RECEIVED
MAR 18 2019
AIR QUALITY DIVISION

EMISSION TEST REPORT

Report Title:	PARTICULATE MATTER EMISSIONS FROM POWDER BLENDING PROCESSES
Report Date:	March 1, 2019
Test Date(s):	January 25, 2019

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.:	71-17D

Testing Contractor	
Company:	Impact Compliance and Testing, Inc.
Mailing Address:	39395 Schoolcraft Rd. Livonia, MI 48150
Phone:	(734) 464-3880
Project No.:	18011012

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

EMISSION TEST REPORT
FOR
THE VERIFICATION OF PARTICULATE MATTER EMISSIONS
FROM
POWDER BLENDING PROCESSES

HAVILAND ENTERPRISES, INC.
GRAND RAPIDS, MICHIGAN

1.0 INTRODUCTION

Impact Compliance and Testing, Inc. (ICT), formerly Derenzo Environmental Services, was contracted by Haviland Enterprises, Inc. (Haviland) for the determination of filterable particulate matter (PM) emissions from the exhaust of a wet scrubber system controlling emissions from powder blending processes at its Grand Rapids, Michigan facility.

The testing was performed in accordance with USEPA Methods 5 and 17 for the measurement of PM emissions. Haviland is currently operating under PTI No. 71-17D that was approved and issued by the Michigan Department of Environmental Quality, Air Quality Division (MDEQ-AQD) on September 21, 2018.

The emission testing was performed January 25, 2019 by ICT personnel Tyler Wilson, Blake Beddow, Brad Thome, and Clay Gaffey. 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 Mr. David Patterson and Ms. Kaitlyn DeVries.

The PM evaluation and exhaust gas sampling and analysis was performed using procedures specified in the Test Plan dated December 12, 2018 that was submitted to the MDEQ-AQD for review and approval.

Questions regarding this report should be directed to:

Tyler J. Wilson
Senior Project Manager
Impact Compliance and Testing, Inc.
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 ICT based on field sampling data collected by ICT. 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:

Tyler J. Wilson
Senior Project Manager
Impact Compliance and Testing, Inc.

Reviewed By:

Blake Beddow
Project Manager
Impact Compliance and Testing, Inc.

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 3/1/2019

Brittany Albin
Environmental Engineer
Haviland Enterprises, Inc.

2.0 TEST RESULTS SUMMARY

Emission testing was performed for the powder blending scrubber inlet and exhaust (emission unit FGWESTPOWDER; exhaust stack SV-7) for the wet scrubber system. A summary of the average PM inlet and exhaust emission rates for the powder blending scrubber are presented in Table 2.1 below. Measured inlet and exhaust gas flowrate, sample train data, and PM concentrations and emission rates for each 60-minute test period are presented at the end of this report in Tables 6.1-6.2.

Emission calculations are presented in Appendix A.

Process data recorded by Haviland representatives during the test periods is provided in Appendix F.

Table 2.1 Summary of measured filterable particulate matter emission rates

Sampling Location	Measured Filterable PM Emissions (lb/hr)
Scrubber Inlet (Powder Blender)	2.60
Scrubber Exhaust (Powder Blender)	0.10

3.0 PROCESS DESCRIPTION

Haviland operates several different types of powder blending processes: Pot Perm powder blender, a Pot Perm filling line, a ribbon powder blend tanks, a paddle powder blend tank, and a double planetary mixer.

The powder blending operations are permitted under emission unit (FGWESTPOWDER). The compliance test event consisted of three (3) simultaneous 1-hour test runs on the inlet and outlet of the wet scrubber.

Test day consisted of three (3) 60-minute PM runs on the inlet /outlet (concurrently) of the powder blending wet scrubber. Sampling results provide scrubber efficiencies for the individual blending operations.

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 PM test events. The average O_2 and CO_2 concentrations measured during 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 5 and 17 sample trains) and determined gravimetrically.

4.5 Particulate Matter Emissions Testing

USEPA Methods 5 and 17 "Determination of Particulate Matter Emissions from Stationary Sources" was used to measure PM concentrations and emission rates for the powder blending scrubber inlet and exhaust.

Appendix E provides a sampling train diagram for Methods 5 and 17.

Prior to testing, a preliminary velocity traverse, dry-bulb/wet-bulb moisture determination, and Fyrite® analysis for the powder blending 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 PM emissions sampling.

ICT used a Nutech Model 2010 modular isokinetic stack sampling system to measure PM emissions in accordance with the above-referenced sampling method. Triplicate 60-minute test runs were conducted simultaneously for the scrubber inlet and exhaust for the powder blending process and an average sample volume of 41.5 dry standard cubic feet (dscf) for the inlet and 43.8 dscf for the exhaust were obtained.

A USEPA Method 5 sample train was used to measure filterable PM. Exhaust gas from the wet scrubber exhaust was drawn at an isokinetic rate through a properly-sized sampling nozzle, heated probe, and heated glass fiber filter (GFF). Following the particulate filter, moisture was removed from the sample gas stream using chilled impingers and sample gas rate was measured using a calibrated dry gas meter.

At the end of each test period, the PM collected in the front half of the sampling train (from the sampling nozzle to the heated filter) was recovered in accordance with the triple rinse and brush procedures specified in USEPA Method 5. The impinger solutions were weighed gravimetrically for moisture content determination.

Since only filterable PM emissions were being measured with the sample train, the nozzle and probe liner were constructed of either glass or stainless steel.

The filters and collected rinses were sent to a qualified third-party laboratory (Bureau Veritas in Novi, Michigan) for gravimetric PM analysis according to the appropriate QA/QC procedures specified in USEPA Method 5.

USEPA Method 17 was used to determine filterable PM concentration in the wet scrubber inlet gas. Inlet gas was drawn from the wet scrubber inlet stack at an isokinetic sampling rate using an appropriately-sized sample nozzle. The collected inlet gas passed through an in-stack filter placed just after the "goose-neck" nozzle. PM in the sampled gas stream was collected onto a pre-tared glass fiber filter. The stainless steel in-stack filter holder was connected to a (unheated) sample probe. The outlet of the sample probe was connected to an impinger train (for moisture removal)

via flexible tubing. The outlet of the impinger train was connected to a dry gas meter and metering console.

At the conclusion of each test, the filter was recovered and the nozzle and filter holder were brushed and rinsed with acetone. Recovered filters and acetone rinses of the nozzle, filter holder, and sample probe were sent to a qualified third-party laboratory (Bureau Veritas in Novi, Michigan) for gravimetric PM analysis according to the appropriate QA/QC procedures specified in USEPA Method 17.

Both the Method 5 and 17 impinger trains were connected to the dry gas meter sampling consoles using a length of umbilical sample line.

The sample trains were 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
- Probe temperature (Method 5 only)
- Filter box temperature (Method 5 only)
- 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.

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 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 PM testing include:

- Prior to their use in the field, the sampling nozzles and probe liners were cleaned in accordance with the guidelines outlined in USEPA Method 5.

- A three-point calibration measurement was performed on the sampling nozzles used in the performance of the isokinetic testing. This field calibration sheets are presented in Appendix C.

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

- Prior to each test run, the sampling trains were 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 trains were leak-checked by drawing a vacuum equal to or greater than the highest vacuum measured during the test run.

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

- Bureau Veritas performed the required internal blank and recovery procedures presented in the USEPA Method 5. A report generated by Bureau Veritas can be found in Appendix G.

6.0 MEASUREMENT RESULTS

6.1 Filterable Particulate Matter Emission Rates

The average measured PM emission rates for the powder blending wet scrubber were as follows:

- 2.60 lb/hr PM for the scrubber inlet during the powder blending process. The average measured exhaust gas flowrate for the wet scrubber inlet during the powder blending process was 1,541 dry standard cubic feet per minute (dscfm).

- 0.10 lb/hr PM for the scrubber exhaust during the power blending process. The average measured exhaust gas flowrate for the wet scrubber exhaust during the powder blending process was 2,111 dscfm.

Tables 6.1-6.2 present the emission concentrations, sample volumes, and measured exhaust gas properties for the PM test runs conducted on the powder blending wet scrubber inlet and exhaust.

6.2 Monitoring Parameters

Material throughput, water circulation through the wet scrubber system and pressure drops across the scrubber were recorded during the test periods. Appendix F provides monitoring data recorded during each 60-minute sampling period.

6.3 Variations from Normal Sampling Procedures or Operating Conditions

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

6.4 Deviations from the Test Protocol

Sampling port locations were changed from those originally proposed in the Test Protocol. Port locations were discussed in email correspondences January 18, 2019. Final port location drawings are attached.

Test Nos. 2 and 3 (for both the inlet and exhaust sampling locations) were paused for brief periods during the tests due to clogging of the USEPA Method 17 filter at the scrubber inlet sampling location, from high levels of PM catch caking on the filter. Upon letting off the vacuum pressure from the sampling console during the test pauses, the PM that was caked on the filter was able to release into the filter holder allowing sample flow to be pulled through the sampling system once testing was resumed. All of the PM collected on the filter and in the filter holder was recovered for laboratory analysis.

Table 6.1 Scrubber Inlet PM Concentrations and Emission Rates (Powder Blending)

Test No.	1	2	3	
Test Date	1/25/19	1/25/19	1/25/19	Test
Test Period (24-hr clock)	08:25-09:34	10:15-11:40	12:35-13:57	Avg.
Exhaust gas flowrate (scfm)	1,157	1,708	1,785	1,550
Exhaust gas flowrate (dscfm)	1,147	1,701	1,774	1,541
Moisture (% vol)	0.85	0.43	0.61	0.63
Sample Train Data (Method 17)				
Sample volume (dscf)	33.3	45.0	46.3	41.5
Sample volume (dscm)	0.90	1.22	1.26	1.13
PM primary filter catch (mg)	540	420	460	473
PM acetone rinse catch (mg)	18.0	35.0	63.0	38.7
PM Total catch (mg)	558	455	523	512
Calculated Filterable PM Emissions				
Filterable PM content (gr/dscf)	0.27	0.16	0.18	0.21
Filterable PM emission rate (lb/hr)	2.66	2.37	2.77	2.60

Table 6.2 Scrubber Exhaust PM Concentrations and Emission Rates (Powder Blending)

Test No.	1	2	3	
Test Date	1/25/19	1/25/19	1/25/19	Test
Test Period (24-hr clock)	08:25-09:34	10:15-11:40	12:35-13:57	Avg.
Exhaust gas flowrate (scfm)	1,969	1,949	2,495	2,138
Exhaust gas flowrate (dscfm)	1,940	1,930	2,463	2,111
Moisture (% vol)	1.46	1.00	1.29	1.25
Sample Train Data (Method 5)				
Sample volume (dscf)	40.3	40.3	50.6	43.8
Sample volume (dscm)	1.12	1.11	1.39	1.21
PM primary filter catch (mg)	4.30	0.63	6.30	3.74
PM acetone rinse catch (mg)	20.0	6.20	6.70	11.0
PM Total catch (mg)	24.3	6.83	13.0	14.7
Calculated Filterable PM Emissions				
Filterable PM content (gr/dscf)	9.45×10^{-3}	2.69×10^{-3}	4.07×10^{-3}	5.40×10^{-3}
Filterable PM emission rate (lb/hr)	0.16	0.04	0.09	0.10