1.0 Introduction

Diamond Chrome Plating, Inc. (DCP) located in Howell, Livingston County, Michigan operates hard chrome plating tanks under State of Michigan Permit to Install (PTI) No. 367-83B supplemented on September 21, 1992 by the Michigan Department of Environment, Great Lakes, and Energy – Air Quality Division (EGLE-AQD) for the operation of its chrome plating lines.

The emission units are each connected to an emission control device. Hard Chrome Plating Tanks 1, 2, 3, 4, 6 and 11 are connected to a scrubber system (Scrubber No. 4) exhaust (exhaust stack indentifier: SV00004). Historically, Scrubber No. 4 has controlled hard chrome plating tanks 1, 2, 3, 4, and 6. Hard chrome plating tank 11 has temporarily been routed to Scrubber No. 4. Testing was performed at the request of EGLE AQD.

The emissions testing was performed pursuant to conditions of Permit to Install No. 367-83B and provisions of 40 CFR Part 63. 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 June 24, 2021 by Impact Compliance & Testing, Inc. (ICT) representatives Blake Beddow and Ryan Prchlik. Mr. Daniel McGeen and Mr. Matt Karl 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 DCP.

The sampling and analysis were performed using procedures specified in the test plan documents dated May 27, 2021 and approved by EGLE-AQD on June 15, 2021.

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

Appendix 2 presents a sampling location diagram for SV00004.

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. Chris Konen Environmental, Health, & Safety Manager Diamond Chrome Plating, Inc. P.O. Box 557 Howell, MI 48844 (517) 546-0150 env@diamondchromeplating.com

2.0 Summary of Test Results and Operating Conditions

2.1 Purpose and Objective of the Tests

Conditions of PTI No. 367-83B, and the provisions of 40 CFR Part 63, Subpart N, the NESHAP for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks, require DCP to test the control device for Total Chromium emissions. The Scrubber No. 4 exhaust (SV00004) was sampled during this compliance test event.

2.2 Operating Conditions During the Compliance Tests

The testing was performed at maximum routine operating conditions. DCP representatives provided process data for each test run as required by the test plan approval letter dated June 15, 2021. The required process data records included process rate in amp-hours, pressure drop across the scrubber, scrubber inlet velocity pressure, and number of parts or "dummy parts" processed.

A summary of the process data is presented in Table 2.1.

Process data sheets are presented in Appendix 3.

2.3 Summary of Air Pollutant Sampling Results

Emission testing was performed for exhaust gas downstream of the No. 4 scrubber system. A summary of the average total chromium exhaust concentration for the No. 4 scrubber system 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. 4 scrubber system 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.* The calculated chromic acid concentration was less than the 0.071 mg/dscm limit specified in permit number 367-83B for the No. 4 scrubber system.

Process data was monitored and recorded by DCP employees during the test event.

Table 2.1 3-Run Average Summary of Scrubber System No. 4 emission test results

Parameter	No. 4 Scrubber System	
Scrubber Pressure Drop	4.1	"WCm
Scrubber Inlet Velocity Pressure	6.9	"WCm
Plating Tank Process Rate	28,524[1]	Total Amp-hours
Scrubber Exhaust Gas Flowrate	28,398	DSCFM
Total Chromium Concentration	5.11	µg
Total Chromium Concentration	0.002	mg/dscm
Total Chromium Emission Limit	*0.011*	*mg/dscm*
Chromic Acid Concentration[2]	0.004	mg/dscm
Chromic Acid Emission Limit	*0.071*	*mg/dscm*

Abbreviations
"WCm = inches of water column
DSCFM = dry standard cubic feet of air per minute
µg = micrograms ($1X10^{-6}$ grams)
mg/dscm = milligrams per dry standard cubic meter of air

1. 3-run average of Total Amp-hours per test run

2. Chromic acid concentration is based on molecular weight of anhydrous CrO_3 as referenced in 40 CFR subpart N.

Chromic acid content (mg/dscm) = Cr content * 100 (MW CrO_3) / 52 (MW Cr)

3.0 Source and Sampling Location 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. Historically, Scrubber No. 4 has controlled hard chrome plating tanks 1, 2, 3, 4, and 6. Hard chrome plating tank 11 has temporarily been routed to Scrubber No. 4; therefore, DCP completed the stack test.

3.2 Rated Capacities and Air Emission Controls

Hard chrome plating tanks 1, 2, 3, 4, 6, and 11 process parts at a varied rate of anywhere from a few minutes to several hours for a single part. Operations are variable due to DCP's customer-directed production. Production during the compliance test was operated at or near routine maximum operating conditions. Two (2) "dummy loads" were used during the first test run due to a reduced production schedule in order to provide representative operating conditions.

The scrubber system that controls emissions from the hard chrome plating tanks utilizes a 3-tier composite mesh-pad to clean the air of airborne contamination. The scrubber has an automatic spray system that cleans the pads with reverse osmosis (R/O) water on regular intervals.

The airflow through the scrubber is achieved using an induced draft blower on the exit of the scrubber. The scrubber system has a design capacity of 45,000 cfm of exhaust gas. The system typically operates at 42,000 cfm.

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 or near routine 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 tank controlled by scrubber No. 4 were recorded at the beginning of the test day. Strike amp-hours, plate amp-hours, scrubber pressure drop, and scrubber inlet velocity pressure 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 53.5-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 composed of 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 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 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 two 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 Chromic acid (CrO3) concentration was determined using the information above and a molecular weight (MW) ratio of chromic acid to elemental chromium. Chromic acid concentration is based on molecular weight of anhydrous CrO_3 as referenced in 40 CFR subpart N.

Chromic acid content (mg/dscm) = C_{Cr} * 100 (MW CrO_3) / 52 (MW Cr)

5.0 Quality Assurance/Quality Control 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 were 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 Quality Assurance/Quality Control Procedures

The laboratory chromium analyses were conducted by a qualified third-party laboratory according to the appropriate Quality Assurance/Quality Control (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 Results

6.1 Test Results and Allowable Emission Limits

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

The average measured total chromium concentration for hard chrome plating tanks 1, 2, 3, 4, 6, and 11 is 0.002 milligrams per dry standard cubic meter (mg/dscm), which is less than (in compliance with) the federal standard for large hard chrome plating operations of 0.011 mg/dscm.

The average calculated chromic acid concentration for the hard chrome plating tanks is 0.004 mg/dscm, which is less than (in compliance with) the permitted limit of 0.071 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 total chromium emission rates for hard chrome plating tanks Nos. 1, 2, 3, 4, 6, and 11

Test No Date Time	1 06/24/2021 0700-0906	2 06/24/2021 0928-1133	3 06/24/2021 1154-1358	Three Test Average
Scrubber Exhaust				
Exhaust gas flowrate (dscfm)	28,353	28,426	28,415	28,398
Exhaust gas flowrate (dscmm)	802.9	804.9	804.6	804.1
Temperature (°F)	79.8	87.1	91.8	86.2
Moisture (%)	2.00	2.01	1.98	2.00
Sample Train Data				
Sample volume (dscf)	92.8	94.7	95.4	94.3
Sample volume (dscm)	2.63	2.68	2.70	2.67
Cr catch weight (µg)	4.88	4.52	5.93	5.11
Emission Rate				
Cr concentration (mg/dscm)	0.002	0.002	0.002	0.002
Cr emission limit (mg/dscm)	-	-	-	*0.011*
Chromic acid concentration (mg/dscm)[1]	0.004	0.003	0.004	0.004
Chromic acid emission limit (mg/dscm)	-	-	-	*0.071*

Abbreviations
"WCm = inches of water column
DSCFM = dry standard cubic feet of air per minute
µg = micrograms ($1X10^{-6}$ grams)
mg/dscm = milligrams per dry standard cubic meter of air

1. Chromic acid concentration is based on molecular weight of anhydrous CrO_3 as referenced in 40 CFR subpart N.

Chromic acid content (mg/dscm) = Cr content * 100 (MW CrO_3) / 52 (MW Cr)

APPENDIX 1

TEST PLAN APPROVAL LETTER

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

GRETCHEN WHITMER
GOVERNOR

LIESL EICHLER CLARK
DIRECTOR

June 15, 2021

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

Dear Scott Wright:

SUBJECT: Diamond Chrome Plating, Inc. Emissions Testing; Permit: 367-83B; SRN: A2931

The protocol for emissions testing at the Diamond Chrome Plating, Inc. Facility has been reviewed by the Department of Environment, Great Lakes, and Energy (EGLE), Air Quality Division (AQD). This testing is required by Permit to Install (PTI) No. 367-83B and Title 40 of the Code of Federal Regulations (40 CFR), Part 63, Subpart N.

Scrubber No. 4 which controls emissions from hard chrome plating tanks 1, 2, 3, 4, 6, and 11 will have exhaust stack SV00004 tested for total chromium (T-Cr) emissions. Testing and sampling will be done in accordance with 40 CFR, Part 60, Appendix A, Methods 1, 2, 4 and 306. Testing will consist of three 120-minute runs. Testing/sampling should be performed with the process running at maximum routine operating conditions. T-Cr emissions will be reported in units of milligrams per dry standard cubic meter (mg/dscm).

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

The following process data will be recorded during testing:

- Process rate in amp-hours;
- Pressure drop across the scrubber;
- Scrubber inlet velocity pressure; and
- Number of parts or “dummy parts” processed.

The test report will include:

- All field data sheets;
- All pre-test and post-test meter box calibration and pitot tube calibration;
- All gas analyzer calibration error, system bias, zero and calibration drift data;
- Analyte spiking data and results;
- Laboratory QC data;
- The process 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:

Daniel McGeen
EGLE, Air Quality Division
Lansing District Office
P.O. Box 30242
Lansing, Michigan 48909-7742

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

This testing is scheduled for June 24, 2021. Please inform Daniel McGeen at 517-833-0342 or email at McgeenD@Michigan.gov and me of any change in the test date. If you have any questions regarding this letter, please contact me at 517-282-2126 or at KarlM@Michigan.gov.

Sincerely,

Matthew R. Karl

Matt Karl
Technical Programs Unit
Field Operations Section
Air Quality Division

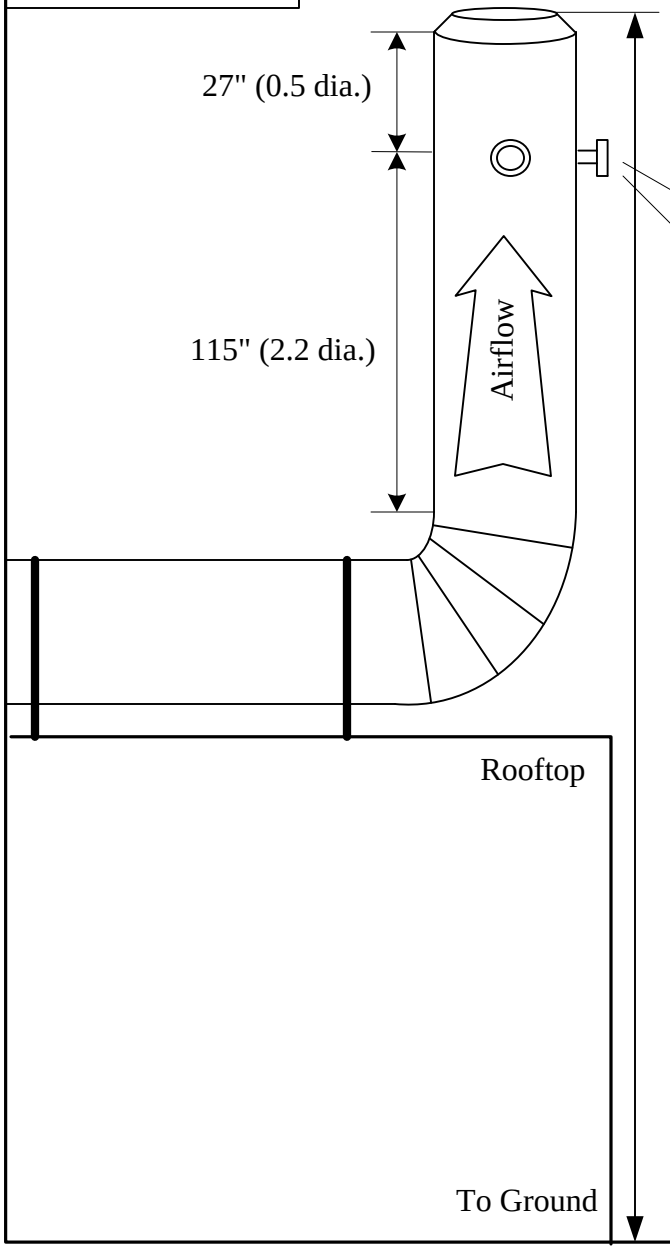
cc: Celeste Holtz, BB&E
Blake Beddow, Impact C&T
Karen Kajiya-Mills, EGLE
Brad Myott, EGLE
Daniel McGeen, EGLE

APPENDIX 2

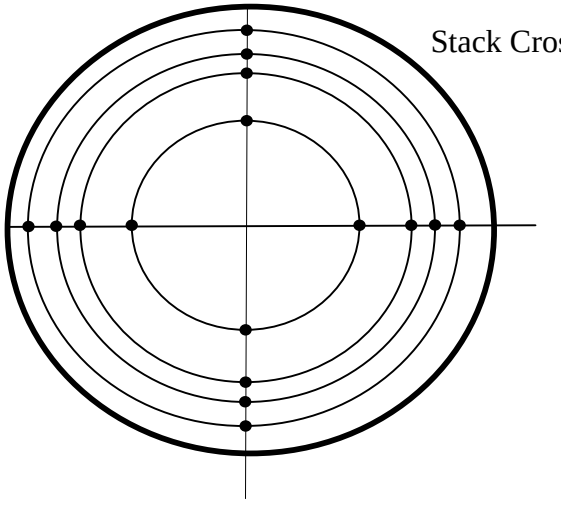
SAMPLING LOCATION DRAWING

Impact Compliance & Testing, Inc.

Scrubber No. 4
Exhaust



Stack Cross Section



Velocity sample locations
(not including 6.0" sampling port nipple)

1	1.71"
2	5.62"
3	10.38"
4	17.23"
5	36.22"
6	43.12"
7	47.88"
8	51.79"

7/9/2021	**Diamond Chrome Plating, Inc.No. 4 Scrubber Exhaust Stack**		
	Scale None	Sheet 1 of 1	ICT Project No. 2100128