</b>		<b>18,100</b>	<b>98.4%</b>
C3WPRE-I1	98.8	<1.0	<75	0.8	30	
C3WPRE-I2	100.8	<1.0	<100	<0.2	<20	
C3WPRE-P	74.9	<1.0	<100	0.6	45	
<b>Totals:</b>			<b>0</b>		<b>75</b>	
C34-I1	94.3	<1.0	<94	0.3	28	
C34-I2	105.1	<1.0	<110	0.2	21	
C34-P	145.8	1.0	150	0.9	130	86.7%
<b>Totals:</b>			<b>150</b>		<b>179</b>	<b>89.9%</b>

The limit of detection (LOD) for Cr by GFAA is 1.0 ng/ml. The LOD for Cr 6+ by IC is 0.2 ng/ml.

### Indoor Ambient Filters

Filter ID	Air Volume liters	Cr(VI) ng/ml	Cr(VI) ng recovered	Cr(VI)		Plating Tank Total amp-hrs
				ng/l	ng/m3	
C30-RA*	2,640	389.1	5837	2.211	2,211	0*
C31-RA	1,220	130.91	1964	1.610	1,610	385
C31-CA	1,320	95.03	1425	1.080	1,080	"
C32-RA	1,280	43.05	646	0.505	505	309
C32-CA	1,290	65.21	978	0.758	758	"
C33-RA	1,250	71.25	1069	0.855	855	316
C33-CA	1,210	71.14	1067	0.882	882	"

extraction volume = ~15 ml.

\* C30-RA was collected during sampling equipment setup. There was no plating at that time.

MONITORING & LABORATORY DIVISION  
 STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
 (FOR FIELD DATA RECORD)

FILE NO. : T-04-014  
 PROJECT NAME: Clovis 3  
 RUN NO. : C31

SUMMARY OF TEST DATA

-----

Volume of Gas Sampled (Vm):	105.085 cubic feet
Vm Meter Cal. Factor (Y)	0.973
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.56 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.342 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):	0.34 /(inches H2O)
Stack Temperature (Ts)	551 deg. R
Static Pressure	-0.20 inches H2O
Absolute Stack Pressure (Ps)	29.55 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	25.5 milliliters
Sampling Time (t):	120 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mh):	19,800 nanograms
Hexavalent Cr. Mass Collected (Mh):	19,690 nanograms

CALCULATED RESULTS

-----

Corrected Sample Volume (Vm std):	103.17 DSCF (68 deg. F)
Water Vapor in Stack (Bws):	1.2 percent by volume
Stack Gas Molecular W, Dry (Md):	28.84 lb/lbmole
Stack Gas Molecular W, Wet	28.71 lb/lbmole
Stack Gas Velocity (Vs):	19.75 feet/second
Stack Gas Flow Rate (Qs):	871 DSCFM(68 deg.F)
Isokinetic Ratio (%):	101.2 percent
Total Cr Mass Conc. (Cs):	191.91807 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	190.85185 nanograms/dscf
Total Cr Mass Conc:	6,777 nanograms/dscm
Hex. Cr. Mass Conc:	6,740 nanograms/dscm
Total Cr. Emission Rate (Wh):	10.03 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wh):	9.97 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
 STATONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
 (FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
 PROJECT NAME: Clovis 3  
 RUN NO.: C32

SUMMARY OF TEST DATA

-----

Volume of Gas Sampled (Vm):	98.78 cubic feet
Vm Meter Cal. Factor (Y)	0.973
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.57 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.038 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):	0.32 /(inches H2O)
Stack Temperature (Ts)	546 deg. R
Static Pressure	-0.21 inches H2O
Absolute Stack Pressure (Ps)	29.55 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	21.4 milliliters
Sampling Time (t):	120 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mh):	14,284 nanograms
Hexavalent Cr. Mass Collected (Mh):	13,284 nanograms

CALCULATED RESULTS

-----

Corrected Sample Volume (Vm std):	96.94 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):	18.59 feet/second
Stack Gas Flow Rate (Qs):	828 DSCFM(68 deg.F)
Isokinetic Ratio (%):	100.0 percent
Total Cr Mass Conc. (Cs):	147.35093 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	137.03512 nanograms/dscf
Total Cr Mass Conc:	5,204 nanograms/dscm
Hex. Cr. Mass Conc:	4,839 nanograms/dscm
Total Cr. Emission Rate (Wh):	7.32 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wh):	6.81 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
 STATONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
 (FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
 PROJECT NAME: Clovis 3  
 RUN NO.: C33

SUMMARY OF TEST DATA

-----

Volume of Gas Sampled (Vm):	99.585 cubic feet
Vm Meter Cal. Factor (Y)	0.973
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.57 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.146 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):	0.33 /(inches H2O)
Stack Temperature (Ts)	552 deg. R
Static Pressure	-0.20 inches H2O
Absolute Stack Pressure (Ps)	29.56 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	13.8 milliliters
Sampling Time (t):	120 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mh):	18,390 nanograms
Hexavalent Cr. Mass Collected (Mh):	18,100 nanograms

CALCULATED RESULTS

-----

Corrected Sample Volume (Vm std):	97.75 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):	18.90 feet/second
Stack Gas Flow Rate (Qs):	836 DSCFM(68 deg.F)
Isokinetic Ratio (%):	99.8 percent
Total Cr Mass Conc. (Cs):	188.12368 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	185.15708 nanograms/dscf
Total Cr Mass Conc:	6,643 nanograms/dscm
Hex. Cr. Mass Conc:	6,539 nanograms/dscm
Total Cr. Emission Rate (Wh):	9.44 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wh):	9.29 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
 STATI ONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
 (FOR FI ELD DATA RECORD)

FILE NO.: T-04-014  
 PROJECT NAME: Clovis 3  
 RUN NO.: C3WPRE

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	102.22 cubic feet
Vm Meter Cal. Factor (Y)	1.001
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	30.34 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.267 inches H2O
Pb + dH avg:	30.51 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):	0.34 /(inches H2O)
Stack Temperature (Ts)	523 deg. R
Static Pressure	-0.20 inches H2O
Absolute Stack Pressure (Ps)	30.33 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	18.2 milliliters
Sampling Time (t):	120 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mn):	75 nanograms*
Hexavalent Cr. Mass Collected (Mn):	75 nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	105.93 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):	18.66 feet/second
Stack Gas Flow Rate (Qs):	892 DSCFM(68 deg.F)
Isokinetic Ratio (%):	101.4 percent
Total Cr Mass Conc. (Cs):	0.7079907 nanograms/dscf*
Hex. Cr. Mass Conc. (Cs):	0.7079907 nanograms/dscf
Total Cr Mass Conc:	25 nanograms/dscm*
Hex. Cr. Mass Conc:	25 nanograms/dscm
Total Cr. Emission Rate (Wm):	0.04 milligrams/hr Total Cr.*
Hex. Cr. Emission Rate (Wm):	0.04 milligrams/hr Hex. Cr.

\* Used hexavalent chromium results for total chrome.  
 Total chrome results were below detection limits

MONITORING & LABORATORY DIVISION  
 STATONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
 (FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
 PROJECT NAME: Clovis 3  
 RUN NO.: C34/ C40 (post3&pre4)

SUMMARY OF TEST DATA

-----

Volume of Gas Sampled (Vm):	110.86 cubic feet
Vm Meter Cal. Factor (Y)	0.973
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.89 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.600 inches H2O
Pb + dH avg:	30.08 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):	0.36 /(inches H2O)
Stack Temperature (Ts)	537 deg. R
Static Pressure	-0.20 inches H2O
Absolute Stack Pressure (Ps)	29.88 inches Hg
Stack Dimensions	12 inches dia.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	8.9 milliliters
Sampling Time (t):	120 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mh):	150 nanograms
Hexavalent Cr. Mass Collected (Mh):	nanograms

CALCULATED RESULTS

-----

Corrected Sample Volume (Vm std):	110.12 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):	20.32 feet/second
Stack Gas Flow Rate (Qs):	936 DSCFM(68 deg.F)
Isokinetic Ratio (%):	100.5 percent
Total Cr Mass Conc. (Cs):	1.3621964 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	nanograms/dscf
Total Cr Mass Conc:	48 nanograms/dscm
Hex. Cr. Mass Conc:	nanograms/dscm
Total Cr. Emission Rate (Wh):	0.08 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wh):	milligrams/hr Hex. Cr.

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## **Appendix A4**

### **Clovis 4 Calculated Results**

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<b>Table A4-1</b>						
<b>Clovis Specialty Plating (Clovis 4) Test</b>						
<b>Indoor Ambient Hexavalent Chromium Results</b>						
<b>(with Capture Hood over Plating Tank)</b>						
<b>Sample Collection: JUNE 2005</b>						
<b>Filter ID</b>	<b>Air Volume</b>	<b>Cr(VI)</b>	<b>Cr(VI)</b>	<b>Cr(VI)</b>		<b>Plating Tank</b>
	<b>liters</b>	<b>ng/ml</b>	<b>ng recovered</b>	<b>ng/liter</b>	<b>ng/m<sup>3</sup></b>	<b>Total amp-hrs</b>
C41-RA	1,330	98.68	1480	1.113	<b>1113</b>	356
C41-CA	1,320	206.81	3102	2.350	<b>2350</b>	"
C41-CAC	136	21.67	325	2.390	<b>2390</b>	"
C42-RA	1,570	46.91	704	0.448	<b>448</b>	299
C42-CA	1,540	122.14	1832	1.190	<b>1190</b>	"
42-CAC	171					"
C43-RA	1,200	63.13	947	0.789	<b>789</b>	345
C43-CA	1,190	101.59	1524	1.281	<b>1281</b>	"
C43-CAC	131	12.91	194	1.481	<b>1481</b>	"
extraction volume = ~15 ml.						
-RA sampler was located on the plating tank rectifier and next to the sampling hood.						
-CA sampler was located behind and on the opposite side of the sampling hood.						
-CAC sampler was located ~1 meter from CA sampler but sampled at 1 lpm instead of 10 lpm.						

Chromium Source Testing Results						
Project: Clovis Plating						
Sample Collection: JUNE/JULY 2005 (Clovis 4)						
Probes and Impingers						
Sample ID	ml of sample collected	Total Cr ng/ml	Total Cr ng recovered	Cr(VI) ng/ml	Cr(VI) ng recovered	Cr (VI) as % of Total Cr
C34-BLK	101.9	<1.0	<100	<0.2	<20	
C41-I1	105.0	31.0	3200	22.0	2400	75.0%
C41-I2	105.9	6.2	660	4.8	510	77.3%
C41-P	74.7	500.0	37000	360.0	27000	73.0%
		<b>Totals:</b>	<b>40,860</b>		<b>29,910</b>	<b>73.2%</b>
C42-I1	108.4	15.0	1600	13.0	1400	87.5%
C42-I2	108.6	12.0	1300	9.1	990	76.2%
C42-P	73.9	170.0	12000	100.0	7500	62.5%
		<b>Totals:</b>	<b>14,900</b>		<b>9,890</b>	<b>66.4%</b>
C43-I1	105.8	25.0	2700	23.0	2500	92.6%
C43-I2	106.6	5.5	590	4.9	520	88.1%
C43-P	92.9	280.0	26000	230.0	22000	84.6%
		<b>Totals:</b>	<b>29,290</b>		<b>25,020</b>	<b>85.4%</b>
C34/40-I1	94.3	<1.0	<94	0.3	28	
C34/40-I2	105.1	<1.0	<110	0.2	21	
C34/40-P	145.8	1.0	150	0.9	130	86.7%
		<b>Totals:</b>	<b>150</b>		<b>179</b>	<b>119.3%</b>
C44-I1	127.2	<1.0	<130	0.2	25	
C44-I2	65.6	6.9	450	0.5	33	7.3%
C44-P	163.2	1.4	230	0.6	100	43.5%
		<b>Totals:</b>	<b>680</b>		<b>158</b>	<b>23.2%</b>
The limit of detection (LOD) for Cr by GFAA is 1.0 ng/ml. The LOD for Cr 6+ by IC is 0.2 ng/ml.						
Indoor Ambient Filters						
Filter ID	Air Volume liters	Cr(VI) ng/ml	Cr(VI) ng recovered	Cr(VI)		Plating Tank Total amp-hrs
				ng/l	ng/m3	
C41-RA	1,330	98.68	1480	1.113	1113	356
C41-CA	1,320	206.81	3102	2.350	2350	"
C41-CAC	136	21.67	325	2.390	2390	"
C42-RA	1,570	46.91	704	0.448	448	299
C42-CA	1,540	122.14	1832	1.190	1190	"
42-CAC	171					"
C43-RA	1,200	63.13	947	0.789	789	345
C43-CA	1,190	101.59	1524	1.281	1281	"
C43-CAC	131	12.91	194	1.481	1481	"
extraction volume = ~15 ml.						
-RA sampler was located on the plating tank rectifier and next to the sampling hood.						
-CA sampler was located behind and on the opposite side of the sampling hood.						
-CAC sampler was located ~1 meter from CA sampler but sampled at 1 lpm instead of 10 lpm.						

MONITORING & LABORATORY DIVISION  
 STATI ONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
 (FOR FI ELD DATA RECORD)

FILE NO.: T-04-014  
 PROJECT NAME: Clovis 4  
 RUN NO.: C41

SUMMARY OF TEST DATA

-----

Volume of Gas Sampled (Vm):	112.97 cubic feet
Vm Meter Cal. Factor (Y)	0.973
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.57 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.867 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):	0.37 /(inches H2O)
Stack Temperature (Ts)	547 deg. R
Static Pressure	-0.24 inches H2O
Absolute Stack Pressure (Ps)	29.55 inches Hg
Stack Dimensions	12 inches di a.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	31.3 milliliters
Sampling Time (t):	120 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mn):	40,860 nanograms
Hexavalent Cr. Mass Collected (Mn):	29,910 nanograms

CALCULATED RESULTS

-----

Corrected Sample Volume (Vm std):	111.09 DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.3 percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84 lb/lbmole
Stack Gas Molecular Wt, Wet	28.69 lb/lbmole
Stack Gas Velocity (Vs):	21.57 feet/second
Stack Gas Flow Rate (Qs):	955 DSCFM(68 deg.F)
Isokinetic Ratio (%):	99.3 percent
Total Cr Mass Conc. (Cs):	367.8047 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	269.23736 nanograms/dscf
Total Cr Mass Conc:	12,989 nanograms/dscm
Hex. Cr. Mass Conc:	9,508 nanograms/dscm
Total Cr. Emission Rate (Wt):	21.08 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wt):	15.43 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
 STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
 (FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
 PROJECT NAME: Clovis 4  
 RUN NO.: C42

SUMMARY OF TEST DATA

-----

Volume of Gas Sampled (Vm):	102.27 cubic feet
Vm Meter Cal. Factor (Y)	0.973
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.54 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.175 inches H2O
Pb + dH avg:	29.70 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):	0.33 /(inches H2O)
Stack Temperature (Ts)	547 deg. R
Static Pressure	-0.17 inches H2O
Absolute Stack Pressure (Ps)	29.53 inches Hg
Stack Dimensions	12 inches di a.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	34.7 milliliters
Sampling Time (t):	120 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mn):	14,900 nanograms
Hexavalent Cr. Mass Collected (Mn):	9,890 nanograms

CALCULATED RESULTS

-----

Corrected Sample Volume (Vm std):	100.30 DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.6 percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84 lb/lbmole
Stack Gas Molecular Wt, Wet	28.66 lb/lbmole
Stack Gas Velocity (Vs):	18.96 feet/second
Stack Gas Flow Rate (Qs):	837 DSCFM(68 deg.F)
Isokinetic Ratio (%):	102.3 percent
Total Cr Mass Conc. (Cs):	148.55963 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	98.607701 nanograms/dscf
Total Cr Mass Conc:	5,246 nanograms/dscm
Hex. Cr. Mass Conc:	3,482 nanograms/dscm
Total Cr. Emission Rate (Wr):	7.46 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wr):	4.95 milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION  
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS  
(FOR FIELD DATA RECORD)

FILE NO.: T-04-014  
PROJECT NAME: Clovis 4  
RUN NO.: C43

SUMMARY OF TEST DATA

-----

Volume of Gas Sampled (Vm):	104.11 cubic feet
Vm Meter Cal. Factor (Y)	0.973
Meter Temperature (Tm):	520 deg. R
Barometric Pressure (Pb):	29.52 inches Hg
Avg. delta H Orifice Press. (dH avg):	2.333 inches H2O
Pb + dH avg:	29.69 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):	0.34 /(inches H2O)
Stack Temperature (Ts)	555 deg. R
Static Pressure	-0.20 inches H2O
Absolute Stack Pressure (Ps)	29.51 inches Hg
Stack Dimensions	12 inches di a.
Stack Area (As)	0.785 square feet
H2O in Impingers and Silica Gel (Vlc):	27.7 milliliters
Sampling Time (t):	120 minutes
Nozzle Diameter (Dn):	0.375 inches
Total Chromium Mass Collected (Mn):	29,290 nanograms
Hexavalent Cr. Mass Collected (Mn):	25,020 nanograms

CALCULATED RESULTS

-----

Corrected Sample Volume (Vm std):	102.07 DSCF (68 deg.F)
Water Vapor in Stack (Bws):	1.3 percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84 lb/lbmole
Stack Gas Molecular Wt, Wet	28.70 lb/lbmole
Stack Gas Velocity (Vs):	19.80 feet/second
Stack Gas Flow Rate (Qs):	864 DSCFM(68 deg.F)
Isokinetic Ratio (%):	100.9 percent
Total Cr Mass Conc. (Cs):	286.95378 nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	245.12064 nanograms/dscf
Total Cr Mass Conc:	10,134 nanograms/dscm
Hex. Cr. Mass Conc:	8,656 nanograms/dscm
Total Cr. Emission Rate (Wr):	14.88 milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wr):	12.71 milligrams/hr Hex. Cr.

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## **Appendix B**

### **Laboratory Results**

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**Chromium Source Testing Results**  
**Project: Clovis Plating**  
**Sample Collection: May 2004 (Clovis 1)**

**Probes and Impingers**

<b>Sample ID</b>	<i>ml of sample collected</i>	<i>Total Cr ng/ml</i>	<b>Total Cr ng recovered</b>	<i>Cr(VI) ng/ml</i>	<b>Cr(VI) ng recovered</b>
C1-I1	123	44	5400	44	5400
C1-I2	111	3.8	420	4.2	470
CB	115	<1.0	<120	<0.2	<23
C1-P	47	1400	68000	1400	65000
C2-I1	113.8	42	4800	40	4600
C2-I2	110.8	4.1	450	1.5	170
C2-P	73.4	1200	88000	1000	77000
C3-I1	117.3	40	4700	40	4700
C3-I2	116.7	4.5	530	3.8	440
C3-P	101.3	700	71000	650	66000
CP-I1	107.4	1.6	170	1.4	150
CP-I2	110.5	<1.0	<110	0.3	33
CP-P	76.2	5.1	390	4.5	340

The limit of detection (LOD) for Cr by GFAA is 1.0 ng/ml. The LOD for Cr 6+ by IC is 0.2 ng/ml.

**Ambient Filters**

<b>Filter ID</b>	<b>Air Volume liters</b>	<b>Cr(VI) ng/ml</b>	<b>Cr(VI) ng recovered</b>	<b>Cr(VI) ng/m3</b>
C1A	2620	420	6400	2400
C2A	14130	500	7500	530
C3A	13940	370	5500	400
C4A	14030	110	1700	120
C5A	13068	240	3600	280
C6A	11150	100	1500	130
C7A	4653	140	2100	460

extraction volume = 15 ml.

**Chromium Source Testing Results**

**Project: Clovis Plating**

**Sample Collection: Oct. 2004 (Clovis 2)**

<b>Date Analyzed</b>	<b>Solution Sample ID</b>	<b>ml of sample collected</b>	<b>Cr(VI) ng/ml</b>	<b>Cr(VI) ng recovered</b>	<b>Total Cr ng/ml</b>	<b>Total Cr ng recovered</b>
10/27/2004	C21-I1	108.4	5.0	540	6.1	660
10/27/2004	C21-I2	106.9	2.4	260	3.1	330
10/27/2004	C21-P	68.8	300.0	21000	290	20000
10/27/2004	C22-I1	106.8	1.6	170	7.5	800
10/27/2004	C22-I2	105.1	1.0	110	1.5	160
10/27/2004	C22-P	64.9	170.0	11000	180	12000
10/27/2004	C23-I1	105.2	3.9	410	4.4	460
10/27/2004	C23-I2	104.6	1.5	160	2	210
10/27/2004	C23-P	78.4	260.0	20000	230	18000
10/27/2004	C24-B	60.4	<0.2	<12	<1.0	<60

<b>Indoor Ambient Filters</b>				
<b>Filter ID</b>	<b>Air Volume liters</b>	<b>Cr(VI) ng/ml</b>	<b>Cr(VI) ng recovered</b>	<b>Cr(VI) ng/m3</b>
C20-CA*	1880	18	270	150
C20-RA*	1960	20	300	150
C21-CA	3050	110	1700	560
C21-RA	3080	340	5000	1600
C22-CA	1380	47	700	510
C22-RA	1430	31	470	330
C23-CA**	**	54	810	**
C23-RA	1320	120	1800	1300
C24-BA	blank	<0.2	<3.0	blank

extraction volume = ~15 ml.

Hexavalent & Total Chromium Laboratory Results						
Project: Clovis Plating						
Data MAY/JUNE 2005 (Clovis 3)						
Probes and Impingers						
Date Analyzed	Solution Sample ID	ml of sample collected	Cr(VI)		Total Cr	
			ng/ml	ng recovered	ng/ml	ng recovered
6/7/2005	C31-I1	107.5	14.0	1500	14.0	1500
6/7/2005	C31-I2	104	1.8	190	2.9	300
6/7/2005	C31-P	105.5	170.0	18000	170.0	18000
6/7/2005	C32-I1	119.7	10.0	1200	10.0	1200
6/7/2005	C32-I2	84	1.0	84	1.0	84
6/7/2005	C32-P	133.6	92.0	12000	100.0	13000
6/7/2005	C33-I1	103.5	16.0	1700	17.0	1800
6/7/2005	C33-I2	98	4.1	400	6.0	590
6/7/2005	C33-P	134	120.0	16000	120.0	16000

Hexavalent Chromium Source Testing Results			
Project: Clovis Plating - Ambient Filters			
Data: JUNE / JULY 2005 Clovis 3 & 4)			
Ambient Filters			
Filter ID	Air Volume liters	Cr (VI) ng/mL	Cr (VI) ng recovered/filter
C33-CA	*	71.14	1067
C33-RA	*	71.25	1069
C32-CA	*	65.21	978
C32-RA	*	43.05	646
C30-RA	*	389.1	5837
C31-RA	*	130.91	1964
C31-CA	*	95.03	1425
C41-RA	*	98.68	1480
C41-CA	*	206.81	3102
C41-CAC	*	21.67	325
C43-RA	*	63.13	947
C43-CA	*	101.59	1524
C43-CAC	*	12.91	194
C42-RA	*	46.91	704
C42-CA	*	122.14	1832

\* Air Volume not provided. All results are in ng/filter units

**Hexavalent & Total Chromium Laboratory Results**

**Project: Clovis Plating (Clovis 4) Source Test**

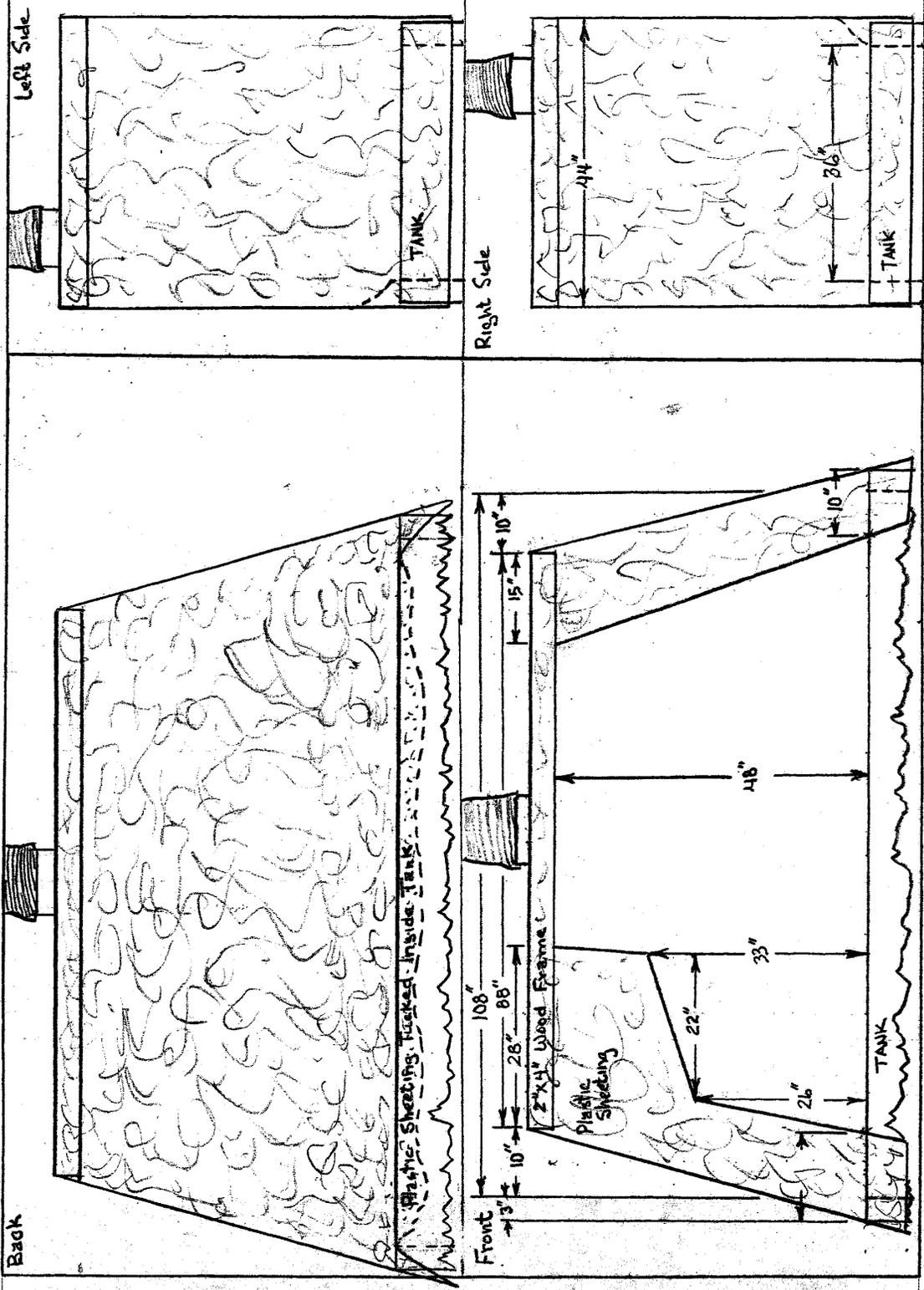
**Data JUNE/JULY 2005**

<b>Probes and Impingers</b>						
<b>Date Analyzed</b>	<b>Solution Sample ID</b>	<b>ml of sample collected</b>	<b>Cr(VI) ng/ml</b>	<b>Cr(VI) ng recovered</b>	<b>Total Cr ng/ml</b>	<b>Total Cr ng recovered</b>
12-Jul-05	C34-BLK	101.9	<0.2	<b>&lt;20</b>	<1.0	<b>&lt;100</b>
12-Jul-05	C34-I1	94.3	0.3	<b>28</b>	<1.0	<b>94</b>
12-Jul-05	C34-I2	105.1	0.2	<b>21</b>	<1.0	<b>&lt;110</b>
12-Jul-05	C34-P	145.8	0.9	<b>130</b>	1.0	<b>150</b>
12-Jul-05	C41-I1	105.0	22.0	<b>2400</b>	31.0	<b>3200</b>
12-Jul-05	C41-I2	105.9	4.8	<b>510</b>	6.2	<b>660</b>
12-Jul-05	C41-P	74.7	360.0	<b>27000</b>	500.0	<b>37000</b>
12-Jul-05	C42-I1	108.4	13.0	<b>1400</b>	15.0	<b>1600</b>
12-Jul-05	C42-I2	108.6	9.1	<b>990</b>	12.0	<b>1300</b>
12-Jul-05	C42-P	73.9	100.0	<b>7500</b>	170.0	<b>12000</b>
12-Jul-05	C43-I1	105.8	23.0	<b>2500</b>	25.0	<b>2700</b>
12-Jul-05	C43-I2	106.6	4.9	<b>520</b>	5.5	<b>590</b>
12-Jul-05	C43-P	92.9	230.0	<b>22000</b>	280.0	<b>26000</b>
12-Jul-05	C44-I1	127.2	0.2	<b>25</b>	<1.0	<b>&lt;130</b>
12-Jul-05	C44-I2	65.6	0.5	<b>33</b>	6.9	<b>450</b>
12-Jul-05	C44-P	163.2	0.6	<b>100</b>	1.4	<b>230</b>

## **Appendix C**

### **Sketch of Capture Hood With Dimensions**

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## **Appendix D**

### **Field Data Sheets**

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