EMISSION TEST REPORT

Report Title	TEST REPORT FOR THE VERIFICATION OF CARBON MONOXIDE, PARTICULATE MATTER, AND VISIBLE EMISSIONS FROM HOT MIX ASPHALT MANUFACTURING PROCESSES
Test Date(s)	July 20-21, 2016
Report Date	August 22, 2016

Facility Information	
Name	Ace-Saginaw Paving Company
Street Address	4190 Jimbo Drive
City, County	Burton, Genessee

Facility Permit Information			
State Registration No.:	B1597	Permit to Install No.:	128-73F

Testing Contractor	
Company	Derenzo Environmental Services
Mailing Address	39395 Schoolcraft Road Livonia, Michigan 48150
Phone	(734) 464-3880
Project No.	1605005

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

ACE-SAGINAW PAVING COMPANY
BURTON, MICHIGAN

Test Date(s): July 20-21, 2016

1.0 INTRODUCTION

Ace-Saginaw Paving Company (Ace Asphalt) operates a hot mix asphalt (HMA) manufacturing process at its facility located in Burton, Genessee County, Michigan. The Michigan Department of Environmental Quality, Air Quality Division (MDEQ-AQD) has issued Permit to Install (PTI) No. 128-73F to Ace Asphalt for the HMA facility (emission unit, EUHMAPLANT) and associated activities. The facility is also regulated under New Source Performance Standards (NSPS) for Hot Mix Asphalt Plants (40 CFR Part 60 Subpart I).

Conditions of PTI No. 128-73F specify:

- Within 60 days after achieving the maximum production rate, but not later than 180 days after commencement of trial operation, the permittee shall verify and quantify emission rates of carbon monoxide from EUHMAPLANT

- 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…in accordance with 40 CFR Subparts A and I.

In addition, the NSPS requires visible emission (VE) observations to be conducted during the particulate matter (PM) test runs.

The emission testing was performed July 20-21, 2016 by Derenzo Environmental Services (DES) personnel Jason Logan, Blake Beddow and Clay Gaffey. Mr. Thomas Gasloli and Mr. Daniel McGeen from the MDEQ-AQD were on-site to observe portions of the compliance testing.

A test protocol was submitted to the MDEQ-AQD prior to the testing project and a test plan approval letter was issued by the regulatory agency. The following items provide information required in MDEQ-AQD *Format for Submittal of Source Emission Test Plans and Reports*, dated December 2013.

Questions concerning this emission report should be directed to:

Mr. Benjamin J. Kroeger
Environmental Engineer
Edward C. Levy Company
51445 W. 12 Mile Road
Wixom, MI 48393
bkroeger@edwclevy.net
(313) 409-5617

Mr. Jason Logan
Environmental Consultant
Derenzo Environmental Services
39395 Schoolcraft Rd.
Livonia, MI 48150
jlogan@derenzo.com
(734) 464-3880

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

I certify that the testing was conducted in accordance with the approved 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:

Jason Logan
Environmental Consultant
Derenzo Environmental Services

Reviewed By:

Robert L. Harvey, P.E.
General Manager
Derenzo Environmental Services

I certify that the facility operating conditions were in compliance with permit requirements or were at the maximum routine operating conditions for the facility. Based on information and belief formed after reasonable inquiry, the statements and information in this report are true, accurate and complete.

William E. Jones
Vice President, Operations
Ace-Saginaw Paving Company

2.0 SUMMARY OF TEST RESULTS

The exhaust gases from the HMA production process (emission unit EUHMAPLANT) were sampled for carbon monoxide (CO), oxygen (O_2), and carbon dioxide (CO_2) for six (6) one-hour test periods. Three (3) test periods were conducted while the facility was fired with natural gas (NG) and three (3) were conducted while the facility was fired with recycled used oil (RUO). Isokinetic sampling for filterable PM was conducted simultaneously with CO measurements for three (3) one-hour test periods while the facility was fired with RUO. Exhaust gas opacity observations were performed by a certified observer on the emission unit exhaust during the PM test periods in accordance with USEPA Method 9.

The PM laboratory and sample train data were reduced to grains PM per dry standard cubic foot (gr/dscf) of exhaust gas and pounds PM per ton of HMA material produced (lb/ton of HMA) for comparison to the allowable emission limits specified in PTI No. 128-73F and Subpart I.

Test data and results for each one hour test period are presented at the end of this report in Tables 7.1 through 7.3.

Table 2.1 Summary of measured carbon monoxide and particulate matter emissions in EUHMAPLANT exhaust

Pollutant (Fuel Type)	Mass Emission Rate (lb/hr)	Exhaust Gas Content (gr/dscf)	Emission Factor (lb/ton of HMA)
Measured PM (RUO fuel)	1.56	0.006	0.004
PM Permit Limit	-	**0.04**	**0.03**
Measured CO (RUO fuel)	46.3	-	0.13
CO Permit Limit, RUO	-	-	**0.201**
Measured CO (NG fuel)	44.4	-	0.13
CO Permit Limit, NG	-	-	**0.198**

Exhaust gas opacity was 0% for each reading during the test periods.

3.0 SOURCE DESCRIPTION

3.1 General Process Description and Type of Raw and Finished Materials

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 and moves towards the opposite (burner) end of the drum 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. The exhaust gases exit the drum and are directed to the baghouse particulate control system.

The drum is permitted to be fired by various fuels; ultra-low sulfur diesel (ULSD), RUO, NG, and liquid petroleum gas (LPG). Testing was conducted while the drum was fired with NG and RUO.

The counter-flow dryer/mixer is manufactured by GenCor and has a maximum design production rating of 500 tons per hour (tph). The facility operated at 351 and 354 tph during compliance testing which is the normal maximum operation.

3.2 Emission Control System Description

Exhaust gas from the dryer/mixer is directed to a particulate matter control system consisting of a primary collector and baghouse. The baghouse filter media is periodically cleaned using counter-flow air through the sequential cleaner opening on top of the baghouse. The filtered baghouse air is exhausted through a vertical stack to the atmosphere (SVHMAPLANT).

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

3.3 Sampling Location

Filtered exhaust gas is discharged to the ambient air through a circular duct exhaust stack (SVHMAPLANT) which is 68 inches in diameter. In accordance with USEPA Method 1, sixteen (16) traverse points were used for flow measurements during the CO test periods while the facility fired with NG, and 24 traverse points for isokinetic testing during the PM/CO testing periods.

Appendix B 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.

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 3	Exhaust gas diluent gas measurements via infrared and paramagnetic analyzers.
USEPA Method 4	Exhaust gas moisture determined using the chilled impinger method.
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.
USEPA Method 10	Exhaust gas carbon monoxide measurements via infrared analyzer.

5.0 SAMPLING AND ANALYSIS PROCEDURES

Testing was performed to verify CO and filterable PM emission rates and opacity from the hot mix asphalt mix/dryer drum. CO concentration measurements were performed on the exhaust stack exiting the baghouse for three (3) one-hour test runs while the facility used RUO and three (3) one-hour test runs while the facility used NG. Isokinetic PM sampling and opacity observations were performed concurrently with the CO measurements for three (3) one-hour test runs while the facility used RUO.

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 PM test period (RUO fuel) as part of the isokinetic sampling procedures. Exhaust gas velocity was measured

before and after each NG fuel CO test period. 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.

Appendix C presents exhaust velocity calculations and field data sheets.

5.2 Diluent Gas Sampling Procedures (USEPA Method 3A)

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

During each sampling period, a continuous sample of the baghouse 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 6.3 of this document). Sampling times were recorded on field data sheets.

Appendix C presents O_2 and CO_2 calculation sheets.

Appendix D presents raw instrument response data.

5.3 Moisture Determination (USEPA Method 4)

Moisture content of the baghouse exhaust gas was determined in accordance with USEPA Method 4 using a chilled impinger sampling train. For the RUO fuel test periods the stack gas moisture content was determined as part of the USEPA Method 5 PM sample train concurrently with the instrumental analyzer test periods. For the NG fuel CO test periods, moisture content was determined using a chilled impinger train that sampled gas from the stack centroid (constant rate, non-isokinetic) for at least 30 minutes during each test period. During each sampling period a metered amount of sample gas was extracted from the source where moisture was removed using impingers that were submersed in an ice bath. At the conclusion of each sampling period, the moisture gain in the impingers was determined gravimetrically by weighing each impinger to determine net weight gain.

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 (GFF) that was housed in a heated filter box. The heated filter box was connected directly to the PM impinger train. PM test periods were conducted while the facility was fired with RUO.

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.

Appendix C presents PM emission calculation sheets.

Appendix F provides the laboratory report.

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 PM 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 PM testing period while the facility was fueled with RUO.

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

Appendix G presents VE data sheets and observer certification.

5.6 Carbon Monoxide Concentration Measurements (USEPA Method 10)

CO pollutant concentrations in the baghouse exhaust gas stream was determined using an infrared CO analyzer. Three one-hour tests were conducted while the facility was fired with NG and three were conducted simultaneously with the PM tests while the facility fired with RUO.

Throughout each test period, a continuous sample of the baghouse exhaust gas was extracted from the stack using the Teflon® heated sample line and gas conditioning system and delivered to the instrumental analyzers. Instrument response for each analyzer was recorded on an ESC Model 8816 data acquisition system that 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.

Appendix C presents CO emission calculation sheets.

Appendix D presents raw instrument response data.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

6.1 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 verified against or calibrated to specifications outlined in the sampling methods.

Prior to performing the initial velocity traverse, and periodically throughout the test program, 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.

6.2 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.

6.3 Instrumental Analyzer Interference Check

The instrumental analyzers used to measure CO, O_2 and CO_2 have had an interference response test performed 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.

6.4 Instrument Calibration and System Bias Check

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the CO, 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, O_2, and CO 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.

6.5 Determination of Exhaust Gas Stratification

A stratification test was performed for the HMA plant baghouse 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 baghouse exhaust stack indicated that the measured CO concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the baghouse exhaust gas was considered to be unstratified and the compliance test sampling was performed at a single sampling location within the baghouse exhaust stack.

6.6 Meter Box Calibrations

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.

6.7 Particulate Matter Sampling and Recovery

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.

All recovered particulate matter samples were stored and shipped in pre-rinsed 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 (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.

7.0 TEST RESULTS AND DISCUSSION

7.1 Test Results and Allowable Emission Limits

Operating data and pollutant emission measurement results for each test period are presented in Tables 7.1, 7.2, and 7.3.

The measured air pollutant concentrations and emission rates for EUHMAPLANT are less than the allowable limits specified in PTI 128-73F and NSPS Subpart I:

- 0.04 gr/dscf and 0.03 lb/ton HMA produced for PM;
- 0.198 lb/ton HMA produced for CO while fired with NG; and
- 0.201 lb/ton HMA produced for CO while fired with RUO.

7.2 Operating Conditions During Compliance Tests

The testing was performed while the process operated at maximum routine operating conditions. Ace Asphalt representatives provided production data at 15-minute intervals for each test period. The average recorded HMA material produced was 351 and 354 tons per hour for each test day.

Additionally, Ace Asphalt operators recorded the pressure drop across the baghouse, RUO firing rate, product temperature, recycled asphalt feed rate, and aggregate feed rate.

Appendix A presents operating data collected during the compliance test.

7.3 Variations from Normal Sampling Procedures or Operating Conditions

The testing was performed as described in the approved test plan and associated USEPA test methods. During the first CO test period on July 20, sampling was paused at 7:50 and resumed at 8:15 due to process shutdown.

During the test periods the process was operated at normal operating conditions, at or near maximum achievable capacity and satisfied the parameters specified in the MDEQ-AQD test plan approval letter.

Table 7.1. Measured particulate matter emission rates for EUHMAPLANT exhaust

Test No. Test Date: Test Times	1 7/20/16 13:45-15:34	2 7/21/16 7:55-9:42	3 7/21/16 10:40-12:12	Three Test Average
Testing Conditions				
Exhaust Gas Flowrate (dscfm)	32,537	32,007	30,633	31,726
Temperature (°F)	227	229	219	225
Moisture (%H_2O)	25.5	29.4	29.8	29.8
Oxygen Content (%)	11.2	11.3	11.4	11.3
Carbon Dioxide Content (%)	7.3	7.2	7.2	7.2
Production Rate (tons/hour)	354	351	351	352
Opacity (%)	0	0	0	0
Opacity Permit Limit (%)				***20***
Sample Train Data				
Sample Volume (dscf)	37.9	39.6	37.5	38.3
PM Catch Primary Filter (mg)	7.7	8.0	6.5	7.4
PM Catch Acetone Rinse (mg)	7.5	2.9	10.0	6.8
Total PM Catch (mg)	15.2	10.9	16.5	14.2
Particulate Matter Emissions				
PM Emission Rate (lb/hr)	1.73	1.17	1.79	1.56
PM Concentration (gr/dscf)	0.006	0.004	0.007	0.006
PM Permit Limit (gr/dscf)				***0.04***
PM Mass Emissions (lb/ton)	0.005	0.003	0.005	0.004
PM Permit Limit (lb/ton)				***0.03***

Table 7.2. Measured carbon monoxide emission rates for EUHMAPLANT exhaust operating with natural gas

Test No. Test Date: Test Times:	1 7/20/16 7:20-8:45*	2 7/20/16 9:15-10:15	3 7/20/16 10:55-11:55	Three Test Average
Testing Conditions				
Exhaust Gas Flowrate (dscfm)	34,763	34,480	32,641	33,961
Temperature (°F)	223	232	236	230
Moisture (%H_2O)	30.1	31.2	30.8	30.7
Oxygen Content (%)	12.2	11.9	11.8	12.0
Carbon Dioxide Content (%)	5.2	5.4	5.4	5.4
Production Rate (tons/hour)	354	354	354	354
Carbon Monoxide Emissions				
CO Concentration (ppmvd)	297	301	300	299
CO Emission Rate (lb/hr)	45.1	45.3	42.7	44.4
CO Emission Factor (lb/ton)	0.13	0.13	0.12	0.13
CO Permit Limit (lb/ton)				***0.198***

*Test paused at 7:50 and resumed at 8:15 due to process shutdown

Table 7.3. Measured carbon monoxide emission rates for EUHMAPLANT exhaust operating with recycled used oil

Test No. Test Date: Test Times*:	1 7/20/16 13:45-15:34	2 7/21/16 7:55-9:42	3 7/21/16 10:40-12:12	Three Test Average
Testing Conditions				
Exhaust Gas Flowrate (dscfm)	32,537	32,007	30,633	31,726
Temperature (°F)	227	229	219	225
Moisture (%H_2O)	25.5	29.4	29.8	29.8
Oxygen Content (%)	11.2	11.3	11.4	11.3
Carbon Dioxide Content (%)	7.3	7.2	7.2	7.2
Production Rate (tons/hour)	354	351	351	352
Carbon Monoxide Emissions				
CO Concentration (ppmvd)	312	333	358	335
CO Emission Rate (lb/hr)	44.4	46.6	47.9	46.3
CO Emission Factor (lb/ton)	0.13	0.13	0.14	0.13
CO Permit Limit (lb/ton)				***0.201***

* The CO test periods were paused while the PM sampling train was moved between stack sampling ports. The CO concentrations presented are for 60 minutes of recorded data concurrent with the PM sampling times.