Derenzo Environmental Services
Consulting and Testing

RECEIVED

OCT 02 2017

AIR QUALITY DIVISION

EMISSION TEST REPORT

Report Title:	TOTAL AND HEXAVALENT CHROMIUM EMISSIONS FROM CHROME BLENDING PROCESSES
Report Date:	September 22, 2017
Test Date:	August 30, 2017

Facility Information	
Name:	Haviland Enterprises, Inc.
Street Address:	421 Ann St. N.W.
City, County:	Grand Rapids, Kent
Phone:	(616) 365-3654

Facility Permit Information			
State Registration No.:	N0878	Permit to Install No.:	71-17

Testing Contractor	
Company:	Derenzo Environmental Services
Mailing Address:	39395 Schoolcraft Rd. Livonia, MI 48150
Phone:	(734) 464-3880
Project No.:	1707002

EMISSION TEST REPORT
FOR
TOTAL AND HEXAVALENT CHROMIUM EMISSIONS
FROM
CHROME BLENDING PROCESSES

HAVILAND ENTERPRISES, INC.
GRAND RAPIDS, MICHIGAN

1.0 INTRODUCTION

Derenzo Environmental Services (DES) was contracted by Haviland Enterprises, Inc. (Haviland) for the determination of total and hexavalent chromium emissions from the exhaust of a wet scrubber system controlling emissions from chrome blending processes at its Grand Rapids, Michigan facility.

The testing was performed in accordance with USEPA Method 306 for the measurement of total and hexavalent chromium emissions. The chrome blending process does not currently have permitted emission limits, as issuance of PTI No. 71-17 is pending.

The emission testing was performed on August 30, 2017 by Derenzo Environmental Services personnel Tyler Wilson and Blake Beddow. The project was coordinated by Ms. Brittany Albin, Haviland Environmental Engineer. The testing was witnessed by Michigan Department of Environmental Quality, Air Quality Division (MDEQ-AQD) personnel David Patterson, Kaitlyn DeVries, and Tyler Salamasick.

The chromium emissions evaluation and exhaust gas sampling and analysis was performed using procedures specified in the Test Plan dated July 28, 2017 that was submitted to the MDEQ-AQD for review and approval.

Questions regarding this report should be directed to:

Tyler J. Wilson
Livonia Office Supervisor
Derenzo Environmental Services
39395 Schoolcraft Road
Livonia, MI 48150
(734) 464-3880

Ms. Brittany Albin
Environmental Engineer
Haviland Enterprises, Inc.
421 Ann St. N.W.
Grand Rapids, MI 49504
(616) 365-3654

Report Certification

This test report was prepared by DES based on field sampling data collected by DES. Haviland representatives or employees provided facility process data and have approved this test report for submittal to the MDEQ-AQD.

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:
Tyler J. Wilson Livonia Office Supervisor Derenzo Environmental Services	Andy Rusnak, QSTI Technical 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:

Brittany Albin
Environmental Engineer
Haviland Enterprises, Inc.

2.0 TEST RESULTS SUMMARY

Emission testing was performed for the chrome scrubber exhaust (exhaust stack SV-2) downstream of the composite wet scrubber system. A summary of the average total and hexavalent chromium exhaust concentrations for the chrome scrubber exhaust are presented in Table 2.1 below. Measured exhaust gas flowrate, sample train data, and chromium concentrations for each 88-minute test period are presented at the end of this report in Table 5.1.

Emission calculations are presented in Appendix A.

The average water circulation through the wet scrubber system during the test periods was 6.27 gallons per minute (GPM). The average material throughput for the chrome blending process during the test periods was 411 pounds per batch (lb/batch). Process data recorded by Haviland representatives are provided in Appendix F.

Table 2.1 Summary of measured total and hexavalent chromium concentrations

Sampling Location	Measured Total Chromium Content (gr/dscf)	Measured Hexavalent Chromium Content (gr/dscf)
Chrome Scrubber Exhaust	3.63×10^{-5}	3.11×10^{-5}

3.0 PROCESS DESCRIPTION

Haviland operates chrome blending processes, including liquid and powder blending, as well as a chrome wastewater treatment area. Two (2) of the chrome tanks are dedicated to liquid blending. It is assumed chrome in the liquid blending tanks remains in solution (i.e., no chrome emissions to the atmosphere). Wastewater from this process is sent to the wastewater treatment area where chrome settles out of solution and is dewatered.

Haviland also operates a MacDermid powder blender. In the powder blender dry materials containing chromium are processed and subsequently packaged. The blender has three (3) process exhausts, which are connected to a wet scrubber. Two (2) of these connections draw air off the mixing drum and the other off the drop leg.

The source that was tested was the exhaust of a wet scrubber that is used to control chromium emissions from the MacDermid chrome blending process.

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. This section provides a summary of the test methods and procedures performed during the test event.

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 the total and hexavalent 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 and hexavalent chromium concentrations and emission rates for the chrome 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 for the chrome 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 88-minute test runs were conducted and an average sample volume of 49.1 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) 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 impinger 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, third, and fourth sampling ports.

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, 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 and then the contents of the impingers (0.1 NaOH and collected moisture) were collected in the sample container. 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 (Element One) 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.

- Prior to the sampling event, the absence of cyclonic flow was verified at the sampling location to ensure the validity of the measured data.

5.2 Isokinetic sampling

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

- Prior to their use in the field, the sampling nozzle, glass liner, 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 5 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.

- Following each test run, the pH of the contents of the first impinger in the sample train was checked and verified to be greater than 8.5.

- 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 One can be found in Appendix G.

6.0 MEASUREMENT RESULTS

6.1 Total Chromium Concentrations and Emission Rates

The average measured total and hexavalent chromium concentrations in the chrome scrubber exhaust were 3.63×10^{-5} and 3.11×10^{-5} grains per dry standard cubic foot (gr/dscf), respectively. The average measured exhaust gas flowrate from the chrome scrubber control device was 1,024 dry standard cubic feet per minute (dscfm) resulting in calculated total and hexavalent chromium mass emission rates of 3.21×10^{-4} and 2.74×10^{-4} pounds per hour (lb/hr), respectively.

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

6.2 Monitoring Parameters

Material throughput and water circulation through the chrome scrubber system were recorded during the test periods. Appendix F provides monitoring data recorded during each 88-minute sampling period. The average water circulation through the chrome scrubber system during the test periods was 6.27 gallons per minute (GPM). The average material throughput for the chrome blending process during the test periods was 411 pounds per batch (lb/batch).

6.3 Variations from Normal Sampling Procedures or Operating Conditions

The chrome blending processes and the chrome scrubber operated normally and no variations from the normal operating conditions occurred during the testing program.

Table 6.1. Total Chromium Concentrations and Emission Rates

Test No.	1	2	3	
Test Date	8/30/17	8/30/17	8/30/17	Test
Test Period (24-hr clock)	07:35-09:08	09:52-11:27	12:30-14:03	Avg.
Exhaust gas flowrate (scfm)	1,038	1,082	1,027	1,049
Exhaust gas flowrate (dscfm)	1,014	1,055	1,003	1,024
Moisture (% vol)	2.29	2.58	2.39	2.42
Sample Train Data (Method 306)				
Sample volume (dscf)	48.0	50.8	48.4	49.1
Sample volume (dscm)	1.36	1.44	1.37	1.39
Total Chrome in sampling train (µg)	83.2	169	96.7	116.3
Hexavalent Chrome in sampling train (µg)	73.9	142	82.7	99.5
Calculated Total Chromium Emissions				
Total Chromium content (gr/dscf)	2.67×10^{-5}	5.14×10^{-5}	3.08×10^{-5}	3.63×10^{-5}
Total Chromium emission rate (lb/hr)	2.32×10^{-4}	4.64×10^{-4}	2.65×10^{-4}	3.21×10^{-4}
Calculated Hexavalent Chromium Emissions				
Hexavalent Chromium content (gr/dscf)	2.38×10^{-5}	4.32×10^{-5}	2.64×10^{-5}	3.11×10^{-5}
Hexavalent Chromium emission rate (lb/hr)	2.06×10^{-4}	3.90×10^{-4}	2.27×10^{-4}	2.74×10^{-4}