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REPORT ON RATA & COMPLIANCE TESTING

Performed for:
MARATHON PETROLEUM COMPANY LP
DETROIT REFINERY

B&W BOILER STACK (SV-B&WBOILER1)

Client Reference No: 4100665755
CleanAir Project No: 12964-1
Revision 0: June 2, 2016

To the best of our knowledge, the data presented in this report are accurate, complete, error free 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.

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REVISION HISTORY

REPORT ON RATA & COMPLIANCE TESTING

DRAFT REPORT REVISION HISTORY

Revision:	Date	Pages	Comments
D0a	05/26/16	All	Draft version of original document.

FINAL REPORT REVISION HISTORY

Revision:	Date	Pages	Comments
0	06/02/16	All	Final version of original document.

PROJECT OVERVIEW

INTRODUCTION

Marathon Petroleum Company LP (MPC) contracted Clean Air Engineering (CleanAir) to perform emissions measurements at the Detroit Refinery as part of a relative accuracy test audit (RATA) and for compliance purposes.

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). The permit limits are referenced in the DEQ, Air Quality Division Permit to Install No. 63-08D, issued May 12, 2014.

Key Project Participants

Individuals responsible for coordinating and conducting the test program were:

Crystal Davis – MPC
Joe Reidy – MPC
Andy Obuchowski – CleanAir
Medel Cendana – CleanAir

Test Program Parameters

The testing was performed at the B&W Boiler Stack (Emission Unit ID No. EU27-B&WBOILER1-S1; Stack ID No. SV-B&WBoiler1) on April 11 and 12, 2016, and included the following emissions measurements:

- particulate matter (PM), assumed equivalent to filterable particulate matter (FPM) only
- sulfuric acid (H_2SO_4)
- volatile organic compounds (VOC), assumed equivalent to total hydrocarbons (THC) minus the following constituents:
  - methane (CH_4)
  - ethane (C_2H_6)
- nitrogen oxide (NO_X)
- carbon monoxide (CO)
- flue gas composition (e.g., O_2, CO_2, H_2O)
- flue gas flow rate

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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	B&W Boiler Stack	USEPA Method 5	FPM	04/11/16	13:48	15:56
2	B&W Boiler Stack	USEPA Method 5	FPM	04/11/16	17:06	19:11
3	B&W Boiler Stack	USEPA Method 5	FPM	04/12/16	08:15	10:24
1	B&W Boiler Stack	USEPA Methods 3A/7E/10	$O_2/CO_2/NO_x/CO$	04/11/16	12:40	13:01
2	B&W Boiler Stack	USEPA Methods 3A/7E/10	$O_2/CO_2/NO_x/CO$	04/11/16	13:15	13:36
3	B&W Boiler Stack	USEPA Methods 3A/7E/10	$O_2/CO_2/NO_x/CO$	04/11/16	13:45	14:06
4	B&W Boiler Stack	USEPA Methods 3A/7E/10	$O_2/CO_2/NO_x/CO$	04/11/16	14:16	14:37
5	B&W Boiler Stack	USEPA Methods 3A/7E/10	$O_2/CO_2/NO_x/CO$	04/11/16	14:49	15:10
6	B&W Boiler Stack	USEPA Methods 3A/7E/10	$O_2/CO_2/NO_x/CO$	04/11/16	15:19	15:40
7	B&W Boiler Stack	USEPA Methods 3A/7E/10	$O_2/CO_2/NO_x/CO$	04/11/16	15:50	16:11
8	B&W Boiler Stack	USEPA Methods 3A/7E/10	$O_2/CO_2/NO_x/CO$	04/11/16	16:20	16:41
9	B&W Boiler Stack	USEPA Methods 3A/7E/10	$O_2/CO_2/NO_x/CO$	04/11/16	16:56	17:17
10	B&W Boiler Stack	USEPA Methods 3A/7E/10	$O_2/CO_2/NO_x/CO$	04/11/16	17:29	17:50
1	B&W Boiler Stack	USEPA Methods 3A/18/25A	$O_2/CO_2/CH_4/C_2H_6/THC$	04/12/16	09:44	10:20
2	B&W Boiler Stack	USEPA Methods 3A/18/25A	$O_2/CO_2/CH_4/C_2H_6/THC$	04/12/16	12:06	13:09
3	B&W Boiler Stack	USEPA Methods 3A/18/25A	$O_2/CO_2/CH_4/C_2H_6/THC$	04/12/16	14:09	15:12
4	B&W Boiler Stack	USEPA Methods 3A/18/25A	$O_2/CO_2/CH_4/C_2H_6/THC$	04/12/16	16:20	17:23
0	B&W Boiler Stack	Draft ASTM CCM	Sulfuric Acid	04/12/16	12:20	13:20
1	B&W Boiler Stack	Draft ASTM CCM	Sulfuric Acid	04/12/16	14:21	15:21
2	B&W Boiler Stack	Draft ASTM CCM	Sulfuric Acid	04/12/16	16:20	17:20
3	B&W Boiler Stack	Draft ASTM CCM	Sulfuric Acid	04/12/16	18:04	19:04

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Results Summary

Tables 1-2 and 1-3 summarize 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 2-11.

Table 1-2:
Summary of Emission ComplianceTest Results

Source Constituent	(Units)	Sampling Method	Average Emission	Permit Limit[1]
B&W Boiler Stack				
PM	(lb/MMBtu)	USEPA 5	0.0011	0.0019
H_2SO_4	(ppmdv)	Draft ASTM CCM	0.14	N/A
H_2SO_4	(lb/MMBtu)	Draft ASTM CCM	0.00047	N/A
VOC	(lb/MMBtu)	USEPA 25A / 18	<0.00064	0.0055
NO_X	(lb/MMBtu)	USEPA 7E	0.06	0.20
CO	(lb/MMBtu)	USEPA 10	0.04	0.04

[1] Permit limits obtained from MDEQ Permit to Install No. 63-08D.

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Table 1-3:
Summary of RATA Results

Source Constituent (Units)	Reference Method	Relative Accuracy (%)[1]	Applicable Specification	Standard Used	Specification Limit
B&W Boiler Stack					
O_2 (% dv)	USEPA 3A	0.1	40 CFR 75, APP. A	abs. diff.	± 1.0%
NO_x (lb/MMBtu)	USEPA 7E	6.5	40 CFR 75, APP. A	% of RM	10%
CO (lb/MMBtu)	USEPA 10	6.0	40 CFR 60, APP. B PS4A	% of RM	10%

[1] Relative Accuracy is expressed in terms of comparison to the reference method (% RM) or avg. absolute difference. The specific expression used depends on the specification limit cited.

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PROJECT OVERVIEW

Discussion of Test Program

FPM Testing - USEPA Method 5

For this test program, PM emission rate is assumed equivalent to FPM emission rate. Three 120-minute Method 5 test runs were performed on April 11 and 12, 2016. The final result was expressed as the average of three valid runs.

H_2SO_4 Testing - Draft ASTM Controlled Condensation Method

Three 60-minute test runs were performed on April 12, 2016. The final result was expressed as the average of three valid runs.

VOC Testing – USEPA Methods 25A and 18

During Method 25A/18 Run 1 the flame on the analyzer switched off causing the run to be aborted. Run 1 was not used in the final result calculations.

Subsequently three 63-minute Method 25A test runs for THC were performed concurrently with three 63-minute Method 18 bag collections for CH_4 and C_2H_6. The final results for each parameter were expressed as the average of three valid runs.

The VOC emission rate is normally equivalent to THC emission rate, minus CH_4 and C_2H_6 emission rate. The calculated emission rate of CH_4 and C_2H_6 detected through analysis of each Method 18 sample bag exceeded the amount of THC measured by the on-line THC analyzer.

This is likely due to variations in the calibration standards, measurement and analytical technique. Therefore, VOC emissions are reported as a value "less than" 1% of the calibration span of THC instrument. The final results were calculated using the average of three valid test runs, all using a concentration of 1% of the instrument span and reported as "less than" the amount.

CEMS RATA System Overview

The B&W Boiler is capable of operating at a maximum heat input capacity greater than 250 MMBtu/hour. Boilers with a heat input capacity greater than 250 MMBtu/hour are required to operate in compliance with the Clean Air Interstate Rule (CAIR). CAIR requires monitoring and reporting of NO_X emissions using continuous emissions monitoring systems (CEMS) operated in accordance with the requirements of 40 CFR Part 75.

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The RATA for NO_X and O_2 was conducted per 40 CFR, Part 75.

The RATA for CO was conducted per 40 CFR 60, Appendix B Performance Specification 4A.

Pre-RATA QA/QC

Prior to conducting the RATA, MPC performed a linearity test which will be reported separately.

RATA Testing – USEPA Methods 3A, 7E and 10

All tests were completed while the facility CEMS was operated in a 'hands off' manner. The boiler was operated at its normal steam load, as that term is defined in 40 CFR part 75 Appendix A. The 'normal' load is the mid-range of operation, or a steam production rate between 50,000 and 152,000 pounds per hour.

Minute-average data points for O_2, NO_X and CO (dry basis) were collected over a period of 21 minutes for each RATA reference method (RM) run. The average CO result for each RM run was calculated and compared to the average CO result from the facility CEMS over identical intervals in order to calculate relative accuracy (RA).

The facility CEMS data acquisition system used for NO_X (Cirrus System) is different than the "normal" data acquisition system used for CO. Following testing, CleanAir was notified that the Cirrus system is restricted to taking a reading every hour on the hour. This disallowed comparing the facility and RM NO_X results over identical intervals. As advised by MPC, CleanAir compared the respective 21-minute RM runs to the most concurrent facility hour data set.

In addition, the facility Cirrus System does not use daylight savings time while all other times referenced in the report do use daylight savings time. This was taken into consideration when comparing RM results and facility results.

A total of 10 RATA runs were performed. In lieu of performing a stratification test, sampling was performed at the three points along the "long measurement line" described in 40 CFR 60, Appendix B, PS2, §8.1.3 (16.7, 50.0 and 83.3% of the way across the stack) for each test run.

Bias tests were performed on all of the NO_X RATA data sets. The CEMS data was found to be biased high in comparison to the RM data in all instances. Since the mean difference between the RM and CEMS data was less than or equal to the absolute value of the confidence coefficient for all runs, the CEMS passed the bias test and a bias adjustment factor (BAF) was not applied to any of the emissions results. Per 40 CFR Part 75, bias is only applicable when the CEMS data is biased low in relation to the RM data.

RM NO_X and CO RATA results were also presented to demonstrate compliance with permit limits. The final result was expressed as the average of all 10 RATA runs.

Calculation of Final Results

Emission results in units of dry volume-based concentration (lb/dscf, ppmdv) were converted to units of pounds per million Btu (lb/MMBtu) by calculating a combination oxygen-based fuel factor (F_d) for natural gas and refinery gas per USEPA Method 19 specifications.

- For natural gas, the volume-based gross heat content (GCV_V) was obtained from a gas analysis report provided by MPC. The natural gas F_d factor was obtained from 40 CFR Part 75, Appendix F, Table 1. This approach should yield worst-case calculated emission results.
- For refinery gas, the heat content and F_d factor were calculated from percent volume composition analytical data provided by MPC and tabulated heating values for each of the measured constituents.

End of Section 1 – Project Overview

RESULTS

Table 2-1:
B&W Boiler Stack – FPM Emissions (USEPA 5)

Run No.		1	2	3	Average
Date (2016)		Apr 11	Apr 11	Apr 12	
Start Time (approx.)		13:48	17:06	08:15	
Stop Time (approx.)		15:56	19:11	10:24	
Process Conditions					
R_P	Steam production (Mlb/hr)	117	117	116	**117**
P_1	Fuel gas flow rate (Mscf/day)	3,357	3,401	3,578	**3,445**
P_2	Natural gas flow rate (Mscf/day)	289	302	391	**327**
F_d	Oxygen-based F-factor (dscf/MMBtu)	8,380	8,380	8,376	**8,379**
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	**8,760**
Gas Conditions					
O_2	Oxygen (dry volume %)	8.6	8.7	8.7	**8.7**
CO_2	Carbon dioxide (dry volume %)	7.1	7.0	7.0	**7.0**
T_s	Sample temperature (°F)	335	337	338	**337**
B_w	Actual water vapor in gas (% by volume)	14.3	14.1	14.1	**14.2**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	71,800	70,500	70,100	**70,800**
Q_s	Volumetric flow rate, standard (scfm)	46,100	45,100	45,600	**45,600**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	39,500	38,800	39,200	**39,100**
Q_a	Volumetric flow rate, actual (acf/hr)	4,310,000	4,230,000	4,210,000	**4,250,000**
Q_s	Volumetric flow rate, standard (scf/hr)	2,760,000	2,710,000	2,730,000	**2,740,000**
Q_{std}	Volumetric flow rate, dry standard (dscf/hr)	2,370,000	2,330,000	2,350,000	**2,350,000**
Sampling Data					
V_{mstd}	Volume metered, standard (dscf)	65.97	64.95	67.12	**66.02**
%I	Isokinetic sampling (%)	99.5	99.7	102.1	**100.4**
Laboratory Data					
m_{filter}	Matter collected on filter(s) (g)	0.00104	0.00078	0.00118	
m_s	Matter collected in solvent rinse(s) (g)	0.00132	0.00126	0.00118	
m_n	Total FPM (g)	0.00236	0.00204	0.00236	
n_{MDL}	Number of non-detectable fractions	N/A	N/A	N/A	
DLC	Detection level classification	ADL	ADL	ADL	
FPM Results					
C_{sd}	Particulate Concentration (lb/dscf)	7.89E-08	6.93E-08	7.75E-08	**7.52E-08**
$E_{lb/hr}$	Particulate Rate (lb/hr)	0.187	0.161	0.182	**0.177**
$E_{T/yr}$	Particulate Rate (Ton/yr)	0.818	0.706	0.798	**0.774**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	1.12E-03	9.94E-04	1.11E-03	**1.08E-03**

Average includes 3 runs.

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Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

DLL = Detection Level Limited - some fractions are below detection limit

BDL = Below Detection Limit - all fractions are below detection limit

RESULTS

Table 2-2:
Uncertainty Analysis – FPM (USEPA 5)

		FPM Results (lb/MMBtu)		FPM Results (lb/hr)		FPM Results (Ton/yr)
Method		**5**		**5**		**5**
Run No.	**1**	1.12E-03	**1**	0.187	**1**	0.818
	2	9.94E-04	**2**	0.161	**2**	0.706
	3	1.11E-03	**3**	0.182	**3**	0.798
SD		7.15E-05		0.0137		0.0599
AVG		**1.08E-03**		**0.1767**		**0.7740**
RSD		6.6%		7.7%		7.7%
N		3		3		3
SE		4.13E-05		0.0079		0.0346
RSE		3.8%		4.5%		4.5%
P		95.0%		95.0%		95.0%
TINV		4.303		4.303		4.303
CI +		1.25E-03		0.2107		0.9227
AVG		**1.08E-03**		**0.1767**		**0.7740**
CI -		8.99E-04		0.1428		0.6253
TB +		1.62E-03		0.2814		1.2323

AVG (average) is the mean value of the runs; N is the number of individual runs.

SD (standard deviation) and RSD (relative standard deviation) are measures of the variability of individual runs.

SE (standard error) and RSE (relative standard error) are measures of the variability of the average of the runs.

P (probability) is the confidence level associated with the two-tailed Student's t-distribution.

TINV (t-value) is the value of the Student's t-distribution as a function of P (probability) and N-1 (degrees of freedom).

CI (confidence interval) indicates that if the test is conducted again under the same conditions, the average would be expected to fall within the interval (CI- to CI+) about 95% of the time.

TB+ (upper tolerance bound) is the value below which 95% of future runs are expected to fall (assuming testing at the same conditions).

RESULTS

Table 2-3:
B&W Boiler Stack – H_2SO_4 Emissions (Draft ASTM CCM)

Run No.		1	2	3	Average
Date (2016)		Apr 12	Apr 12	Apr 12	
Start Time (approx.)		14:21	16:20	18:04	
Stop Time (approx.)		15:21	17:20	19:04	
Process Conditions					
R_P	Steam Production (Mlb/hr)	117	123	126	**122**
P_1	Fuel gas flow rate (Mscf/day)	3,548	3,530	3,528	**3,535**
P_2	Natural gas flow rate (Mscf/day)	365	358	352	**359**
F_d	Oxygen-based F-factor (dscf/MMBtu)	8,374	8,373	8,373	**8,373**
Gas Conditions					
O_2	Oxygen (dry volume %)	7.9	7.9	7.7	**7.8**
CO_2	Carbon dioxide (dry volume %)	7.6	7.6	7.7	**7.6**
T_s	Sample temperature (°F)	315	320	322	**319**
B_w	Actual water vapor in gas (% by volume)	14.8	14.1	15.0	**14.6**
Sampling Data					
V_{mstd}	Volume metered, standard (dscf)	26.00	27.53	25.06	**26.19**
Laboratory Data (Ion Chromatography)					
m_n	Total H2SO4 collected (mg)	0.3675	0.5490	0.3317	
Sulfuric Acid Vapor (H2SO4) Results					
C_{sd}	H2SO4 Concentration (lb/dscf)	3.12E-08	4.40E-08	2.92E-08	**3.48E-08**
C_{sd}	H2SO4 Concentration (ppmdv)	0.123	0.173	0.115	**0.137**
E_{Fd}	H2SO4 Rate - Fd-based (lb/MMBtu)	4.20E-04	5.92E-04	3.87E-04	**4.66E-04**

Average includes 3 runs.

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RESULTS

Table 2-4:
Uncertainty Analysis – H_2SO_4 (Draft ASTM CCM)

		H2SO4 Results (ppmdv)		H2SO4 Results (lb/MMBtu)
Method		**CCM**		**CCM**
Run No.	**1**	0.1225	**1**	4.20E-04
	2	0.1728	**2**	5.92E-04
	3	0.1147	**3**	3.87E-04
SD		3.15E-02		1.10E-04
AVG		**0.1367**		**4.66E-04**
RSD		23.1%		23.6%
N		3		3
SE		1.82E-02		6.36E-05
RSE		13.3%		13.6%
P		95.0%		95.0%
TINV		4.303		4.303
CI +		0.2150		7.40E-04
AVG		**0.1367**		**4.66E-04**
CI -		0.0584		1.93E-04
TB +		0.378		1.31E-03

AVG (average) is the mean value of the runs; N is the number of individual runs.

SD (standard deviation) and RSD (relative standard deviation) are measures of the variability of individual runs.

SE (standard error) and RSE (relative standard error) are measures of the variability of the average of the runs.

P (probability) is the confidence level associated with the two-tailed Student's t-distribution.

TINV (t-value) is the value of the Student's t-distribution as a function of P (probability) and N-1 (degrees of freedom).

CI (confidence interval) indicates that if the test is conducted again under the same conditions, the average would be expected to fall within the interval (CI- to CI+) about 95% of

TB+ (upper tolerance bound) is the value below which 95% of future runs are expected to fall (assuming testing at the same conditions).

RESULTS

Table 2-5:
B&W Boiler Stack – THC, CH_4, C_2H_6 and VOC Emissions (USEPA 25A / 18)

Run No.[1]		2	3	4	Average
Date (2016)		Apr 12	Apr 12	Apr 12	
Start Time (approx.)		12:06	14:09	16:20	
Stop Time (approx.)		13:09	15:12	17:23	
Process Conditions					
R_P	Steam Production (Mlb/hr)	118	118	123	**120**
P_1	Fuel gas flow rate (Mscf/day)	3,545	3,553	3,529	**3,542**
P_2	Natural gas flow rate (Mscf/day)	372	365	358	**365**
F_d	Oxygen-based F-factor (dscf/MMBtu)	8,374	8,374	8,373	**8,374**
Gas Conditions					
O_2	Oxygen (dry volume %)	8.0	7.9	7.8	**7.9**
CO_2	Carbon dioxide (dry volume %)	7.5	7.6	7.8	**7.6**
B_w	Actual water vapor in gas (% by volume)[2]	13.8	14.8	14.1	**14.2**
THC Results					
C_{sd}	Concentration (ppmdv as C_3H_8)	2.71	2.43	2.21	**2.45**
C_{sd}	Concentration (lb/dscf)	3.11E-07	2.78E-07	2.53E-07	**2.80E-07**
E_{Fd}	Emission Rate - F_d-based (lb/MMBtu)	4.21E-03	3.74E-03	3.38E-03	**3.78E-03**
Methane Results					
C_{sd}	Concentration (ppmdv)	6.05	5.37	4.66	**5.36**
C_{sd}	Concentration (lb/dscf)	2.52E-07	2.24E-07	1.94E-07	**2.23E-07**
E_{Fd}	Emission Rate - F_d-based (lb/MMBtu)	3.41E-03	3.01E-03	2.59E-03	**3.00E-03**
Ethane Results					
C_{sd}	Concentration (ppmdv)	<0.0875	<0.0875	<0.0875	**<0.0875**
C_{sd}	Concentration (lb/dscf)	<6.83E-09	<6.83E-09	<6.83E-09	**<6.83E-09**
E_{Fd}	Emission Rate - F_d-based (lb/MMBtu)	<9.25E-05	<9.20E-05	<9.12E-05	**<9.19E-05**
VOC Results					
E_{Fd}	Emission Rate - F_d-based (lb/MMBtu)	<6.46E-04	<6.43E-04	<6.38E-04	**<6.42E-04**

Average includes 3 runs.

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[1] Run 1 was invalidated 20 minutes into the test run when the flame went out in the JUM 3-500 FID analyzer.

[2] Moisture data used for ppmwv to ppmdv correction obtained from nearly-concurrent CCM runs.

For methane and ethane, '<' indicates a measured response below the analytical detection limit determined by the laboratory.

For VOCs, '<' indicates a measured/calculated response below the detectiono limit (assumed to be 1% of the instrument calibration span).

RESULTS

Table 2-6:
B&W Boiler Stack – NO_X and CO Emissions (USEPA 7E, 10)

Run No.		1	2	3	4	5	6
Date (2016)		Apr 11	Apr 11	Apr 11	Apr 11	Apr 11	Apr 11
Start Time (approx.)		12:40	13:15	13:45	14:16	14:49	15:19
Stop Time (approx.)		13:01	13:36	14:06	14:37	15:10	15:40
Process Conditions							
R_P	Steam Production (klb/hr)	115	117	117	116	116	117
P_1	Fuel gas flow rate (kscf/hr)	140	140	140	140	140	140
P_2	Natural gas flow rate (kscf/hr)	11.8	11.8	11.8	11.8	11.8	11.8
F_d	Oxygen-based F-factor (dscf/MMBtu)	8,379	8,379	8,379	8,379	8,379	8,379
Gas Conditions							
O_2	Oxygen (dry volume %)	8.5	8.6	8.6	8.6	8.6	8.6
CO_2	Carbon dioxide (dry volume %)	7.4	7.3	7.3	7.2	7.2	7.3
Nitrogen Oxides Results							
C_{sd}	Concentration (ppmdv)	33.9	33.2	33.3	33.5	33.6	34.1
C_{sd}	Concentration (lb/dscf)	4.05E-06	3.96E-06	3.97E-06	4.00E-06	4.01E-06	4.07E-06
E_{Fd}	Emission Rate - F_d-based (lb/MMBtu)	0.0571	0.0564	0.0565	0.0570	0.0572	0.0580
Carbon Monoxide Results							
C_{sd}	Concentration (ppmdv)	33.2	35.0	33.7	34.4	34.0	31.8
C_{sd}	Concentration (lb/dscf)	2.41E-06	2.55E-06	2.45E-06	2.50E-06	2.47E-06	2.31E-06
E_{Fd}	Emission Rate - F_d-based (lb/MMBtu)	0.0340	0.0362	0.0349	0.0356	0.0352	0.0330

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Run No.		7	8	9	10	Average
Date (2016)		Apr 11	Apr 11	Apr 11	Apr 11	
Start Time (approx.)		15:50	16:20	16:56	17:29	
Stop Time (approx.)		16:11	16:41	17:17	17:50	
Process Conditions						
R_P	Steam Production (Klb/hr)	117	116	115	115	**116**
P_1	Fuel gas flow rate (kscf/hr)	140	140	141	141	**140**
P_2	Natural gas flow rate (kscf/hr)	11.8	11.8	11.9	11.9	**11.8**
F_d	Oxygen-based F-factor (dscf/MMBtu)	8,379	8,379	8,379	8,379	**8,379**
Gas Conditions						
O_2	Oxygen (dry volume %)	8.7	8.7	8.9	8.7	**8.7**
CO_2	Carbon dioxide (dry volume %)	7.2	7.2	7.1	7.2	**7.2**
Nitrogen Oxides Results						
C_{sd}	Concentration (ppmdv)	33.7	34.1	33.9	34.2	**33.7**
C_{sd}	Concentration (lb/dscf)	4.03E-06	4.07E-06	4.04E-06	4.08E-06	**4.03E-06**
E_{Fd}	Emission Rate - F_d-based (lb/MMBtu)	0.0579	0.0586	0.0588	0.0585	**0.0576**
Carbon Monoxide Results						
C_{sd}	Concentration (ppmdv)	32.1	35.0	35.1	35.6	**34.0**
C_{sd}	Concentration (lb/dscf)	2.33E-06	2.54E-06	2.55E-06	2.59E-06	**2.47E-06**
E_{Fd}	Emission Rate - F_d-based (lb/MMBtu)	0.0335	0.0366	0.0370	0.0372	**0.0353**

Average includes 10 runs.

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RESULTS

Table 2-7:
B&W Boiler Stack – O_2 Relative Accuracy (USEPA 3A)

Run No.	Start Time	Date (2016)	RM Data (%dv)	CEMS Data (%dv)	Difference (%dv)	Difference Percent
1	12:40	Apr 11	8.5	8.4	0.1	1.1%
2	13:15	Apr 11	8.6	8.5	0.1	1.0%
3	13:45	Apr 11	8.6	8.5	0.1	1.2%
4	14:16	Apr 11	8.6	8.5	0.1	0.8%
5	14:49	Apr 11	8.6	8.5	0.1	0.7%
6	15:19	Apr 11	8.6	8.5	0.1	1.3%
7	15:50	Apr 11	8.7	8.5	0.2	2.4%
8	16:20	Apr 11	8.7	8.6	0.1	1.1%
9 *	16:56	Apr 11	8.9	8.6	0.3	3.3%
10	17:29	Apr 11	8.7	8.6	0.1	1.3%
Average			**8.6**	**8.5**	**0.1**	**1.2%**

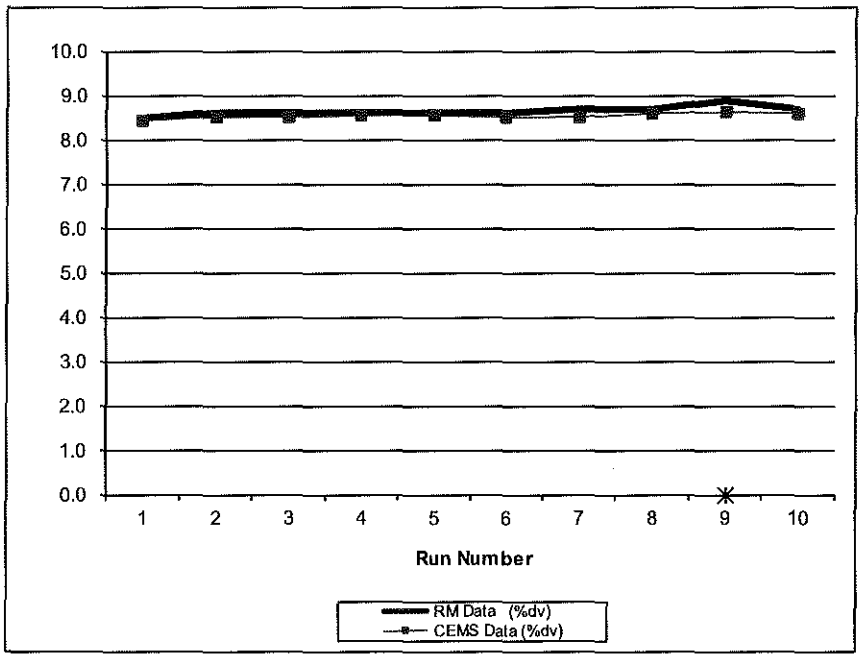
Relative Accuracy Test Audit Results

Standard Deviation of Differences	0.043	
Confidence Coefficient (CC)	0.033	
t-Value for 9 Data Sets	2.306	
		Limit
Avg. Abs. Diff. (%dv)	**0.104**	**1.0**

RM = Reference Method (CleanAir Data) 051816 083851

CEMS = Continuous Emissions Monitoring System (Marathon Pertroleum Corporation Data)

RATA calculations are based on 9 of 10 runs. * indicates the excluded run.



RESULTS

Table 2-8:
B&W Boiler Stack – NO_X (lb/MMBtu) Relative Accuracy (USEPA 7E)

Run No.	Start Time[1]	Date (2016)	RM Data (lb/MMBtu)	CEMS Data (lb/MMBtu)	Difference (lb/MMBtu)	Difference Percent
1 *	12:40	Apr 11	0.057	0.058	-0.001	-1.8%
2	13:15	Apr 11	0.056	0.060	-0.004	-7.1%
3	13:45	Apr 11	0.056	0.060	-0.004	-7.1%
4	14:16	Apr 11	0.057	0.060	-0.003	-5.3%
5	14:49	Apr 11	0.057	0.061	-0.004	-7.0%
6	15:19	Apr 11	0.058	0.061	-0.003	-5.2%
7	15:50	Apr 11	0.058	0.061	-0.003	-5.2%
8	16:20	Apr 11	0.059	0.061	-0.002	-3.4%
9	16:56	Apr 11	0.059	0.062	-0.003	-5.1%
10	17:29	Apr 11	0.059	0.062	-0.003	-5.1%
Average			**0.058**	**0.061**	**-0.003**	**-5.6%**

Relative Accuracy Test Audit Results

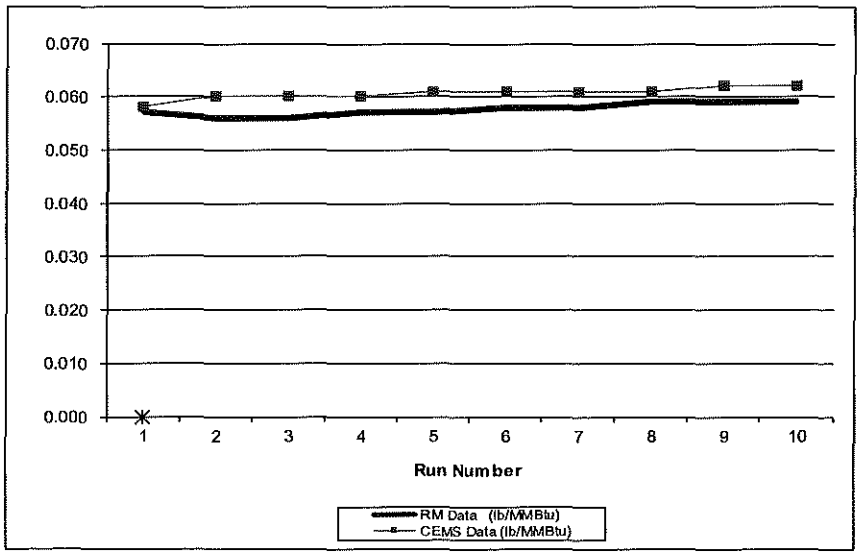
Standard Deviation of Differences	0.001	
Confidence Coefficient (CC)	0.001	
t-Value for 9 Data Sets	2.306	
		Limit
Relative Accuracy (as % of RM)	**6.5%**	**10.0%**
Avg. Abs. Diff. (lb/MMBtu)	**0.003**	**0.020**
Bias Test	-0.003 ≤ 0.001	
Bias Test Status	**Pass**	

[1] Start time applicable to reference method only

RM = Reference Method (CleanAir Data) 052616 145136

CEMS = Continuous Emissions Monitoring System (Marathon Pertroleum Corporation Data)

RATA calculations are based on 9 of 10 runs. * indicates the excluded run.



RESULTS

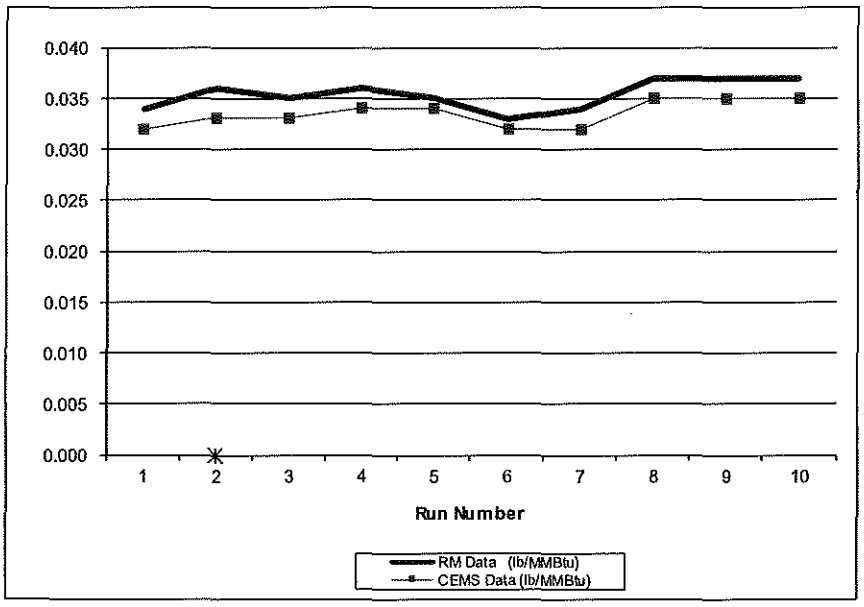
Table 2-9:
B&W Boiler Stack – CO (lb/MMBtu) Relative Accuracy (USEPA 10)

Run No.	Start Time	Date (2016)	RM Data (lb/MMBtu)	CEMS Data (lb/MMBtu)	Difference (lb/MMBtu)	Difference Percent
1	12:40	Apr 11	0.034	0.032	0.002	5.9%
2 *	13:15	Apr 11	0.036	0.033	0.003	8.3%
3	13:45	Apr 11	0.035	0.033	0.002	5.7%
4	14:16	Apr 11	0.036	0.034	0.002	5.6%
5	14:49	Apr 11	0.035	0.034	0.001	2.9%
6	15:19	Apr 11	0.033	0.032	0.001	3.0%
7	15:50	Apr 11	0.034	0.032	0.002	5.9%
8	16:20	Apr 11	0.037	0.035	0.002	5.4%
9	16:56	Apr 11	0.037	0.035	0.002	5.4%
10	17:29	Apr 11	0.037	0.035	0.002	5.4%
Average			**0.035**	**0.034**	**0.002**	**5.0%**

Relative Accuracy Test Audit Results

Standard Deviation of Differences	0.000	
Confidence Coefficient (CC)	0.000	
t-Value for 9 Data Sets	2.306	
		Limit
Relative Accuracy (as % of RM)	**6.0%**	**10.0%**
Avg. Abs. Diff. (lb/MMBtu)	**0.002**	**0.04**

RM = Reference Method (CleanAir Data) 051916 171158
CEMS = Continuous Emissions Monitoring System (Marathon Petroleum Corporation Data)
RATA calculations are based on 9 of 10 runs. * indicates the excluded run.



End of Section 2 – Results