EMISSION TEST REPORT

Report Title:	Test Report for the Verification of Total Chromium Emissions from Chrome Plating Operations
Report Date:	October 29, 2014
Test Date:	September 10 – 11, 2014

Facility Information	
Name:	Diamond Chrome Plating, Inc.
Street Address:	604 S Michigan Ave
City, County:	Howell, Livingston
Phone:	(517) 546-0150

Facility Permit Information	
Permit to Install No.:	367-83B

Testing Contractor	
Company:	Derenzo and Associates, Inc.
Mailing Address:	39395 Schoolcraft Road Livonia, MI 48150
Phone:	(734) 464-3880
Project No.:	1407008

TEST REPORT
FOR THE
VERIFICATION OF TOTAL CHROMIUM EMISSIONS
FROM CHROME PLATING OPERATIONS

DIAMOND CHROME PLATING, INC.
HOWELL, MICHIGAN

1.0 INTRODUCTION

Diamond Chrome Plating, Inc. (Diamond Chrome) operates two (2) chrome plating lines at its facility located in Howell, Livingston County, Michigan. The Michigan Department of Environmental Quality (MDEQ) has issued the facility a Permit to Install (PTI No. 367-83B) for the operation of the chrome plating lines.

Line No. 1 consists of Tank Nos. 1, 2, 3, 4 and 6. Line No. 2 consists of Tank Nos. 8, 9, 11 and 12. Emissions from each individual chrome plating line are controlled by a dedicated wet scrubber. The North Scrubber controls emissions from Line No. 1 (Exhaust Stack No.: SV00004) and the South Scrubber controls emissions from Line No. 2 (Exhaust Stack No. SV00003).

Conditions of PTI No. 367-83B require Diamond Chrome to perform compliance testing upon request of the MDEQ to verify compliance with the permitted chromic acid emission rate. In addition, provisions of 40 CFR Part 63, Subpart N, (National Emission Standards for Hazardous Air Pollutants for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks), specifies applicable chromium emission limits and testing requirements. Testing was completed to demonstrate compliance with the revised emission limits stated in 40 CFR 63.342(c)(1).

The testing was performed September 10 – 11, 2014 by Derenzo and Associates, Inc. representatives Andy Rusnak and Patrick Triscari. Mr. Nathan Hund and Mr. Dan McGeen of the MDEQ-AQD were on-site to observe portions of the compliance testing. The project was coordinated by Ms. Wendi R. Willis, P.E. of BB&E, L.L.C. and Mr. John D. Wagner, P.E., R.E.M., C.S.P of Diamond Chrome.

The sampling and analysis was performed using procedures specified in the test protocol documents received by the MDEQ-AQD on August 13, 2014.

Appendix 1 contains a copy of the test protocol approval letter.

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

Testing Contractor:	Andy Rusnak, QSTI, Sr. Env. Engineer Derenzo and Associates, Inc. 4990 Northwind Dr. #120 East Lansing, MI 48823 (517) 324-1880 arusnak@derenzo.com
Facility Compliance Contact:	Wendi R. Willis, P.E., CHMM, Civil Engineer BB&E, L.L.C. 235 E. Main St. #107 Northville, MI 48167 (248) 489-9636 x306 wwillis@bbande.com
Site Operations:	John D. Wagner, P.E., R.E.M., C.S.P., Director Health, Safety and Environmental Affairs Diamond Chrome Plating, Inc. P.O. Box 557 Howell, MI 48844 (517) 546-0150 env@diamondchromeplating.com

Report Certification

This test report was prepared by Derenzo, Associates, Inc. based on field sampling data collected by Derenzo and Associates, Inc. Facility process data were collected and provided by Diamond Chrome employees or representatives. This test report has been reviewed by Diamond Chrome representatives and approved for submittal to the MDEQ-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:

Andy Rusnak, QSTI
Sr. Environmental Engineer
Derenzo and Associates, Inc.

Reviewed By:

Robert L. Harvey, P.E.
General Manager
Derenzo and Associates, Inc.

This test report has been reviewed by Diamond Chrome representatives and approved for submittal to the Michigan Department of Environmental Quality. I certify that the facility operating conditions were in compliance with permit requirements and were at the maximum routine operating conditions for the facility. Based on information and belief formed after reasonable inquiry, I believe that the testing was performed in accordance with the approved test plan and the statements and information in this report are true, accurate and complete.

John D. Wagner, P.E., R.E.M., C.S.P.,
Director Health, Safety and Environmental Affairs
Diamond Chrome Plating, Inc.

2.0 SUMMARY OF RESULTS

The chrome plating line exhaust gases were each sampled for three (3) two-hour test periods to determine the total chromium exhaust gas concentration. Exhaust gas velocity measurements were performed during each test period to determine volumetric flowrate and pollutant mass emission rate. The average measured total chromium mass emission rates were less than the limits specified in the Chrome Plating NESHAP (Subpart N) and PTI No. 367-83B.

Table No. 2.1 presents a summary of the operating parameters measured during the testing.

Table No. 2.2 presents a summary of the total chromium test results compared to NESHAP emission limits.

Table No. 2.3 presents a summary of the total chromium test results compared to PTI No. 367-83B chromic acid emission limits.

Table 2.1 Summary of chrome plating line operating parameters

Operating Parameter	Avg. Measured Value[1]
Line No. 1 amp-hours	28,218
Line No. 2 amp-hours	27,210
North Scrubber pressure drop (inH_2O)	3.5
South Scrubber pressure drop (inH_2O)	3.2
North Scrubber liquid flowrate (gpm)	0.54
South Scrubber liquid flowrate (gpm)	0.49

Table 2.2 Summary of chrome plating line test results compared to NESHAP emission limits

Emission Unit	Total Chromium[1] (mg/dscm)	Total Chromium[1] (gr/dscf)
Line No. 1 (North Scrubber)	0.001	5.44E-07
Line No. 2 (South Scrubber)	0.001	5.62E-07
Emission Limit	*0.011*	*4.8E-06*

Table 2.3 Summary of chrome plating line test results compared to PTI No. 367-83B emission limits

Emission Unit	Chromic Acid[1,2] (mg/dscm)
Line No. 1 (North Scrubber)	0.003
Line No. 2 (South Scrubber)	0.003
Permitted Limit	*0.071*

Notes for Tables Nos. 2.1 through 2.3:

1. Average for three (3) two-hour test periods.
2. Chromic acid concentration calculated based on the measured total chromium concentration and the ratio of the molecular weight of chromic acid (H_2CrO_4) to the molecular weight of chromium (118/52).

3.0 SOURCE DESCRIPTION

3.1 General Process Description

Diamond Chrome operates two (2) chrome plating lines. Chrome plating the surface of metallic parts requires the parts to be degreased, mechanically cleaned, masked to prevent chrome application on certain surfaces, and placed into the plating solution. Once the parts are placed into the coating tanks chrome is electrolytically deposited onto the metal part in varying thicknesses depending on the application.

Process gas from the chrome plating lines is captured and exhausted to two (2) scrubber control devices, which are used to reduce chromium emissions to the atmosphere.

3.2 Emission Control System Description

Each chrome plating line is equipped with a dedicated mist collection system and composite mesh pad (CMP) scrubber.

Line No. 1 (Chrome Plating Tank Nos. 1, 2, 3, 4 and 6) is connected to the North Scrubber and exhaust stack SV00004. Line No. 2 (Chrome Plating Tank Nos. 8, 9, 11 and 12) are connected to the South Scrubber and exhaust stack SV00003.

Appendix 2 provides sampling location drawings for the scrubber exhausts.

3.3 Process Operating Conditions During the Compliance Testing

Line No. 1 consumed an average of 28,218 amp-hrs for each two (2) hour test period. The North Scrubber (Line No. 1 control device) had an average pressure drop of 3.5 in H_2O and liquid flow rate of 0.54 gallons per minute (gpm).

Line No. 2 consumed an average of 27,210 amp-hrs for each two (2) hour test period. The South Scrubber (Line No. 2 control device) had an average pressure drop of 3.2 in H_2O and liquid flow rate of 0.49 gallons per minute (gpm).

Appendix 3 provides plating line and control device operating data for the test periods. The data sheets provided in the appendix also list the part type (dummy or production) that was coated during each test period.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

A test protocol was prepared by Derenzo and Associates and submitted to the MDEQ-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 protocol.

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

The exhaust stacks on each scrubber are identical in size and configuration. Exhaust gas sampling was performed using the existing exhaust stack sampling ports. These ports are in the 53.5-inch diameter exhaust stack 112-inches (2.09 duct diameters) downstream of the nearest flow disturbance and 28-inches (0.52 duct diameters) upstream from the termination of the exhaust stack. The stack gas sampling locations (i.e., pollutant concentration and velocity pressure measurement locations) were verified in accordance with procedures specified in USEPA Method 1.

To determine pollutant mass flow emission rates, the stack gas velocity was measured, using procedures specified in USEPA Method 2, throughout the test period using the isokinetic sample probe. Gas velocity (pressure) measurements were performed at each traverse point of the stack with an S-type Pitot tube and red-oil manometer. Temperature measurements were conducted at each traverse point using a K-type thermocouple and a calibrated digital thermometer. The absence of cyclonic flow was verified at all sampling locations to ensure the validity of the measured data. Prior to performing the initial velocity traverse the S-type Pitot tube and manometer lines were leak-checked at the test site.

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

4.2 Diluent Gas Content (USEPA Method 3)

The CO_2/O_2 content for each scrubber exhaust gas stream was comparable to ambient air and verified using Fyrite® gas scrubbers.

Appendix 4 provides O_2 and CO_2 concentrations recorded on field data sheets.

4.3 Exhaust Gas Moisture Content (USEPA Method 4)

Moisture content of the scrubber exhaust gas was determined in accordance with the USEPA Method 4 chilled impinger method. The moisture content of the scrubber exhaust gas was determined as a component of the isokinetic sampling procedures for chromium (i.e., not as a separate measurement train). Moisture was removed from the sample stream using chilled impingers. The amount of moisture removed from the sample stream 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 Total 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 total 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 directly to the first impinger using a glass adapter.

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

At the conclusion of each two-hour test period the weight of each impinger was measured. The total silica gel 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. Prior to shipment, the pH of the recovered solutions was checked using litmus paper to verify that the pH exceeded 8.5.

The total chrome content in the recovered solutions was determined by Element One, Inc. using inductively coupled plasma mass spectrometry (ICP-MS).

Appendix 5 contains a copy of the laboratory report.

The total chromium concentration was determined using the laboratory reported chromium mass in conjunction with the following equations:

$C_{Cr} = M_{Cr} / V_m / (1000\ \mu g/mg)$

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

or

$C_{Cr} = M_{Cr} / V_m * (1.543E\text{-}05\ gr/\mu g)$

C_{Cr} = Concentration of total Cr (gr/dscf)
M_{Cr} = Mass Cr in recovered solutions (μg)
V_m = Sample gas volume for test period (dscf)

The chromic acid concentration was determined using the calculated total chromium concentration in conjunction with the ratio of chromic acid and chromium molecular weights:

$C_{H2CrO4} = C_{Cr} * (118/52)$

C_{H2CrO4} = Concentration of chromic acid (mg/dscm)
C_{Cr} = Concentration of total Cr (mg/dscm)

5.0 QA/QC ACTIVITIES

5.1 Meter Box Calibrations

The Nutech Model 2010 sampling 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 Nutech metering consoles were calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

5.2 Total Chromium Recovery and Analysis

All recovered total chromium 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 total chromium content.

The glassware used in the total chromium train was washed and rinsed prior to use in accordance with the procedures of USEPA Method 306. The glass sample nozzle and probe liner was washed, rinsed and soaked in acid prior to use in accordance with USEPA Method 306. Analysis of the reagent blank indicated a total of less than 0.49 micrograms (μg) of total chromium (i.e., no chromium detected) recovered from the reagent.

5.3 Laboratory QA/QC Procedures

The laboratory total 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 AND DISCUSSION

6.1 Test Results and Allowable Emission Limits

Operating data and air pollutant emission measurement results for each two hour test period are presented in Table No. 6.1.

The measured air pollutant concentrations and emission rates for Line Nos. 1 and 2 are less than the allowable limits specified in PTI No. 367-83B and the NESHAP (Subpart N) for each of the plating lines:

- 0.011 mg total chromium/dscm (4.8E-06 gr total chromium/dscf); and
- 0.071 mg chromic acid/dscm.

6.2 Variations from Normal Sampling Procedures or Operating Conditions

The testing was performed in accordance with the approved test protocols. The chrome plating lines were operated at the maximum routine output and no variations from the normal operating conditions of the plating lines occurred during the test periods.

Table 6.1 Measured exhaust gas conditions and pollutant emission rates for the chrome plating lines

Test No.	1	2	3	Three Test Average
Line No. 1 amp-hours	26,776	29,074	28,806	28,218
Line No. 2 amp-hours	28,364	26,380	26,888	27,210
North Scrubber pressure drop (inH_2O)	3.4	3.7	3.4	3.5
South Scrubber pressure drop (inH_2O)	3.2	3.2	3.2	3.2
North Scrubber liquid flowrate (gpm)	0.53	0.56	0.53	0.54
South Scrubber liquid flowrate (gpm)	0.54	0.55	0.37	0.49
Line No. 1 Exhaust gas flowrate (dscfm)	32,331	31,487	31,437	31,752
Line No. 2 Exhaust gas flowrate (dscfm)	25,968	25,811	24,806	25,528
Line No. 1 Total Chromium Emissions				
Total chromium catch weight (µg)	3.39	2.62	2.77	2.93
Total chromium conc. (mg/dscm)	0.001	0.001	0.001	0.001
Chromic acid conc. (mg/dscm)[1]	0.003	0.003	0.003	0.003
NESHAP Emission Limit (mg/dscm)[2]	-	-	-	0.011
PTI No. 367-83B Limit (mg/dscm)[3]	-	-	-	0.071
Line No. 2 Total Chromium Emissions				
Total chromium catch weight (µg)	3.14	3.51	2.83	3.16
Total chromium conc. (mg/dscm)	0.001	0.001	0.001	0.001
Chromic acid conc. (mg/dscm)[1]	0.003	0.003	0.003	0.003
NESHAP Emission Limit (mg/dscm)[2]	-	-	-	0.011
PTI No. 367-83B Limit (mg/dscm)[3]	-	-	-	0.071

Notes for Table 6.1:

1. Chromic acid concentration calculated based on the measured total chromium concentration and the ratio of the molecular weight of chromic acid (H_2CrO_4) to the molecular weight of chromium (118/52).
2. Emission limit is for total chromium concentration.
3. Emission limit is for chromic acid concentration.