CleanAir

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EES Coke Battery, LLC
1400 Zug Island Road
River Rouge, Michigan 48218

REPORT ON COMPLIANCE TEST PROGRAM

Performed for:
EES COKE BATTERY, LLC
UNDERFIRE COMBUSTION STACK
ZUG ISLAND FACILITY

Client Reference No: 4700887921
CleanAir Project No: 12831
Revision 0: November 11, 2015

To the best of our knowledge, the data presented in this report are accurate, complete, error free, legible and representative of the actual emissions during the test program. Clean Air Engineering operates in conformance with the requirements of ASTM D7036-04 Standard Practice for Competence of Air Emission Testing Bodies.

Submitted by,

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DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating (RO) Permit program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: EES Coke Battery LLC — County: Wayne

Source Address: PO Box 18309, Zug Island — City: River Rouge

AQD Source ID (SRN): A7809 — RO Permit No.: 199600132,51-08C — RO Permit Section No.: 7

Please check the appropriate box(es):

☐ **Annual Compliance Certification (General Condition No. 28 and No. 29 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the RO Permit.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (General Condition No. 23 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From N/A To N/A

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

Test Report at EUCOKE-BATTERY Combustion Stack for PM, PM10, PM2.5, and VOC performed September 9-11, 2015

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete.

M Krchmar	Plant Manager	313-216-2535
Name of Responsible Official (print or type)	Title	Phone Number

Roberta Cuba for M Krchmar — Nov 11 2015

Signature of Responsible Official — Date

* Photocopy this form as needed.

EQP 5736 (Rev 9/01)

PROJECT OVERVIEW

INTRODUCTION

EES Coke Battery, LLC contracted Clean Air Engineering (CleanAir) to perform air emissions testing at the Underfire Combustion Stack located in River Rouge, Michigan for compliance purposes.

The objective of the test program was to demonstrate that the Combustion Stack was in compliance with the limits as specified in the Michigan Permit to Install (MI-PTI) No. 51-08C.

All testing was conducted in accordance with the regulations set-forth by the United States Environmental Protection Agency (USEPA) and the Michigan Department of Environmental Quality (DEQ).

Key Project Participants

Individuals responsible for coordinating and conducting the test program were:

B. Harden – EES Coke Battery, LLC
T. Maza – DEQ
J. McKeever – CleanAir
A. Pallone – CleanAir

Test Program Parameters

The testing was performed at the Underfire Combustion Stack on September 6-11, 2015 and included the following emissions measurements:

- total particulate matter (TPM) (filterable and condensable particulate matter) reported as:
  - particulate matter less than 10 microns in diameter (PM_{10})
  - particulate matter less than 2.5 microns in diameter ($PM_{2.5}$)
- nonsulfate filterable particulate matter (NSFPM)
- volatile organic compounds (VOC), excluding methane (CH_4)
- flue gas composition (e.g., O_2, CO_2, H_2O)
- flue gas temperature
- flue gas flow rate

PROJECT OVERVIEW

TEST PROGRAM SYNOPSIS

Test Schedule

The on-site schedule followed during the test program is outlined in Table 1-1.

Table 1-1:
Schedule of Activities

Run Number	Location	Method	Analyte	Date	Start Time	End Time
1	Combustion Stack	USEPA Method 5F	Nonsulfate FPM	09/09/15	10:14	12:59
5	Combustion Stack	USEPA Method 5F	Nonsulfate FPM	09/10/15	18:10	21:32
7	Combustion Stack	USEPA Method 5F	Nonsulfate FPM	09/11/15	11:46	14:09
2	Combustion Stack	USEPA Method 5/202	FPM/CPM	09/09/15	15:00	18:48
3	Combustion Stack	USEPA Method 5/202	FPM/CPM	09/10/15	09:11	12:03
4	Combustion Stack	USEPA Method 5/202	FPM/CPM	09/10/15	12:59	16:42
1	Combustion Stack	USEPA Method 201A/202	PM10/PM2.5/CPM	09/10/15	12:39	15:50
3	Combustion Stack	USEPA Method 201A/202	PM10/PM2.5/CPM	09/11/15	10:37	12:40
4	Combustion Stack	USEPA Method 201A/202	PM10/PM2.5/CPM	09/11/15	13:39	15:46

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Results Summary

Table 1-2 summarizes the results of the test program. A more detailed presentation of the test conditions and results of analysis are shown on pages 2-1 through 2-4.

Table 1-2:
Summary of Permit Limits

Source Constituent	Sampling Method	Average Emission	Permit Limit[1]
Underfire Combustion Stack			
PM (lb/hr)	EPA 5F	0.111	25.7 [2]
PM (gr/dscf)	EPA 5F	0.000095	0.012 [2]
PM (lb/1000 lb exhaust gas @50% EA)	EPA 5	0.078	0.095
PM_{10} (lb/hr)	EPA 5/202	49.4	73.3
$PM_{2.5}$ (lb/hr)	EPA 5/202	49.4	73.0
PM_{10} (lb/hr)	EPA 201A/202	50.8	73.3
$PM_{2.5}$ (lb/hr)	EPA 201A/202	50.5	73.0
VOC (lb/hr), as propane	EPA 18/25A	19.5	43.1 [3]
VOC (lb/MMBtu, heat input), as propane	EPA 18/25A	0.0391	0.0956 [3]

[1] Permit limits obtained from Michigan Permit to Install (MI-PTI) No. 51-08C. 110515 121321

[2] excludes sulfates

[3] excludes methane concentrations

Discussion of Test Program

CleanAir incorporated guidelines as stated in Appendix A Part 60, Title 40 of the Code of Federal Regulations (40 CFR 60) and Title 40 CFR Part 51, Appendix M. The specific testing followed procedures in EPA Methods 1, 2, 3A, 4, 5, 5F (modified), 201A and 202.

Abbreviated versions of the laboratory report are included in Appendix H. The full version of the report is included in the electronic copy of the final test report.

Verification of the Absence of Cyclonic Flow – EPA Method 1

A cyclonic flow check was performed in accordance with EPA Method 1, Section 2.4. This procedure is referred to as the "nulling" technique. An S-type pitot tube connected to an inclined manometer is used in this method. This is the same apparatus as referenced in EPA Method 2.

The pitot tube was positioned at each of the EPA Method 1 traverse point locations so that the face openings of the pitot tube were orientated perpendicular to the stack or duct cross-sectional plane. This position will be referenced as the "0° reference." The velocity pressure (ΔP) measurement at this position was recorded.

If the ΔP reading was zero, a cyclonic angle of 0° was recorded. If the ΔP reading was not zero, the pitot tube was rotated clockwise (positive) or counter-clockwise (negative), as required, to obtain a zero ΔP reading. The angle required to obtain the zero reading was measured using a digital protractor (± 0.1degree) attached to the pitot tube.

After all of the traverse points were checked, the average of the absolute values of each angle was calculated. If this resultant angle was ≤ 20 degrees, the flow condition at the location was considered acceptable. Field data is presented in Appendix D.

Determination of Nonsulfate Filterable Particulate Matter (Modified) – EPA Method 5F

A conference call between EES, MDEQ and CleanAir representatives was held on Monday, January 26, 2015 to discuss the best methodology for the determination of sulfate free particulate emissions at the Underfire Combustion Stack. It was agreed upon to perform EPA Method 5F for the sulfate-free filterable particulate matter (nonsulfate PM) measurements. This method is contained in Appendix A of 40 CFR 60.

Particulate matter was withdrawn isokinetically and collected on a filter maintained at a temperature in the range 320 ±25°F. A minimum of 60 dry standard cubic feet (dscf) of sample gas was collected over a 120-minute test period for each run.

During a conference call between MDEQ, EES and CleanAir on January 26, 2015 MDEQ elected for Method 5F testing over Method 5B. However, concern was raised by MDEQ that the recovery of the probe with a water rinse would not be adequate and requested a change to acetone. The following deviations to the method were agreed upon during the conference call and performed on-site:

1. The sample train nozzle, probe liner and front-half filter holder were rinsed and recovered with acetone (Method 5F outlines the use of deionized distilled water; ASTM D1193–77 or 91 Type 3).
2. Due to the use of acetone, additional analytical steps were taken by the CleanAir Analytical laboratory, located in Palatine Illinois, during the first recovery step:
    a. The acetone was evaporated in a tared FEP beaker liner while the filter was being digested.
    b. The acetone residue was combined with the filter digestate and brought to volume in a 500mL flask.
    c. The flask was allowed to settle and an aliquot was removed for sulfate determinations.
    d. The solution was re-evaporated in the original tared FEP beaker liner and then the normal analytical steps, as outlined in Method 5F, were followed.

Determination of Total Particulate Matter (Reported as PM_{10} and $PM_{2.5}$) – EPA Methods 5/202 and 201A/202

CleanAir used both EPA Method 5 and EPA Method 201A to collect the PM_{10} and $PM_{2.5}$ filterable particulate matter. Each of these methods was combined with EPA Method 202 for analysis of condensable particulate matter. The results from the filterable and condensable particulate matter determined the total particulate matter of the gas sample.

During Method 5 testing, the sample was withdrawn isokinetically through a heated probe and high efficiency quartz fiber filter to collect all filterable particulate matter. The $PM_{2.5}$ portion was considered to be the addition of Method 202 and Method 5 particulate matter, as defined by MDEQ. The PM_{10} portion was treated as the same result.

For Method 201A, the sample was passed through two stainless steel cyclones and a high efficiency quartz fiber filter to collect the PM_{10} and $PM_{2.5}$ portions of the filterable particulate matter. The first cyclone collected particulate matter greater than 10 microns, the second gathered particulate matter between 2.5 and 10 microns, and the filter collected any particulate matter less than 2.5 microns. The gas was sampled at a constant flow rate to ensure the various sized particulate dropped out at the appropriate cyclone. The sampling times at each point varied proportionally with the velocity at each point, as determined from a pre-test velocity traverse.

The Method 5/202 $PM_{2.5}$ and PM_{10} results were compared to results obtained from Method 201A/202 $PM_{2.5}$ and PM_{10}. Both test methods were compared against applicable permit limits.

Volatile Organic Compounds (VOC) – EPA Methods 18 and 25A

The definition utilized in this project for the term VOC was an organic compound that participated in atmospheric chemical reactions; that is, an organic compound other than those which the EPA has designated as having negligible photoreactivity. The exempted compounds, one of which is methane, are listed in 40 CFR 51.100(s)(1).

EPA Method 25A, which was used to determine the VOC concentration in the stack exhaust stream, does not distinguish between the photoreactive and non-photoreactive compounds present in the sample stream. Based on the process, the potential for a positive bias to the VOC results due to the high methane content in the flue gas was a possibility.

PROJECT OVERVIEW

CleanAir determined the non-methane hydrocarbon emissions using a combination of EPA Methods 18 via gas chromatography (GC) and 25A via flame ionization detector (FID). CleanAir directly measured the non-methane hydrocarbons (NMHC) on-site using a Thermo Model 55i analyzer.

This analyzer utilized a back-flush GC/FID system in order to measure methane (GC) and non-methane hydrocarbons (FID) directly. It has lower detection limits of 20 parts per billion (ppb) methane and 50 ppb NMHC. The proprietary column design is unaffected by the oxygen content of the sample and provides complete recovery of low volatility compounds while achieving absolute separation of methane from all dicarbon (C_2) compounds.

The concentrations were measured on a propane-equivalent basis, as this was the gas used to calibrate the instrument. The measurements were made on a wet volumetric basis and corrected to a dry basis with flue gas moisture measurements obtained from concurrently conducted wet chemistry sampling trains. Each measurement cycle was approximately 70 seconds.

Explanation of the Test Program's Invalidated Runs

The original test protocol required three test runs each of Method 5F, Method 5/202, Method 201A/202 and Method 18/25A. At the completion of the test program, there were a total of seven Method 5F runs, four Method 5/202 runs, four Method 201A/202 runs and three Method 18/25A runs completed.

CleanAir believed it was necessary to invalidate Runs 2, 3, 4, and 6 for the Method 5F testing. Each of these runs experienced equipment issues that resulted in broken glassware getting on the Method 5F filter. The issues were further impacted by high winds experienced during the test program. This contamination would have led to inaccurate results. The glassware was replaced and new filter media was installed to improve the accuracy of the test results.

CleanAir equipment issues were caused by a variety of events. Two of the invalidated runs were due to the lack of required clearance. CleanAir needed to access the points from an angle. Due to the long port length, the nozzle hit the port, causing a chipped probe liner in one instance and a crack in the filter holder assembly in another.

The test crew also experienced a probe falling from the Unistrut assembly due to an improper connection. Additionally, excessive wind moved the Unistrut assembly while the probe was attached and inside the stack, bending the probe and cracking the glass liner. In all of the cases mentioned, CleanAir replaced any broken equipment prior to resuming any testing.

PROJECT OVERVIEW

Run 1, Method 5/202 was invalidated due to fluctuating flows in the stack resulting in failed isokinetic sampling. These fluctuations were taken into account for the subsequent runs, and no further isokinetic issues were experienced.

Method 201A/202, Run 2 was invalidated due to maximum vacuum issues of the sampling system. CleanAir analyzed the filter media after reloading the sample train. The filter appeared to have been exposed to large droplets of water which combined with particulate to decrease the area for stack gas to flow freely. This resulted in the gas sample not being pulled at the desired constant rate. The run was cut short with less than 30 dry standard cubic feet (dscf) of volume collected. A similar issue was experienced during Run 4. However, an excess of 30 dscf was able to be sampled, allowing the run to be included in the test program analysis and calculations.

End of Section 1 – Project Overview

RESULTS

Table 2-1:
Underfire Combustion Stack – NSFPM (Method 5F)

Run No.[1]		1	5	7	Average
Date (2015)		Sep 9	Sep 10	Sep 11	
Start Time (approx.)		10:14	18:10	11:46	
Stop Time (approx.)		12:59	21:32	14:09	
Process Conditions					
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	**8,760**
Gas Conditions					
O_2	Oxygen (dry volume %)	10.0	10.0	10.4	**10.1**
CO_2	Carbon dioxide (dry volume %)	5.5	5.2	5.1	**5.3**
T_s	Sample temperature (°F)	523	518	519	**520**
B_w	Actual water vapor in gas (% by volume)	15.6	15.0	15.0	**15.2**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	232,000	336,000	366,000	**312,000**
Q_s	Volumetric flow rate, standard (scfm)	121,000	177,000	192,000	**163,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	102,000	150,000	163,000	**139,000**
NSFPM Results					
C_{sd}	Particulate Concentration (lb/dscf)	1.51E-08	1.13E-08	1.42E-08	**1.35E-08**
C_{sd}	Particulate Concentration (gr/dscf)	1.05E-04	7.88E-05	9.96E-05	**9.46E-05**
$E_{lb/hr}$	Particulate Rate (lb/hr)	0.0925	0.102	0.139	**0.111**
$E_{T/yr}$	Particulate Rate (Ton/yr)	0.405	0.445	0.609	**0.487**

Average includes 3 runs.

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[1] Runs 2, 3, 4 and 6 were invalidated due to equipment issues.

RESULTS

Table 2-2:
Underfire Combustion Stack – TPM (Method 5/202)

Run No.		2	3	4	Average
Date (2015)		Sep 9	Sep 10	Sep 10	
Start Time (approx.)		15:00	09:11	12:59	
Stop Time (approx.)		18:48	12:03	16:42	
Process Conditions					
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	8,760
Gas Conditions					
O_2	Oxygen (dry volume %)	10.5	10.5	10.5	10.5
CO_2	Carbon dioxide (dry volume %)	6.0	6.0	6.0	6.0
T_s	Sample temperature (°F)	517	518	521	519
B_w	Actual water vapor in gas (% by volume)	14.9	14.7	14.4	14.7
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	260,000	244,000	309,000	271,000
Q_s	Volumetric flow rate, standard (scfm)	136,000	128,000	162,000	142,000
Q_{std}	Volumetric flow rate, dry standard (dscfm)	116,000	110,000	139,000	121,000
FPM Results (Method 5) = PM					
C_{sd}	Particulate Concentration (lb/dscf)	5.10E-06	7.16E-06	3.27E-06	5.18E-06
C_{sd}	Particulate Concentration (gr/dscf)	0.0357	0.0501	0.0229	0.0362
$E_{lb/hr}$	Particulate Rate (lb/hr)	35.5	47.1	27.2	36.6
$E_{T/yr}$	Particulate Rate (Ton/yr)	156	206	119	160
CPM Results (Method 202)					
C_{sd}	Particulate Concentration (lb/dscf)	1.56E-06	1.69E-06	1.95E-06	1.73E-06
C_{sd}	Particulate Concentration (gr/dscf)	0.0109	0.0118	0.0137	0.0121
$E_{lb/hr}$	Particulate Rate (lb/hr)	10.8	11.1	16.3	12.7
$E_{T/yr}$	Particulate Rate (Ton/yr)	47.5	48.8	71.2	55.8
Total Particulate Matter Results (Method 5/202) = PM_{10} = $PM_{2.5}$					
C_{sd}	Particulate Concentration (lb/dscf)	6.66E-06	8.85E-06	5.22E-06	6.91E-06
C_{sd}	Particulate Concentration (gr/dscf)	0.0466	0.0620	0.0365	0.0484
$E_{lb/hr}$	Particulate Rate (lb/hr)	46.4	58.2	43.5	49.4
$E_{T/yr}$	Particulate Rate (Ton/yr)	203	255	190	216
$E_{EA50\%}$	Particulate Rate (lb per 1000lb exhaust gas at 50% EA)[1]	0.0769	0.108	0.0494	0.0781

Average includes 3 runs.

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[1] Plant CEMS were not installed due to testing. CO values assumed to be zero for calculations which yield values biased high.

RESULTS

Table 2-3:
Underfire Combustion Stack – TPM (Method 201A/202)

Run No.		1	3	4	Average
Date (2015)		Sep 10	Sep 11	Sep 11	
Start Time (approx.)		12:39	10:37	13:39	
Stop Time (approx.)		15:50	12:40	15:46	
Process Conditions					
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	**8,760**
Gas Conditions					
O_2	Oxygen (dry volume %)	10.1	9.7	9.8	**9.9**
CO_2	Carbon dioxide (dry volume %)	5.3	4.9	4.9	**5.0**
T_s	Sample temperature (°F)	521	515	518	**518**
B_w	Actual water vapor in gas (% by volume)	14.5	15.4	15.7	**15.2**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	340,000	277,000	288,000	**302,000**
Q_s	Volumetric flow rate, standard (scfm)	178,000	146,000	151,000	**158,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	153,000	123,000	127,000	**134,000**
Total PM Results					
C_{sd}	Particulate Concentration (lb/dscf)	7.42E-06	5.68E-06	6.86E-06	**6.65E-06**
C_{sd}	Particulate Concentration (gr/dscf)	0.0519	0.0398	0.0480	**0.0466**
$E_{lb/hr}$	Particulate Rate (lb/hr)	67.9	42.0	52.4	**54.1**
$E_{T/yr}$	Particulate Rate (Ton/yr)	297	184	230	**237**
Total PM10 Results					
C_{sd}	Particulate Concentration (lb/dscf)	6.62E-06	5.47E-06	6.73E-06	**6.27E-06**
C_{sd}	Particulate Concentration (gr/dscf)	0.0463	0.0382	0.0471	**0.0439**
$E_{lb/hr}$	Particulate Rate (lb/hr)	60.6	40.4	51.4	**50.8**
$E_{T/yr}$	Particulate Rate (Ton/yr)	265	177	225	**223**
Total PM2.5 Results					
C_{sd}	Particulate Concentration (lb/dscf)	6.61E-06	5.39E-06	6.68E-06	**6.23E-06**
C_{sd}	Particulate Concentration (gr/dscf)	0.0463	0.0377	0.0467	**0.0436**
$E_{lb/hr}$	Particulate Rate (lb/hr)	60.5	39.9	51.0	**50.5**
$E_{T/yr}$	Particulate Rate (Ton/yr)	265	175	223	**221**

Average includes 3 runs.

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RESULTS

Table 2-4:
Underfire Combustion Stack – VOC, Non-methane (Methods 18 and 25A)

Run No.	1	2	3	Average
Date (2015)	Sep 9	Sep 9	Sep 10	
Start Time	10:28	16:41	9:13	
End Time	11:28	17:41	10:13	
Elapsed Time	1:00	1:00	1:00	
Process Conditions				
Actual Gas Flow Rate - Stack (acfm)	232,377	259,820	244,293	**245,497**
Standard Gas Flow Rate - Stack (scfm)	121,174	136,369	128,469	**128,670**
Dry Standard Gas Flow Rate - Stack (dscfm)	102,321	116,056	109,614	**109,330**
H2O - Stack (%)	15.56	14.90	14.68	**15.04**
Gas Conditions				
Oxygen (O2) - Stack (%dv)	10.0	10.5	10.7	**10.4**
Carbon Dioxide (CO2) - Stack (%dv)	5.53	5.18	5.02	**5.24**
VOC, as propane (excludes methane)				
Concentration (ppmwv)	22.3	20.5	23.6	**22.1**
Mass Rate (lb/hr)	18.6	19.2	20.8	**19.5**
Mass Rate (lb/MMBtu) - Heat Input	0.0372	0.0384	0.0417	**0.0391**

Note: 102315 142415

Run 1 Process Conditions from M5F Run 1.

Run 2 Process Conditions from M5/202 Run 2.

Run 3 Process Conditions from M5/202 Run 3.

End of Section 2 – Results