EMISSION TEST REPORT
FOR
TOTAL CHROMIUM EMISSIONS
FROM
EXHAUST OF PACKED BED SCRUBBER NO. 5

DIAMOND CHROME PLATING, INC.
HOWELL, LIVINGSTON COUNTY, MICHIGAN

1.0 INTRODUCTION

Diamond Chrome Plating, Inc. (DCP) located in Howell, Livingston County, Michigan operates four (4) hard chrome plating tanks under State of Michigan Permit to Install (air permit) No. 386-85A issued March 11, 1996 from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for the operation of its chemical processing (plating) of various metals processes located in Howell, Livingston County, Michigan.

The emission units are each connected to an emission control device. Hard Chrome Plating Tanks 5, 7, 15, and 17 are connected to the Packed Bed Scrubber (PBS) system (System No.5) exhaust.

The emissions testing was performed following DCP's discontinued use of fume suppressants in the chrome plating tanks (CR-5, CR-7, CR-15, and CR-17) and in accordance with the Revised Work Plan submitted to EGLE by BB&E, on DCP's behalf, on March 27, 2020.

In addition, provisions of 40 CFR Part 63, Subpart N, the National Emission standard for Hazardous Air Pollutants (NESHAP) for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks, specifies applicable chromium emission limits and testing requirements.

The emissions testing was performed on May 27, 2020 by Impact Compliance & Testing, Inc. (ICT) representatives Blake Beddow and Andrew Eisenberg. Mr. Daniel McGeen and Ms. Lindsey Wells of EGLE-AQD were on-site to observe portions of the emissions testing. The project was coordinated by Ms. Celeste Holtz of BB&E, Inc., and Mr. Scott Wright of Diamond Chrome Plating, Inc.

The sampling and analysis were performed using procedures specified in the test plan documents dated April 13, 2020 and approved by the EGLE-AQD on April 29, 2020.

Appendix 1 provides a copy of the test plan approval letter.

Questions concerning the source and test report should be addressed to:

Testing Manager: Blake Beddow
Project Manager
Impact Compliance & Testing, Inc.
37660 Hills Tech Dr
Farmington Hills, MI 48331
(734) 464-3880
Blake.Beddow@ImpactCandT.com

Compliance Manager: Ms. Celeste Holtz
Environmental Scientist
BB&E, Inc.
235 E. Main St., Suite 107
Northville, MI 48167
(517) 673-1792
choltz@bbande.com

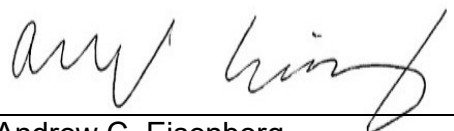
Site Operations: Mr. Scott Wright
Environmental Manager
Diamond Chrome Plating, Inc.
P.O. Box 557
Howell, MI 48844
(547) 546-0150
env@diamondchromeplating.com

Report Certification

This test report was prepared by Impact Compliance & Testing, Inc. based on field sampling data collected by ICT. Facility process data were collected and provided by Diamond Chrome Plating, Inc. employees or representatives. This test report has been reviewed by Diamond Chrome Plating representatives and approved for submittal to the EGLE-AQD.

I certify that the testing was conducted in accordance approved methods unless otherwise specified in this report. I believe the information provided in this report and its attachments are true, accurate, and complete.

Report Prepared By:



Andrew C. Eisenberg,
Environmental Consultant
Impact Compliance & Testing, Inc.

Test Plan Reviewed By:

Blake Beddow,
Project Manager
Impact Compliance & Testing, Inc.

2.0 SUMMARY OF RESULTS

Emission testing was performed for exhaust gas downstream of the No. 5 PBS System. A summary of the average total chromium exhaust concentration for the No. 5 PBS is presented in Table 2.1 below. Measured exhaust gas flowrate, sample train data, and chromium concentrations for each two-hour test period are presented at the end of this report in Table 6.1.

The measured total chrome content in the No. 5 PBS exhaust gas is less than the allowable limit 0.011 milligrams per dry standard cubic meter (mg/dscm) specified in 40 CFR §63.342(c)(1) *Standards for open surface hard chromium electroplating tanks*, and 0.016 pounds per hour (lb/hr) or 0.06 tons per year (TPY) specified in permit number 386-85A for the No. 5 PBS. Emission calculations are presented in Appendix 4.

Process data was monitored and recorded by DCP employees during the total chromium test event. The annual emission rate (TPY) calculation is based on 8,760 hours, which assumes continuous plating operations (24 hours per day, 365 days per year). DCP typically operates their plating tanks a few hours per day, five to six days per week, excluding holidays. Therefore, this emission rate is a conservative, worst case scenario.

Table 2.1 3-Run Average Summary of PBS Scrubber No. 5 emission test results

Parameter	No. 5 Packed Bed Scrubber	
Scrubber Pressure Drop	1.7	"WCm
Scrubber Liquid Flow Rate	64	Hz
Scrubber Exhaust Gas Flowrate	19,757	DSCFM
Total Chromium Concentration	7.38	µg
Total Chromium Concentration	0.003	mg/dscm
Total Chromium Emission Limit	*0.011*	*mg/dscm*
Total Chromium Emission Rate	2.15×10^{-4}	lb/hr
	9.41×10^{-4}	TPY
Total Chromium Emission Limit	*0.016*	*lb/hr*
	0.06	*TPY*

Abbreviations
"WCm = inches of water column
Hz = hertz
DSCFM = dry standard cubic feet of air per minute
µg = micrograms ($1X10^{-6}$ grams)
mg/dscm = milligrams per dry standard cubic meter of air
lb/hr = pounds per hour
TPY = tons per year

3.0 SOURCE DESCRIPTION

3.1 General Process Description

DCP provides hard chrome plating for the aerospace, aircraft, food, and other commercial industries. In general, the hard chrome plating process requires the parts to be degreased, mechanically cleaned, masked to prevent chrome application on certain surfaces, and placed into plating solution. Emissions were tested from four (4) hard chrome plating tanks that are serviced by one (1) scrubber.

3.2 Emission Control System Description

The No.5 Scrubber services tanks 5, 7, 15, and 17, and utilizes packed scrubber beds with an exhaust mist eliminator pad.

The PBS consists of a collection of packing media that is sprayed down by liquid distribution nozzles. The exhaust passes through a mist eliminator pad prior to its release to the atmosphere. The PBS is designed to remove mist and entrained chromium droplets from the hard chrome plating tanks. The collected droplets agglomerate and drain from the packing media. The packing media is replaced periodically.

The airflow through the PBS is achieved using an induced draft blower on the exit of the scrubber. The scrubber system has a design capacity of 20,000 scfm of exhaust gas.

Appendix 2 provides a sampling location drawing for the scrubber exhaust.

3.3 Process Operating Conditions During the Compliance Testing

Testing was conducted when DCP operated at maximum operating conditions. Process data that was required on the Protocol Approval letter was monitored by DCP representatives and logged on a data sheet.

Surface tension readings of each hard chrome plating tanks controlled by PBS No. 5 were recorded at the beginning of the test day. Strike amp-hours, plate amp-hours, scrubber pressure drop, and scrubber liquid flowrate were recorded periodically throughout each test period.

Appendix 3 presents the operating data recorded for the test periods.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

A test plan was prepared by ICT and submitted to EGLE-AQD prior to performing the compliance test. This section provides a summary of the sampling and analytical procedures that were used during the tests and presented in the test plan.

4.1 Exhaust Gas Velocity and Flowrate (USEPA Methods 1 and 2)

Exhaust gas sampling was performed in the 36-inch diameter scrubber exhaust stack using sampling ports that satisfied USEPA Method 1 criteria. A diagram and measurements for the exhaust gas sampling location is provided in Appendix 2.

To determine pollutant mass flow emission rates, the stack gas velocity was measured using procedures specified in USEPA Method 2 throughout each test period using an S-type Pitot tube connected to the isokinetic sampling probe. Gas velocity (pressure) measurements were performed at each traverse point using a red-oil manometer. Temperature was recorded at each traverse point using a K-type thermocouple and a calibrated digital thermometer.

Appendix 4 provides copies of exhaust gas velocity field data sheets and flowrate calculations.

4.2 Exhaust Gas Molecular Weight

The exhaust gas is primarily captured building air that has been drawn through the scrubber system. A dry molecular weight of 29.0 was used as specified in Section 8.6 of USEPA Method 2.

4.3 Exhaust Gas Moisture Content (USEPA Method 4)

Moisture content of the scrubber exhaust gas was determined in using the USEPA Method 4 chilled impinger method as part of the isokinetic sampling procedures for chromium. The amount of moisture removed from the sample stream by the chilled impingers was determined gravimetrically by weighing the impinger contents before and after the test period to determine net weight gain.

Appendix 4 provides moisture train sampling data and calculations.

4.4 Chromium Emission Rate (USEPA Method 306)

USEPA Method 306, *Determination of Chromium Emissions from Decorative and Hard Chrome Electroplating and Chromium Anodizing Operations*, was used to determine hexavalent chromium concentration in the scrubber exhaust gas. Process gas was withdrawn from the scrubber exhaust stack at an isokinetic sampling rate using a glass sampling nozzle, glass-lined probe and an impinger train containing 0.1N sodium hydroxide

(NaOH) solution. Pursuant to USEPA Method 306, the sample probe was not heated, and the filter was omitted. Therefore, the glass probe liner was connected to a clean flexible Teflon line connected directly to the first impinger.

Stack gas temperature and velocity pressure at each traverse point were monitored and recorded throughout each four-hour test period to determine volumetric flowrate.

At the conclusion of each test period the final weight of each impinger was measured. The moisture gain was determined gravimetrically, and the stack gas total moisture was determined based on the total weight gain of the impingers and silica gel. The sample nozzle, probe liner, first three impingers and connective glassware were rinsed using 0.1N NaOH solution. The rinse and impinger solutions were combined and shipped to Element One, Inc. (Wilmington, North Carolina) for analysis.

The total chromium content in the recovered solutions was determined by Element One, Inc.

Appendix 5 contains a copy of the Element One laboratory report.

The total chromium [Cr] concentration was determined using the sample train data and laboratory reported Cr mass with the following equation:

$C_{Cr} = M_{Cr} / V_m / (1{,}000\ \mu g/mg)$

C_{Cr} = Cr concentration (mg/dscm)
M_{Cr} = Mass Cr in recovered solutions (µg)
V_m = Sample gas volume for test period (dscm)

The Cr mass emission rate was determined using the information above and the measured volumetric flowrate with the following equation:

$E_{Cr} = M_{Cr} / V_m * Q_d * (60\ min/hr) / (454E\text{-}06\ \mu g/lb)$

E_{Cr} = Cr(VI) emission rate (lb/hr)
Q_d = Exhaust gas volumetric flowrate (dscfm)

The annual emission rate (TPY) was calculated assuming continuous plating operations (8,760 hours). As described in section 2.0, this is an over-estimate based on current DCP shift schedules.

5.0 QA/QC ACTIVITIES

5.1 Exhaust Gas Flow Measurement

Prior to arriving onsite, the instruments used during the source test to measure exhaust gas properties and velocity (barometer, pyrometer, and Pitot tube) were calibrated to specifications in the sampling methods.

The absence of cyclonic flow for each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each of the velocity traverse points with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

5.2 Meter Box and Isokinetic Rate

The dry gas metering console, which was used for the isokinetic sampling, was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges presented in USEPA Method 5.

The digital pyrometer in the metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

The sampling nozzle diameter was determined using the three-point calibration technique.

The sampling rate for all test periods was within 10% of the calculated isokinetic sampling rate required by USEPA Methods 306 and 5.

5.3 Total Chromium Recovery and Analysis

All recovered samples were stored and shipped in pre-rinsed polyethylene sample bottles with Teflon® lined caps. The liquid level on each bottle was marked with a permanent marker prior to shipment and the caps were secured closed with tape. Samples of the reagent used in the test event (500 milliliters of 0.1N sodium hydroxide) was sent to the laboratory for analysis to verify that the reagent used to recover the samples has low chromium content.

The glassware and Teflon line used in the sample train was washed and rinsed prior to use in accordance with the procedures of USEPA Method 306. The glass sample nozzle and probe liner were washed, rinsed and soaked in acid prior to use in accordance with USEPA Method 306.

5.4 Laboratory QA/QC Procedures

The laboratory chromium analyses were conducted by a qualified third-party laboratory according to the appropriate QA/QC procedures specified in the associated USEPA test methods and are included in the final report provided by Element One (Wilmington, NC).

Appendix 6 presents test equipment quality assurance data (instrument calibration records, meter box calibration records, cyclonic flow determinations sheets, Pitot tube, nozzle and probe assembly calibration records).

6.0 TEST RESULTS

6.1 Test Results and Allowable Emission Limits

Air pollutant emission measurement results for each four-hour test period are presented in Table 6.1.

The average measured total chromium emission rate for hard chrome plating tanks CR-5, CR-7, CR-15, and CR-17 is 2.15 X 10^{-4} pounds per hour (lb/hr), which is less than (in compliance with) the permitted total chromium emission rate of 0.016 lb/hr.

Assuming continuous chrome plating operation (8,760 hours) the annual emission rate for hard chrome plating tanks CR-5, CR-7, CR-15, and CR-17 is 9.41 X 10^{-4} TPY. This is less than (in compliance with) the permitted total chromium emission rate of 0.06 TPY.

The average measured total chromium concentration for hard chrome plating tanks CR-5, CR-7, CR-15, and CR-17 is 0.003 mg/dscm. This is less than (in compliance with) the federal standard for large hard chrome plating operations of 0.011 mg/dscm.

6.2 Variations from Normal Sampling Procedures or Operating Conditions

There were no variations from normal sampling procedures or operating conditions during the testing project.

Table 6.1 Measured exhaust gas conditions and hexavalent chromium emission rates for hard chrome plating tanks Nos. CR-5, CR-7, CR-15, and CR-17

Test No	1	2	3	
Date	05/27/20	05/27/20	05/27/20	Three Test
Time	0845-1047	1112-1314	1338-1539	Average
Scrubber Exhaust				
Exhaust gas flowrate (dscfm)	19,973	19,960	19,340	19,757
Exhaust gas flowrate (dscmm)	565.6	565.2	547.7	559.5
Temperature (°F)	79.2	80.6	80.5	80.1
Moisture (%)	3.01	2.85	3.14	3.00
Sample Train Data				
Sample volume (dscf)	90.6	90.3	88.8	89.9
Sample volume (dscm)	2.57	2.56	2.51	2.55
Cr catch weight (µg)	11.0	6.29	4.85	7.38
Emission Rate				
Cr concentration (mg/dscm)	0.004	0.002	0.002	0.003
Permitted concentration (mg/dscm)	-	-	-	*0.011*
Cr emission rate (lb/hr)	3.21×10^{-4}	1.84×10^{-4}	1.40×10^{-4}	2.15×10^{-4}
Permitted emission rate (lb/hr)	-	-	-	*0.016*
Cr emission rate (TPY)	1.41×10^{-3}	8.05×10^{-4}	6.12×10^{-4}	9.41×10^{-4}
Permitted emission rate (TPY)	-	-	-	*0.06*

Abbreviations
dscfm = dry standard cubic feet of air per minute
dscmm = dry standard cubic meters of air per minute
µg = micrograms (1E-06 grams)
mg/dscm = milligrams per dry standard cubic meter of air
lb/hr = pounds per hour

APPENDIX 1

TEST PLAN APPROVAL LETTER

STATE OF MICHIGAN
DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
LANSING

GRETCHEN WHITMER
GOVERNOR

LIESL EICHLER CLARK
DIRECTOR

April 29, 2020

Mr. Scott Wright
Environmental Manager
Diamond Chrome Plating, Inc.
P.O. Box 557
Howell, Michigan 48844

Dear Mr. Wright:

SUBJECT: Diamond Chrome Plating, Emission Testing, Permit #: 386-85A;
SRN: A2931

The Department of Environment, Great Lakes, and Energy (EGLE), Air Quality Division (AQD) has reviewed the protocol for emission testing at Diamond Chrome Plating Inc. in Howell. Scrubber No. 5 that controls emissions from chrome tanks CR-5; CR-7; CR-15; and CR-17 will be tested for total chromium. This testing is required by Permit No. 386-85A and Title 40 of the Code of Federal Regulations (40 CFR), Part 63, Subpart N.

Testing will be performed in accordance with 40 CFR, Part 60, Methods 1, 2, 3, 4; 40 CFR, Part 63, Method 306:

- Method 306 runs will be no less than 120-minutes in duration and collect no less than 60 dscf;
- A field reagent blank will be required as per method 306 paragraph 8.2.4; and
- Emissions of total chromium will be reported in mg/dscm, lb/hr, and ton/yr.

All requirements and specifications of the above methods apply; any modifications of the test methods on-site must be approved by the AQD.

Testing should be performed while the lines are in maximum routine operating conditions with the equipment boost amps at the higher end of normal. The following process and control device data will be recorded during testing:

- Amp-hours data, including both strike amps and plate amps;
- Part type during testing (dummy or customer order);
- Scrubber pressure drop during testing recorded at the beginning, middle, and end of each run;
- The liquid flow rate of scrubber recorded at the beginning, middle, and end of each run; and
- Surface tension readings, as measured by a tensiometer, of the chrome plating tanks served by scrubber No. 5 on the day of testing.

Mr. Daniel McGeen of the Lansing District Office will coordinate the collection of process data. Please contact him at 517-284-6638; or McgeenD@Michigan.gov with questions regarding process parameters.

The test report will include:

- All pre-test and post-test meter box calibration, pitot tube calibration, and field data sheets;
- All laboratory data including quality control audits;
- The process and control device data listed above; and
- All aborted or failed runs must be included in the report.

A complete copy of the test report should be sent to the following locations:

Mr. Daniel McGeen
EGLE, Air Quality Division
Constitution Hall, 1st Floor South
525 West Allegan Street
Lansing, Michigan 49833

Mrs. Karen Kajiya-Mills
EGLE, Air Quality Division
Constitution Hall, 2nd Floor South
525 West Allegan Street
Lansing, Michigan 48933

The link below details guidance for companies that would like to submit documentation electronically to AQD during the COVID-19 emergency: https://www.michigan.gov/documents/egle/egle-aqd-covid19-guidance_685893_7.pdf.

EGLE has established an email box (EGLE-EnforcementDiscretion@mi.gov) to accept requests for regulatory flexibility from entities who face unavoidable non-compliance directly due to the COVID-19 emergency. Additional information on EGLE's process for handling enforcement discretion due to COVID-19 can be viewed at https://www.michigan.gov/egle/0,9429,7-135--523592--,00.html, or by clicking the Enforcement Discretion link at www.michigan.gov/egle.

Testing is scheduled for May 27, 2020. Please inform Mr. Daniel McGeen, of the Lansing District Office, at 517-284-6638, and me, of any change in the test date. If you have any questions regarding this letter, please contact me by telephone or email at WellsL8@Michigan.gov.

Sincerely,

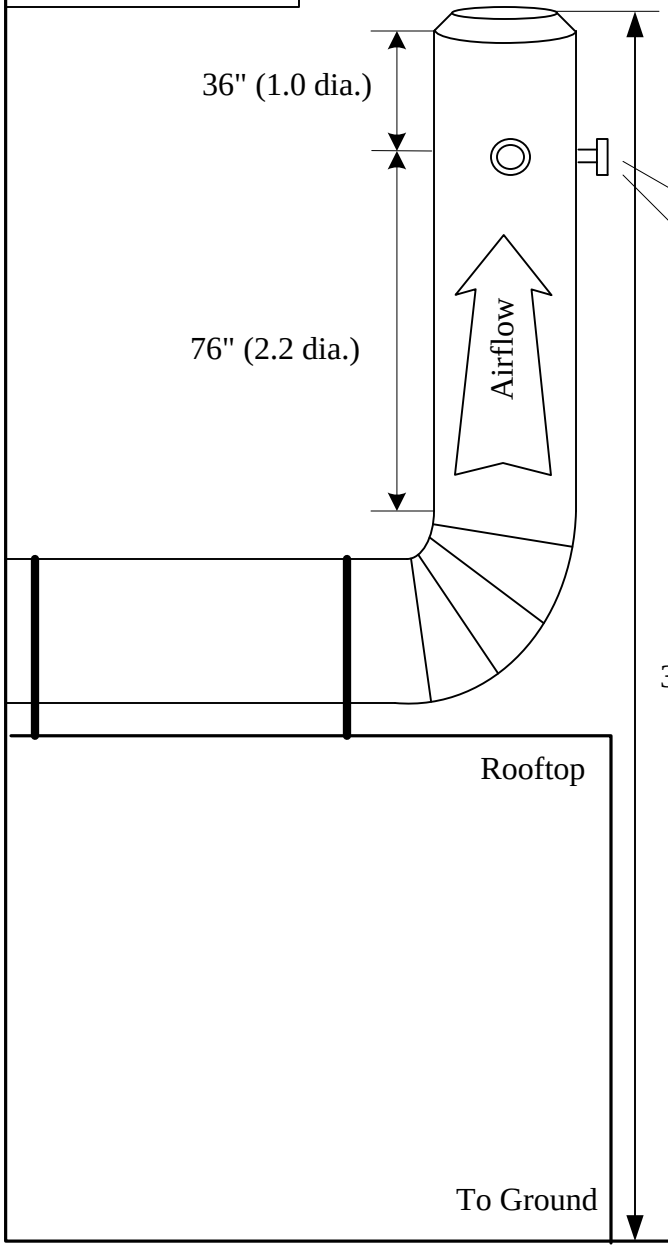
Lindsey Wells
Technical Programs Unit
Field Operations Section
Air Quality Division
517-282-2345

cc: Mr. Blake Beddow, Impact Compliance & Testing
Ms. Karen Kajiya-Mills, EGLE
Mr. Brad Myott, EGLE
Mr. Daniel McGeen, EGLE

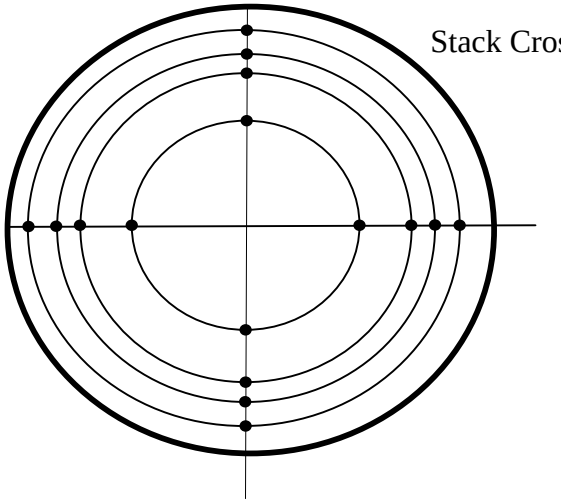
APPENDIX 2

SAMPLE LOCATION DRAWING

Scrubber No. 5
Exhaust



Stack Cross Section



Velocity sample locations (not including 3.0" sampling port nipple)

1	1.15"
2	3.78"
3	6.98"
4	11.59"
5	24.37"
6	29.02"
7	32.22"
8	34.85"

6/15/2020	**Diamond Chrome Plating, Inc.** **No. 5 Packed Bed Scrubber Exhaust Stack**		
	Scale None	Sheet 1 of 1	ICT Project No. 2000109