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SOURCE TESTING



Source Test Report

Meridian Brick, LLC  
3820 E. Serr Road  
Corunna, MI 48817

Test Date: June 21, 2018

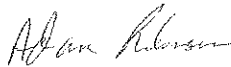


AST Project No. 2018-0652

Alliance Source Testing, LLC (AST) has completed the source testing as described in this report. Results apply only to the source(s) tested and operating condition(s) for the specific test date(s) and time(s) identified within this report. All results are intended to be considered in their entirety, and AST is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Onsite testing was conducted in accordance with approved internal Standard Operating Procedures. Any deviations or problems are detailed in the relevant sections on the test report.

This report is only considered valid once an authorized representative of AST has signed in the space provided below; any other version is considered draft. This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.



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**Adam Robinson, QSTI**  
**Alliance Source Testing, LLC**

7/27/2018

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Date

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**1.0 Introduction**

Alliance Source Testing, LLC (AST) was retained by Meridian Brick, LLC (Meridian Brick) to conduct source testing at the Corunna, Michigan facility. The facility operates under Michigan Department of Environmental Quality (MDEQ) Permit No. MI-ROP-A6497-2015. Testing was conducted to determine the emission rates of particulate matter (PM), hydrogen chloride (HCl), hydrogen fluoride (HF), chlorine (Cl<sub>2</sub>), mercury (Hg), and non-Hg metal hazardous air pollutants (HAPS) from the exhaust of one (1) brick tunnel kiln to evaluate compliance against the requirements of 40 CFR 63, Subpart JJJJ. These non-Hg metal HAPS included antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), lead (Pb), manganese (Mn), nickel (Ni) and selenium (Se).

**1.1 Process/Control System Descriptions**

Meridian Brick owns two (2) natural-gas fired brick tunnel kilns with associated dryers, lime injection systems and two (2) fabric filter collectors. One (1) kiln is permanently shut down.

**1.2 Project Team**

Personnel involved in this project are identified in the following table.

**Table 1-1  
Project Team**

<b>Facility Personnel</b>	Robert Clements – Meridian Brick
<b>Regulatory Personnel</b>	Tom Gasloli – MDEQ Michelle Luplow – MDEQ
<b>AST Personnel</b>	Kenji Kinoshita Jarret Sproull Keith Rhodes

**1.3 Site Specific Test Plan & Notification**

Testing was conducted in accordance with the Site Specific Test Plan (SSTP) submitted to Karen Kajiya-Mills of the MDEQ on June 7, 2018.

## 2.0 Summary of Results

AST conducted source testing at the Meridian Brick facility in Corunna, Michigan on June 21, 2018. Testing consisted of determining the emission rates of PM, HCl, HF, Cl<sub>2</sub>, Hg, and non-Hg HAPS from the exhaust of one (1) brick tunnel kiln.

Table 2-1 provides a summary of the emission testing results. Any difference between the summary results listed in the following table and the detailed results contained in appendices is due to rounding for presentation.

**Table 2-1  
Summary of Results**

Run Number	Run 1	Run 2	Run 3	Average
Date	6/21/18	6/21/18	6/21/18	--
<b>Particulate Matter Data</b>				
Concentration, grain/dscf @ 17% O <sub>2</sub>	0.0024	0.0021	0.0020	0.0022
Concentration, mg/dscm @ 7% O <sub>2</sub>	19.4	17.2	16.3	17.6
Emission Rate, lb/hr	0.35	0.31	0.29	0.32
Emission Factor, lb/ton fired product	0.043	0.039	0.036	0.039
<b>Mercury Data</b>				
Concentration, ug/dscm @ 17% O <sub>2</sub>	1.1	1.1	1.1	1.1
Emission Rate, lb/hr	6.9E-05	6.9E-05	6.8E-05	6.8E-05
Emission Factor, lb/ton fired product	8.5E-06	8.6E-06	8.4E-06	8.5E-06
<b>Total Non-Hg Metal HAPS Data <sup>1</sup></b>				
Concentration, ug/dscm	17.2	18.7	16.1	17.4
Emission Rate, lb/hr	1.2E-03	1.3E-03	1.1E-03	1.2E-03
Emission Factor, lb/ton fired product	1.5E-04	1.7E-04	1.4E-04	1.5E-04
<b>Hydrogen Chloride-Equivalent Data</b>				
HCl Emission Rate, lb/hr	0.30	0.33	0.33	0.32
Cl <sub>2</sub> Emission Rate, lb/hr <sup>1</sup>	8.33E-03	8.29E-03	5.74E-04	5.73E-03
HF Emission Rate, lb/hr	0.049	0.046	0.080	0.058
HCl-Equivalent Emission Rate, lb/hr	1.5	1.5	0.52	1.2

<sup>1</sup> The laboratory results for beryllium and cadmium for all runs, antimony Runs 2 and 3, and cobalt Run 3 were below the detection limit. The detection limit was used for emission calculation purposes.

### 3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix D.

**Table 3-1**  
**Source Testing Methodology**

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1, 2	Full Velocity Traverses
Oxygen/Carbon Dioxide	3A	Instrumental Analysis
Moisture Content	4	Volumetric / Gravimetric Analysis
Particulate Matter / Metals	5 / 29	Isokinetic Sampling
Hydrogen Chloride / Hydrogen Fluoride / Chlorine	26	Constant Rate Sampling
Gas Dilution System Certification	205	---

#### 3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-1 in U.S. EPA Reference Test Method 1.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

#### 3.2 U.S. EPA Reference Test Method 3A – Oxygen/Carbon Dioxide

The oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) testing was conducted in accordance with U.S. EPA Reference Test Method 3A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.7.

#### 3.3 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of water or silica gel. Post testing, the quantities of water and silica gel were measured to determine the amount of moisture condensed during the test run. Alternatively, each impinger was analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

### 3.4 U.S. EPA Reference Test Methods 5 and 29 – Particulate Matter and Metals

The particulate matter and metals testing was conducted in accordance with U.S. EPA Reference Test Methods 5 and 29. The complete sampling system consisted of a Teflon-coated nozzle, glass-lined probe, pre-weighed and pre-cleaned heated quartz filter, gas conditioning system, pump and calibrated dry gas meter. The gas conditioning train consisted of six (6) chilled impingers – the first and second containing 750-800 grams of HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub>, an empty third impinger, the fourth and fifth containing 750-800 grams of KMnO<sub>4</sub>, and the fifth containing 850-950 grams of silica gel. The probe liner and filter heating systems were maintained at a temperature of 120 ± 14°C (248 ± 25°F), and the impinger temperature was maintained at 20°C (68°F) or less throughout testing. Prior to testing, all glassware was cleaned and sealed in a controlled environment as outlined in the test method.

Following the completion of each test run, the sample train was leak checked at a vacuum pressure equal to or greater than the highest vacuum pressure observed during the run and the contents of the impingers were measured for moisture gain. The quartz filter was carefully removed and placed into container 1. The probe and nozzle were rinsed and brushed three (3) times with acetone using a non-metallic brush and these rinses were placed in container 2. The front half of the filter holder was rinsed three (3) times with acetone and these rinses were added to container 2. The probe, nozzle and front half of the filter holder were then triple-rinsed with 0.1 N HNO<sub>3</sub>. This rinse was recovered in container 3. The contents of impingers 1, 2, and 3 were placed in container 4. Impingers 1, 2 and 3 along with the filter support, back half of the filter holder and all connecting glassware were triple-rinsed with 0.1 N HNO<sub>3</sub> and these rinses were added to container 4. The contents of impinger 4 were placed in container 5A. The impinger and connecting glassware were triple-rinsed with 0.1 N HNO<sub>3</sub> and these rinses were added to container 5A. The contents of impingers 5 and 6 were placed in container 5B. The impingers and all connecting glassware were triple-rinsed with acidified KMnO<sub>4</sub> and then with de-ionized (DI) water and these rinses were added to container 5B. Impingers 5 and 6 were rinsed again with 25 mL of 8N HCl and this rinse was collected into container 5C, which contained 200 mL of DI water. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for analysis.

### 3.5 U.S. EPA Reference Test Method 26 – Hydrogen Chloride, Hydrogen Fluoride and Chlorine

The hydrogen chloride (HCl), hydrogen fluoride (HF) and chlorine (Cl<sub>2</sub>) testing was conducted in accordance with EPA Reference Test Method 26A. The complete sampling system consisted of a heated glass-lined probe, heated Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of six (6) chilled impingers. The first and second impingers contained 100 mL of 0.1 N H<sub>2</sub>SO<sub>4</sub>, the third and fourth impingers contained 100 mL of 0.1 N NaOH and the fifth impinger contained 200-300 grams of silica gel. The probe liner and filter heating systems were maintained at 248-273°F, and the impinger temperature was maintained at 20°C (68°F) or less throughout the testing.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run and the contents of the impingers were measured for moisture gain. The absorbing solution (0.1 N H<sub>2</sub>SO<sub>4</sub>) from the first and second impingers and absorbing solution (0.1 N NaOH) from the third and fourth impingers were placed into separate sample containers (container 3 and container 4). The back-half of the filter holder, first and second impingers and all glassware leading to the outlet of the second impinger were triple-rinsed with DI water. These rinses were placed in container 3. The third and fourth impingers and all associated glassware were triple-rinsed with DI water. These rinses were recovered in container 4. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for analysis.

### 3.6 U.S. EPA Reference Test Method 205 – Gas Dilution System Certification

A calibration gas dilution system field check was conducted in accordance with U.S. EPA Reference Method 205. Multiple dilution rates and total gas flow rates were utilized to force the dilution system to perform two dilutions on each mass flow controller. The diluted calibration gases were sent directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The analyzer response agreed within 2% of the actual diluted gas concentration. A second Protocol 1 calibration gas, with a cylinder concentration within 10% of one of the gas divider settings described above, was introduced directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The cylinder concentration and the analyzer response agreed within 2%. These steps were repeated three (3) times. Copies of the Method 205 data can be found in the Quality Assurance/Quality Control Appendix.

### 3.7 Quality Assurance/Quality Control – U.S. EPA Reference Test Methods 3A

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Low Level gas was introduced directly to the analyzer. After adjusting the analyzer to the Low-Level gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas. For the Calibration Error Test, Low, Mid, and High Level calibration gases were sequentially introduced directly to the analyzer. All values were within 2.0 percent of the Calibration Span or 0.5 ppmv absolute difference.

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe and the time required for the analyzer reading to reach 95 percent or 0.5 ppm (whichever was less restrictive) of the gas concentration was recorded. The analyzer reading was observed until it reached a stable value, and this value was recorded. Next, Low Level gas was introduced at the probe and the time required for the analyzer reading to decrease to a value within 5.0 percent or 0.5 ppm (whichever was less restrictive) was recorded. If the Low-Level gas was zero gas, the response was 0.5 ppm or 5.0 percent of the upscale gas concentration (whichever was less restrictive). The analyzer reading was observed until it reached a stable value and this value was recorded. The measurement system response time and initial system bias were determined from these data. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv absolute difference

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe. After the analyzer response was stable, the value was recorded. Next, Low Level gas was introduced at the probe, and the analyzer value recorded once it reached a stable response. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv absolute difference or the data was invalidated and the Calibration Error Test and System Bias were repeated.

Drift between pre- and post-run System Bias was within 3% of the Calibration Span or 0.5 ppmv absolute difference. If the drift exceeded 3% or 0.5 ppmv, the Calibration Error Test and System Bias were repeated.

To determine the number of sampling points, a gas stratification check was conducted prior to initiating testing. The pollutant concentrations were measured at three points (16.7, 50.0 and 83.3 percent of the measurement line). Each traverse point was sampled for a minimum of twice the system response time.

If the pollutant concentration at each traverse point did not differ more than 5% or 0.5 ppm (whichever was less restrictive) of the average pollutant concentration, then single point sampling was conducted during the test runs. If the pollutant concentration did not meet these specifications but differed less than 10% or 1.0 ppm from the average concentration, then three (3) point sampling was conducted (stacks less than 7.8 feet in diameter - 16.7, 50.0 and 83.3 percent of the measurement line; stacks greater than 7.8 feet in diameter - 0.4, 1.0, and 2.0 meters from the stack wall). If the pollutant concentration differed by more than 10% or 1.0 ppm from the average concentration, then sampling was conducted at a minimum of twelve (12) traverse points. Copies of stratification check data can be found in the Quality Assurance/Quality Control Appendix.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a \*.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the AST server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.

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