EMISSION TEST REPORT

Report Title	TEST REPORT FOR THE MEASUREMENT OF PARTICULATE MATTER AND VISIBLE EMISSIONS FROM HOT MIX ASPHALT MANUFACTURING PROCESSES
Test Date(s)	August 30, 2018
Report Date	September 24, 2018

Facility Information	
Name	Ajax Materials Corporation, Plant 6
Street Address	7392 Kensington Road
City, County	Brighton, Livingston

Facility Permit Information			
State Registration No.:	B5823	Permit to Install No.:	76-17

Testing Contractor	
Company Mailing Address	Derenzo Environmental Services 39395 Schoolcraft Road Livonia, Michigan 48150
Phone	(734) 464-3880
Project No.	1803013

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TEST REPORT
FOR THE VERIFICATION OF
PARTICULATE MATTER AND VISIBLE EMISSIONS FROM
HOT MIX ASPHALT MANUFACTURING PROCESSES

AJAX MATERIALS CORPORATION, PLANT 6
BRIGHTON, MICHIGAN

Test Date: August 30, 2018

1.0 INTRODUCTION

Ajax Materials Corporation (Ajax) operates a hot mix asphalt (HMA) manufacturing process at its facility located in Brighton, Livingston County, Michigan. The Michigan Department of Environmental Quality, Air Quality Division (MDEQ-AQD) has issued Permit to Install (PTI) No. 76-17 (dated November 3, 2017) to Ajax for the HMA facility (emission unit, EUHMAPLANT) and associated activities.

HMA is produced in a counter-flow, direct-fired rotary drum that is typically fired with natural gas. Exhaust gas from the dryer/mixer is directed to a primary collector and a pulse jet baghouse. The filtered process air from the baghouse is exhausted through a vertical stack to the atmosphere (SVHMAPLANT).

The Testing / Sampling conditions of the issued Permit to Install (PTI 76-17) specify that:

Within 60 days after achieving the maximum production rate, but not later than 180 days after commencement of trial operation, federal Standards of Performance for New Stationary Sources require verification of particulate emission rates from EUHMAPLANT, by testing at owner's expense, in accordance with 40 CFR Part 60 Subparts A and I ... No less than 30 days prior to testing, a complete test plan shall be submitted to the AQD.

The emission testing was performed August 30, 2018 by Derenzo Environmental Services (DES) personnel Tyler Wilson, Brad Thome, and Kevin Anderson. Mr. David Patterson and Mr. Dan McGeen from the MDEQ-AQD were on-site to observe portions of the compliance testing.

A test protocol was submitted to MDEQ-AQD prior to the testing project and a test plan approval letter was issued by MDEQ-AQD. The following items provide information required in MDEQ-AQD *Format for Submittal of Source Emission Test Plans and Reports*, dated March 2018.

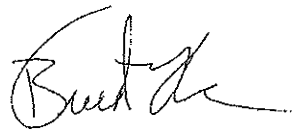
Appendix A provides a copy of the USEPA test plan approval letter.

Questions concerning this emission report should be directed to:

Testing Procedures	Tyler J. Wilson Livonia Office Supervisor Derenzo Environmental Services 39395 Schoolcraft Road Livonia, MI 48150 twilson@derenzo.com (734) 464 – 3880
Facility Compliance	Kathleen T. Anderson Axis Environmental Consulting Corporation Environmental Consultant for Ajax Materials Corp. kanderson@ajaxpaving.com (810) 845-3925
Site Operations	David Grabowski Operations Manager Ajax Materials Corporation PO Box 7058 Troy, MI 48007 dgrabowski@ajaxpaving.com (248) 388-3302

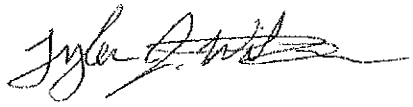
This test report was prepared by Derenzo Environmental Services based on the field sampling data collected by DES. Certain analyses were contracted to and performed by third parties and the results are presented in this report and its appendices. Facility process data was collected and provided by Ajax employees or representatives.

Report Prepared By:



Brad Thome
Environmental Consultant

Reviewed By:



Tyler J. Wilson
Livonia Office Supervisor

2.0 SUMMARY OF TEST RESULTS

The exhaust gases from the HMA production process (emission unit EUHMAPLANT) were sampled for filterable PM content and emission rate using a USEPA Method 5 sampling train. Exhaust gas opacity observations were performed on the emission unit exhaust (SVHMAPLANT) using USEPA Method 9.

The PM emission test data were reduced to grains PM per dry standard cubic foot (gr/dscf) of exhaust gas and pounds PM per tons of hot mix asphalt (lb/ton HMA) for comparison to the allowable emission limits specified in PTI No. 76-17.

Table 2.1 presents a summary of measured particulate matter emission rates and visual emission opacity readings for the process.

Test results for each one-hour sampling period are presented at the end of this report in Section 6.0 and Tables 6.1 and 6.2.

Table 2.1 Summary of measured particulate matter emission rates and exhaust plume opacity for EUHMAPLANT

Emission Unit	PM Mass Emission Rate (lb/hr)	PM Mass Emission Rate (lb/ton HMA)	Exhaust Gas PM Content (gr/dscf)	6-Minute Avg Opacity (%)
EUHMAPLANT	1.55	0.004	0.007	0.2
Permit Limit / Standard		**0.05**	**0.04**	**20**

3.0 SOURCE DESCRIPTION

3.1 General Process Description and Type of Raw and Finished Materials

The HMA process combines aggregate with a liquid asphalt cement mixture using a counter-flow, direct-fired rotary drum. The drum is permitted to be fired by various fuels including natural gas, propane, Fuel Oils No. 2 through 6, and Recycled Used Oil (RUO). The facility typically uses natural gas and used natural gas to fuel the drum during the compliance testing event.

The counter-flow dryer/mixer has a maximum design production rating of 500 tons per hour (TPH). However, the facility operated at a production rate of approximately 400 TPH. The dryer/mixer utilizes a burner with maximum firing rate of 150 million British thermal units per hour (MMBtu/hr input).

The process produces HMA material by combining aggregate and liquid asphalt cement in a horizontal, rotating counter-flow drum. Aggregate is introduced into the drum opposite the burner end and moves towards the burner end in counter-flow with the hot gases of combustion. Liquid asphalt cement is introduced into the mixing zone of the drum (located behind the burner flame zone) and the finished HMA material is discharged from the drum and conveyed to storage/loadout silos.

PTI 76-17 specifies that the asphalt mixture may contain up to 50% recycled asphalt pavement (RAP) and recycled asphalt shingles (RAS), combined.

3.2 Emission Control System Description

Exhaust gas from the dryer/mixer is directed to a particulate matter emission control system consisting of a primary collector and a pulse jet baghouse. The baghouse filter media is periodically cleaned using reverse air technology.

The filtered process air from the baghouse is exhausted through a vertical stack to the atmosphere (SVHMAPLANT).

3.3 Operating Variables

A test plan approval letter dated July 16, 2018 requested that Ajax monitor and record the following process operational data during each test period:

- Aggregate processed (TPH);
- RAP processed (TPH);
- Asphalt cement processed (TPH);
- Total HMA produced (TPH);
- HMA product types produced during testing;
- RAP percentage;
- Fuel type and usage rate;
- HMA discharge temperature;
- Baghouse temperature and pressure drop;
- Frequency of filter fabric cleaning cycle;
- Damper position (% open); and
- Burner position (% open).

Appendix B provides process and control device operating records for the test periods.

3.4 Sampling Location

Filtered exhaust gas is discharged to the ambient air through a cylindrical 67-inch diameter exhaust stack (SVHMAPLANT). Two (2) sample ports were installed 90° apart that were 25 ft. (300 in.) downstream and 64 ft. (768 in.) upstream from the nearest flow disturbance. Exhaust gas was sampled from twelve (12) points across each diameter for a total of 24 sampling points.

Appendix C provides a drawing for the exhaust stack sampling location.

4.0 SUMMARY OF USEPA TEST METHODS

The following USEPA reference test methods and sampling trains were used to perform the emission compliance testing.

4.1 Exhaust Gas Flowrate and Particulate Matter Sampling Methods

USEPA Method 1	Velocity and sampling locations were selected based on physical stack measurements in accordance with USEPA Method 1.
USEPA Method 2	Exhaust gas velocity pressure and temperature using a Type-S Pitot tube connected to a red oil incline manometer and K-type thermocouple.
USEPA Method 3A	Exhaust gas O_2 and CO_2 content was determined using paramagnetic and infrared instrumental analyzers, respectively.
USEPA Method 4	Exhaust gas moisture determined using the chilled impinger method (as part of the particulate sampling train).
USEPA Method 5	Filterable PM was determined using isokinetic sampling procedures and analysis of the front half of the particulate matter sampling train (filter and acetone rinse).
USEPA Method 9	Exhaust gas opacity during each sampling period was determined by a certified observer of visible emissions.

5.0 SAMPLING AND ANALYSIS PROCEDURES

Testing was performed to verify filterable PM emission rates and opacity from the hot mix asphalt mix/dryer drum. The exhaust gas existing the baghouse was sampled for three (3) one-hour test periods using isokinetic sampling methods. Filterable PM emissions were determined based on the amount of filterable PM catch in the sample train and the measured exhaust gas volumetric flowrate.

5.1 Velocity Measurements (USEPA Methods 1 and 2)

The representative sample locations were determined in accordance with USEPA Method 1 based on the measured distance to upstream and downstream disturbances. The absence of significant cyclonic flow was determined at each sampling location.

Exhaust gas velocity was measured using USEPA Method 2 throughout each test period as part of the isokinetic sampling procedures. Velocity pressure measurements were performed at each

stack traverse point using an S-type Pitot tube and red-oil manometer. Temperature measurements were performed at each traverse point using a K-type thermocouple and a calibrated digital thermometer.

Prior to performing the initial velocity traverse, the S-type Pitot tube and manometer lines were leak-checked at the test site. These checks were made by blowing into the impact opening of the Pitot tube until 3 or more inches of water were recorded on the manometer, then capping the impact opening and holding it closed for 15 seconds to ensure that it was leak free. The static pressure side of the Pitot tube was leak-checked using the same procedure.

5.2 Diluent Gas Sampling Procedures (USEPA Method 3A)

CO_2 and O_2 content in the exhaust gas stream was measured continuously throughout each test period in accordance with USEPA Method 3A. The exhaust gas CO_2 content was monitored using a Servomex 1440D single beam single wavelength (SBSW) infrared gas analyzer. The exhaust gas O_2 content was monitored using a paramagnetic sensor within the Servomex 1440D gas analyzer.

During each sampling period, a continuous sample of the exhaust gas stream was extracted from the stack using a stainless steel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being introduced to the analyzers; therefore, measurement of O_2 and CO_2 concentrations correspond to standard dry gas conditions. Instrument response data were recorded using an ESC Model 8816 data acquisition system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.7 of this document). Sampling times were recorded on field data sheets.

5.3 Moisture Determination (USEPA Method 4)

Moisture content was measured concurrently with the particulate matter sampling trains and determined in accordance with USEPA Method 4. Moisture from the gas sample was removed by the chilled impingers of the isokinetic sampling train. The net moisture gain from the gas sample was determined by either volumetric or gravimetric analytical techniques in the field. Percent moisture was calculated based on the measured net gain from the impingers and the metered gas sample volume of dry air.

5.4 Particulate Matter Sampling Procedures (USEPA Method 5)

Filterable PM was determined using USEPA Method 5. Exhaust gas was withdrawn from the emission unit exhaust stack at an isokinetic sampling rate using an appropriately-sized stainless steel sample nozzle and heated probe. The collected exhaust gas was passed through a pre-tared glass fiber filter that was housed in a heated filter box. The heated filter box was connected directly to the PM impinger train.

Recovered filters and acetone rinses of the nozzle, filter holder, and sample probe were sent to Bureau Veritas North America, Inc. (Novi, Michigan) for gravimetric measurements.

5.5 Opacity Observations (USEPA Method 9)

USEPA Method 9 procedures were used to evaluate the opacity of the exhaust gas during each 60-minute test period. In accordance with USEPA Method 9, the qualified observer stood at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. As much as possible, the line of vision was approximately perpendicular to the plume direction.

Opacity observations were made at the point of greatest opacity in the portion of the plume where condensed water vapor was not present. Observations were made at 15-second intervals for the duration of the 60-minute testing period.

All visible emissions determinations were performed by a qualified observer in accordance with USEPA Method 9, Section 3.

5.6 Number and Length of Sampling Runs

The emission verification test consisted of triplicate (3), one-hour sampling periods of the exhaust stack. The particulate and opacity were sampled simultaneously.

5.7 Quality Assurance/Quality Control Procedures

Appendix E provides sampling equipment quality assurance and calibration data. A summary of these procedures is provided in this section.

5.7.1 Flow Measurement Equipment

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 outlined in the sampling methods.

5.7.2 Isokinetic Sampling for Particulate Matter

The dry gas meter sampling console was calibrated prior to and after the testing program using the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges required by 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 Method 5.

5.7.3 Particulate Matter Analyses

All recovered particulate matter samples were stored and shipped in glass sample bottles with Teflon® lined caps. The liquid level on each bottle was marked with permanent marker and the caps were secured closed with tape. Samples of the reagents used in the test project (approximately 200 milliliters of acetone) were sent to the laboratory for analysis to verify that the reagents used to recover the samples have low particulate matter residue values.

5.7.4 Sampling System Response Time Determination

The response time of the CO_2 / O_2 sampling system was determined prior to the compliance test program by introducing upscale gas and zero gas, in series, into the sampling system using a tee connection at the base of the sample probe. The elapsed time for the analyzer to display a reading of 95% of the expected concentration was determined using a stopwatch.

The Servomex Model 1440D analyzer exhibited a system response time of 26 seconds. Results of the response time determinations were recorded on field data sheets. For each test period, test data were collected once the sample probe was in position for at least twice the maximum system response time.

5.7.5 Gas Divider Certification (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a

primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivered calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

5.7.6 Instrumental Analyzer Interference Check

The instrumental analyzers used to measure O_2 and CO_2 have had an interference response test preformed prior to their use in the field pursuant to the interference response test procedures specified in USEPA Method 7E. The appropriate interference test gases (i.e., gases that would be encountered in the exhaust gas stream) were introduced into each analyzer, separately and as a mixture with the analyte that each analyzer is designed to measure. All of analyzers exhibited a composite deviation of less than 2.5% of the span for all measured interferent gases. No major analytical components of the analyzers have been replaced since performing the original interference tests.

5.7.7 Instrument Calibration and System Bias Checks

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the CO_2 and O_2 analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing the upscale calibration gas and zero gas into the sampling system (at the base of the stainless steel sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO_2 and O_2, in nitrogen and zeroed using hydrocarbon free nitrogen. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

5.7.8 Determination of Exhaust Gas Stratification

A stratification test was performed for the HMA process exhaust stack. The stainless steel sample probe was positioned at sample points correlating to 16.7, 50.0 (centroid) and 83.3% of the stack diameter. Pollutant concentration data were recorded at each sample point for a minimum of twice the maximum system response time.

The recorded concentration data for the exhaust stack indicates that the measured O_2 and CO_2 concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the exhaust gas was considered to be unstratified and the compliance test sampling was performed at a single sampling location within the exhaust stack.

6.0 TEST RESULTS AND DISCUSSION

6.1 Particulate Matter Emission Test Results

Exhaust gas filterable PM content was calculated based on the amount of dry stack gas metered through the sampling system and the laboratory results for PM recovered from the USEPA Method 5 sampling train (filter and nozzle/probe/filter housing rinses). The average PM content was 0.007 grains PM per dry standard cubic foot (gr/dscf) of exhaust gas and 0.004 pounds PM per ton hot mix asphalt (lb/ton HMA).

The average measured exhaust gas flowrate was 26,210 dscfm resulting in a calculated PM mass emission rate of 1.55 pounds per hour (lb/hr).

Table 6.1 presents particulate matter test results for the three (3) test periods.

Appendix F provides isokinetic sampling train data and mass emission rate calculations.

Appendix G provides a copy of the Bureau Veritas N.A. laboratory analytical report for gravimetric analysis of the filterable particulate matter samples.

Opacity observations were made at the point of greatest opacity in the portion of the plume where condensed water vapor was not present. Observations were made at 15-second intervals for the duration of the 60-minute testing period.

Table 6.2 presents the opacity reading test results for the three (3) sampling periods.

6.2 Operating Conditions During Compliance Tests

The testing was performed while the process operated at maximum routine operating conditions. Ajax representatives provided production data at 15-minute intervals for each test period. The average recorded Asphalt production rate was 403 tons per hour (TPH) for the three test periods. Additionally, Ajax operators recorded aggregate processed (TPH), RAP processed (TPH), asphalt cement processed (TPH), total HMA produced (TPH), HMA product types produced during testing, RAP percentage, fuel type and usage rate, HMA discharge temperature, baghouse inlet temperature and pressure drop, frequency of filter fabric cleaning cycle, damper position (% open), and burner position (% open).

Appendix B provides operating data collected during the compliance tests.

6.3 Compliance Determination

The test results presented in Table 6.1 indicate that the source operated in compliance with the applicable allowable PM emission rates of 0.04 gr/dscf of exhaust gas and 0.05 lb/ton HMA.

The visual emission observation results presented in Table 6.2 indicate that the exhaust gas released via SVHMAPLANT exhibits opacity that is less than that allowed in the Permit to Install and NSPS.

Appendix H provides visible emission data sheets and the observer certificate.

6.4 Variations from Normal Sampling Procedures or Operating Conditions

The testing was performed as described in the approved test plan and reference test methods. During the test periods the process was operated at normal routine operating conditions, at or near maximum achievable capacity and satisfied the parameters specified in the test plan approval letter. The test event was witnessed by Mr. David Patterson and Mr. Dan McGeen of the MDEQ-AQD.

Each one-hour test was paused for a few minutes to move the sampling train to the second sampling port.

As with most HMA production facilities, a significant steam plume was present at the exhaust point. The certified VE reader performed the opacity observations downwind of the steam plume at the point where there was no longer visible water vapor.

Table 6.1. Measured particulate matter emission rates for the EUHMAPLANT exhaust

Test No. Test Date:	**1** 8/30/2018	**2** 8/30/2018	**3** 8/30/2018	**Avg**
Test Times	6:00-6:30; 6:38-7:08	7:53-8:23; 8:33-9:03	9:28-9:58; 10:06-10:36	
Exhaust Gas Properties				
Exhaust gas flow (dscfm)	26,001	26,165	26,464	26,210
Temperature (°F)	217	217	215	216
Moisture (%H_2O)	31.9	33.5	29.8	31.7
Sample Train Data				
Sample volume (dscf)	33.3	33.4	32.5	33.1
PM catch primary filter (mg)	8.40	7.70	6.40	7.50
PM catch acetone rinse (mg)	7.50	7.60	6.90	7.33
Total PM catch (mg)	15.9	15.3	13.3	14.8
PM Emission Rate				
PM Emission Rate (lb/hr)	1.64	1.59	1.43	1.55
PM Emission Rate (lb/ton HMA)	0.004	0.004	0.004	0.004
PM Concentration (gr/dscf)	0.007	0.007	0.006	0.007
PM Permit Limit (lb/ton HMA)				**0.05**
PM Permit Limit (gr/dscf)				**0.04**

Table 6.2 Measured exhaust plume opacity results for the exhaust plume from SVHMAPLANT

Test ID	Test Date	Test Times (EDT)	Production (Tons)	6-Minute Average (%)	Highest 6-Minute Average (%)
Test 1	08/30/18	7:53-8:23; 8:35-9:03	401	0.2	0.2
Test 2	08/30/18	9:28-9:58; 10:06-10:36	408	0.2	0.2
Test 3	08/30/18	10:42-11:42	401	0.2	0.2
		Averages	403	0.2	0.2
			Permit Limit:	**20.0**	**27.0**