Derenzo Environmental Services
Consulting and Testing

EMISSION TEST REPORT

Title	TOTAL CHROMIUM EMISSION FROM HARD CHROME ELECTROPLATING OPERATIONS
Report Date	March 10, 2016
Test Date(s)	January 25, 2016

Facility Information	
Name:	Stelmi America, Inc.
Street Address:	1601 Brooks Drive
City, County:	Marshall, Calhoun
Phone:	(269) 781-6222

Facility Permit Information			
Facility ID.:	N7166	Permit No.:	PTI 67-15

Testing Contractor	
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Project No.:	1509002

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EMISSION TEST REPORT
FOR
TOTAL CHROMIUM EMISSIONS
FROM
HARD CHROME ELECTROPLATING OPERATIONS

STELMI AMERICA, INC.
MARSHALL, MICHIGAN

1.0 INTRODUCTION

Derenzo Environmental Services (DES) was contracted by Stelmi America, Inc. (Stelmi America) for the determination of total chromium emissions from the exhaust of a composite mesh pad (CMP) scrubber system controlling emissions from hard chromium electroplating operations at its Marshall, Michigan facility.

Testing was performed in accordance with the requirements of Michigan Department of Environmental Quality - Air Quality Division (MDEQ-AQD) Permit to Install No. 67-15 and 40 CFR Part 63 Subpart N, the National Emissions Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks.

The emission testing was performed on January 25, 2016 by Derenzo Environmental Services personnel Blake Beddow, Robert Harvey, and Clay Gaffey. Steven Dodge, Grant Bloom, and Michael Hall with Stelmi America provided assistance and process coordination. The testing was witnessed by MDEQ-AQD personnel Tom Gasloli and Rex Lane.

The testing was performed within 180 days after the commencement of trial operations as required by PTI 67-15 and was performed in accordance with the provisions of 40 CFR §63.344 "Performance test requirements and test methods." This report serves as part of the notification of compliance status (NOCS) as required in 40 CFR §63.347.

Questions regarding this report should be directed to:

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Report Certification

This test report was prepared by DES based on field sampling data collected by DES. Stelmi America representatives or employees provided facility process data and have approved this test report for submittal to the MDEQ-AQD. Report data and information has also been submitted to the USEPA Compliance and Emissions Data Reporting Interface (CEDRI) using the Emission Reporting Tool (ERT) application.

I certify that the testing was conducted in accordance with the specified test methods and submitted test plan 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:	Reviewed By:
Blake Beddow Environmental Consultant Derenzo Environmental Services	Robert L. Harvey, P.E. General Manager Derenzo Environmental Services

I certify that the facility and emission units were operated at maximum routine operating conditions for the test event. Based on information and belief formed after reasonable inquiry, the statements and information in this report are true, accurate and complete.

Responsible Official Certification:

Steven Dodge
President
Stelmi America, Inc.

2.0 TEST RESULTS SUMMARY

Emission testing was performed for EUCHROME6 (FGCHROME1) downstream of the composite mesh pad (CMP) scrubber system. A summary of the average total chromium exhaust concentration for FGCHROME1 are 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 5.1.

The measured total chrome content in the FGCHROME1 exhaust gas is less than the allowable limit (0.006 mg/dscm) specified in MDEQ-AQD Permit to Install No. 67-15. Emission calculations are presented in Appendix A.

The average pressure drop across the CMP scrubber system during the test periods was 1.94 inches of water. EUCHROME6 produced 24 steel bars during the time period of 0700-1600, which is equivalent to a production rate of 2.67 bars per hour. This exceeds the production rate that was specified in the MDEQ test plan approval letter dated December 10, 2015. Process data recorded by Stelmi representatives are provided in Appendix F.

Table 2.1 Summary of measured total chromium concentration

Sampling Location	Measured Total Chromium Content (mg/dscm)	Permit Limit (mg/dscm)
SVCMP1 Exhaust	0.005	0.006

3.0 PROCESS DESCRIPTION

Stelmi America is a mill volume producer of long length hard chrome plated steel bars. Using an advanced chrome plating process, Stelmi America produces long length hard chrome plated steel bars and micro-finished steel tubes with a market focus on the hydraulic cylinder industry.

The hard chromium plating process is a 24-hour a day continuous horizontal operation. Using an automated material handling system, which also transfers the required electrical contact to each bar, the bars advance and rotate, driven one by one through a series of circular anodes in the chrome plating machines. The ground and polished bars enter the machine from one side and exit, fully plated, from the other.

The chromium plating is accomplished with a series of circular anodes, and each bar continuously advances and rotates through the anodes, so that a completely homogeneous and dimensionally uniform chrome layer is guaranteed. There are two (2) separate electroplating lines associated with FGCHROME1 specified in the Permit to Install. At this time, only one electroplating line (EUCHROME6) is installed and was included in the testing.

Air contaminates are captured from the plating operations and are directed to the CMP scrubber via PVC ductwork.

4.0 TESTING AND ANALYSIS

The emission testing was conducted using appropriate USEPA stationary source test methods as presented in the test protocol submitted to the MDEQ-AQD and USEPA CEDRI. This section provides a summary of the test methods and procedures.

Pollutant mass emission rate calculations require an accurate determination of exhaust gas flowrate (USEPA Methods 1 and 2). Exhaust gas flowrate measurements require (1) measurement of the velocity head and temperature at various, predetermined locations within the gas stream (USEPA Method 2), (2) measurement of the molecular weight of the exhaust gas (USEPA Method 3), and (3) measurement of the moisture content of the exhaust gas (USEPA Method 4). Field measurement data sheets are presented in Appendix B.

4.1 Sample and Velocity Traverse

USEPA Method 1, *Sample and Velocity Traverses for Stationary Sources*, was used to determine the number of traverse points required for testing the source. Based on flow disturbance data, the sampling port locations meet the minimum criteria for a "representative measurement" of the gas velocity. Appendix D provides a schematic of the traverse and sampling locations.

4.2 Stack Gas Velocity and Volumetric Flowrate

USEPA Method 2, *Determination of Stack Gas Velocity and Volumetric Flowrate*, was used to determine the average gas velocity. Average velocity pressure measurements of the exhaust gas were made using a Stausscheibe (Type S) Pitot tube connected to an oil manometer capable of reading pressures from 0.0 to 10 inches water column. Concurrent temperature measurements of the exhaust gas were made with a type-K thermocouple attached to the Pitot tube. Cyclonic flow determinations were conducted on the exhaust stack and the angle was determined to be less than 20° on average.

4.3 Determination of Molecular Weight

The gas collected by the emission control system is primarily in-plant air. Carbon dioxide (CO_2) and oxygen (O_2) samples were collected and analyzed using a Fyrite® combustion gas analyzer. Samples were taken for the determination of CO_2 and O_2 during each total chromium test event. The average O_2 and CO_2 concentrations measured during the testing were 20.9% and 0% respectively.

4.4 Determination of Moisture Content

USEPA Method 4, *Determination of Moisture Content in Stack Gases,* was used to determine the moisture content of the exhaust for each test period. Exhaust gas moisture was collected in chilled impingers (as part of the USEPA Method 306 sample train) and determined gravimetrically.

4.5 Chromium Emissions Testing

USEPA Method 306 "Determination of Chromium Emissions from Decorative and Hard Chromium Electroplating and Anodizing Operations" was used to measure total chromium concentration and emission rates at the CMP scrubber exhaust. Appendix E provides a sampling train diagram for Method 306.

Prior to testing, a preliminary velocity traverse, dry-bulb/wet-bulb moisture determination, and Fyrite® analysis at the CMP scrubber exhaust was conducted to determine the appropriate nozzle size for isokinetic sampling. After the preliminary traverse, exhaust gas velocity pressures and temperatures were continuously monitored during the chromium emissions sampling.

DES used a Nutech Model 2010 modular isokinetic stack sampling system to measure chromium emissions in accordance with the above-referenced sampling method. Triplicate 120-minute test runs were conducted and an average sample volume of 64.1 dry standard cubic feet (dscf) was obtained.

The Method 306, chromium sampling train consisted of (1) a borosilicate-glass nozzle, (2) a non-heated glass probe liner, (3) an unheated 3/8 inch Teflon® line connecting the glass probe liner to the first impinge (filter bypass), (4) a set of four Greenberg-Smith (GS) impingers with the first modified and second standard GS impingers each containing 100 milliliters (ml) of 0.1 Normal Sodium hydroxide (0.1 N NaOH), a third dry modified GS impinger, and a fourth modified GS impinger containing a known weight of silica gel desiccant. The impinge train was connected to the dry gas meter sampling console using a length of umbilical sample line.

The sample train was assembled and leak checked. Upon successful completion of the leak check, the initial dry gas meter reading was recorded. The duct temperature, dry gas meter temperature and duct velocity pressure were measured and recorded on the data sheet. The isokinetic-sampling rate in terms of pressure drop across the calibrated orifice was calculated and recorded on the data sheet. The pump and timer were turned on, and the sample rate was adjusted to correspond to the calculated isokinetic rate.

Once the sample rate was set, the following data were recorded:

- Dry gas meter inlet and outlet temperatures
- Sample vacuum
- Stack temperature
- Last impinger temperature
- Velocity pressure
- Orifice differential pressure
- Sample volume (dry gas meter readings)

At the end of the sample time for the first point, the probe was moved to the next point, and the measurements, calculations and recording of data was repeated. Upon completion of sampling from a port, the pump was turned off and the dry gas meter reading recorded. The probe assembly was then placed into the next sampling port and the previously described sampling procedure was repeated for the second sampling port.

When the sample run was completed, the final, dry gas meter reading was recorded and the probe was removed from the port. A post-test leak check was performed on the sampling train at a vacuum at least as great as that of the highest sample vacuum measured during the sample run. The final leak rate was recorded on the data sheet. The sample train was sealed from contamination and disassembled for recovery.

The interior of the nozzle, probe liner, Teflon® line, and all glassware up to the fourth impinger were rinsed with 0.1 NaOH. The 0.1 N NaOH rinses were collected in a pre-cleaned sample container. Prior to rinsing the impingers, gravimetric analyses (post-test weights) were obtained for the determination of moisture content of the stack gases. Each container was uniquely labeled with the test number, location, and date. The sample container caps were sealed with tape and the level of liquid was marked on the outside of the container. Samples were shipped to Element One, Inc. laboratory in Wilmington, North Carolina. The samples were analyzed using a Perkin-Elmer NEXLON 350X ICP-MS in accordance with USEPA Method 306, at Element One's laboratory.

The laboratory analytical report is provided in Appendix G.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

USEPA Quality Assurance/Quality Control (QA/QC) procedures were followed during the emissions testing program. The following information is a general overview of the QA/QC requirements of the test program. Please refer to the individual USEPA test methods in 40 CFR Part 60, Appendix A, for detailed information regarding these procedures.

5.1 Exhaust Gas Properties and Flowrate

In accordance with the USEPA Methods 1-4, the following QA/QC activities were performed:

- Prior to arriving onsite, the instruments used during the source testing to measure the exhaust gas properties, such as the barometer, pyrometer, and Pitot tube are calibrated and documented to specifications outlined in the sampling methods. Calibration and inspection sheets are presented in Appendix C.

- During isokinetic sampling, the exposed space of the sample port opening, between the probe and the port wall, was covered in order to minimize influence of ambient conditions on velocity pressure readings.

- Prior to the sampling event, the velocity measurement assembly (Pitot tube, flexible line, and inclined manometer) was leak checked through both the positive and negative side of the Pitot at a velocity pressure equal to or greater than 3 inches water column.

5.2 Isokinetic sampling

The QA/QC guidelines practiced during the total chromium testing include:

- Prior to their use in the field, the sampling nozzle, glass liner, filter bypass Teflon® line, the first three impingers, and all connecting glassware were cleaned in accordance with the guidelines outlined in USEPA Method 306 Section 5 (1)(b).

- A three-point calibration measurement was performed on the glass nozzle used in the performance of the isokinetic testing. This field calibration sheet is presented in Appendix C.

- The Nutech Model 2010 sampling console was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5. Meter calibration sheets are presented in Appendix C.

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

- Prior to each test run, the sampling train was assembled and leak-checked at the sampling site by plugging the inlet to the probe and pulling a vacuum of approximately 10 in. Hg. At the conclusion of each test run, the sampling train was leak-checked by drawing a vacuum equal to or greater than the highest vacuum measured during the test run.

- Blank samples of the 0.1 N NaOH used in the compliance testing were obtained and submitted to the laboratory for subsequent analysis in the same manner as each of the chromium test samples.

- Element One performed the required internal blank and recovery procedures presented in the USEPA Method 306. A duplicate analysis of one of the test samples was performed and the Method QA/QC requirements were within acceptable limits. A report generated by Element Once can be found in Appendix G.

6.0 MEASUREMENT RESULTS

6.1 Total Chromium Concentrations and Emission Rates

The average measured total chromium concentration in the FGCHROME1 CMP exhaust was 0.0047 milligrams per dry standard cubic meter (mg/dscm). The average measured exhaust gas flowrate from the CMP scrubber control device was 1,199 dry standard cubic feet per minute (dscfm) resulting in a calculated chromium mass emission rate of 2.11×10^{-5} pounds per hour (lb/hr).

Table 5.1 presents the emission concentrations, sample volumes, and measured exhaust gas properties for the three total chromium test runs conducted on the CMP scrubber exhaust.

6.2 Monitoring Parameters

The production rate, rectifier's settings, and pressure drop across the CMP scrubber system were recorded during the test day. Appendix F provides monitoring data recorded during each 120-minute sampling event. The average pressure drop across the CMP scrubber system was 1.94 inches of water. During the sampling period, 24 steel bars were produced during the time period of 0700-1600 resulting in an average production rate of 2.67 bars per hour.

6.3 Variations from Normal Sampling Procedures or Operating Conditions

FGCHROME1 operated normally and no variations from the normal operating conditions occurred during the testing program.

One additional sampling run was performed for a total of four (4) sampling runs. Run 2 failed a post leak check, which resulted in an invalid run. The test 2 samples were not analyzed. However, the failed run field data sheets are included in Appendix B.

Table 6.1. Total Chromium Concentrations and Emission Rates

Test No.	1	3	4	
Test Date	1/25/16	1/25/16	1/25/16	Test
Test Period (24-hr clock)	09:34-11:38	14:49-17:00	17:30-19:37	Avg.
Exhaust gas flowrate (scfm)	1,229	1,245	1,240	1,238
Exhaust gas flowrate (dscfm)	1,188	1,206	1,204	1,199
Moisture (% vol)	3.4	3.1	2.9	3.1
Sample Train Data (Method 306)				
Sample volume (dscf)	66.1	66.3	66.2	66.2
Sample volume (dscm)	1.87	1.88	1.87	1.87
Total Chrome in sampling train (ug)	7.4	8.0	11.0	8.8
Calculated Chromium Emissions				
Exhaust gas Chromium content (mg/dscm)	0.0040	0.0043	0.0059	0.0047
Chromium emission rate (lb/hr)	1.76×10^{-5}	1.92×10^{-5}	2.65×10^{-5}	2.11×10^{-5}

APPENDIX A

EMISSIONS CALCULATION SHEETS

- Total Chromium Test Calculations

Derenzo Environmental Services

Company		**Stelmi America**		
Source Designation		**FGCHROME1**		
Test Date	**1/25/2016**	**1/25/2016**	**1/25/2016**	
Test Start Time	**9:34**	**14:49**	**17:30**	
Meter/Nozzle Information	**SA-01**	**SA-03**	**SA-04**	**Average**
Meter Temperature, Tm (°F)	79.75	85.44	81.97	82.39
Meter Pressure, Pm (in. Hg)	29.28	29.20	29.16	29.21
Measured Sample Volume, Vm (ft³)	69.556	70.783	70.265	70.20
Meter Correction Factor, Y	0.9924	0.9924	0.9924	0.9924
Sample Volume at STP, Vm (Std ft³) = (Vm*Y*17.64*Pm)/(Tm+460)	66.06	66.33	66.17	66.19
Sample Volume at STP, Vm (Std m³) = (Vm(Std ft³))*0.028317	1.87	1.88	1.87	1.87
Condensate Volume, Vw (std) = (0.04707 * Vwc) + (0.04715 * Vwsg)	2.31	2.15	1.94	2.13
Gas Density, ρs (std lbs/ft³) = (Md(1-Bws) + 18(Bws))/385	0.0740	0.0740	0.0741	0.0740
Total weight of sampled gas, Ws (lbs) = (Vm + Vw) * ρs	5.056	5.069	5.048	5.058
Nozzle Size, An (sq. ft.) = Π(D/4)², where D = Nozzle dia.	0.0003519	0.0003519	0.0003519	0.0003519
Isokinetic Variation, I =100*Ts(0.002669(Vwc + Wsg)+((Vm*Y)/Tm)*Pm)/(60*C*vs*Ps*An)	103.5	102.3	102.2	102.7
Stack Data				
Average Stack Temperature, Ts (°F)	81.3	81.4	81.2	81.3
Molecular Weight Stack Gas-dry, Md (lb/lb mole)	28.84	28.84	28.84	28.84
Molecular Weight Stack Gas-wet, Ms (lb/lb mole)	28.47	28.50	28.53	28.50
Stack Gas Specific Gravity, Gs	0.98	0.98	0.99	0.98
Percent Moisture, Bws = Vw/(Vw+Vm)*100	3.37	3.13	2.85	3.12
Water Vapor Volume (fraction) = Bws/100	0.034	0.031	0.028	0.031
Stack Pressure, Ps("Hg)	29.23	29.14	29.10	29.16
Average Stack Velocity, Vs (ft/s)	27.37	27.81	27.72	27.63
Area of Stack, As (ft²)	0.79	0.79	0.79	0.79
Exhaust Gas Flowrate				
Actual flowrate, Qs (ACFM)= Vs*As*60	1,290	1,310	1,306	1,302
Standard wet flowrate, Qw (WSCFM) = 528*Qs*Ps/(Ts*29.92)	1,229	1,245	1,240	1,238
Dry standard flowrate, Qstd (DSCFM) = Qw *(1-Bws/100)	1,188	1,206	1,204	1,199
Dry standard flowrate, Qstd (DSCMM) = Qstd*0.028317	33.6	34.1	34.1	34.0
Standard Temperature and Pressure = 29.92 "Hg and 68°F				
Laboratory Result				
Total Chrome - Cont. 1 (ug)	7.4	8.0	11.0	8.8
Chromium Exhaust Concentration				
Chrome catch (mg)	7.41E-03	7.99E-03	1.10E-02	8.80E-03
Sample volume (dscm)	1.87	1.88	1.87	1.87
Chrome content (mg/dscm)	0.0040	0.0043	0.0059	0.0047
Chromium Emission Rate				
Chromium Emission Rate (lb/hr) = Cr catch (lb) / Vm * Qstd * 60 min/hr	1.76E-05	1.92E-05	2.65E-05	2.11E-05