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Detroit, MI 48217

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REPORT ON COMPLIANCE TESTING

Performed for:
MARATHON PETROLEUM COMPANY LP
GOHT HEATER STACK (SV08-H1)
DETROIT REFINERY

Client Reference No: 4100665755
CleanAir Project No: 12950
Revision 0: May 18, 2016

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.

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PROJECT OVERVIEW

INTRODUCTION

Marathon Petroleum Company LP (MPC) contracted Clean Air Engineering (CleanAir) to perform emission measurements at the Detroit Refinery for compliance purposes.

All testing was conducted in accordance with the regulations set-forth by the United States Environmental Protection Agency (EPA) and the Michigan Department of Environmental Quality (DEQ). The permit limits are referenced in Michigan Department of Environmental Quality, 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
Chad Eilering – CleanAir

Test Program Parameters

The testing was performed at the GOHT Heater Stack (Emission Unit ID No. EU08-GOHTCHARHTR-S1; Stack ID No. SV08-H1) on March 30, 2016, and included the following emissions measurements:

- particulate matter (PM), assumed equivalent to filterable particulate matter (FPM) only
- flue gas composition (e.g. O_2, CO_2, H_2O)
- 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	GOHT Heater Stack	USEPA Method 5	FPM	03/30/16	09:43	11:54
2	GOHT Heater Stack	USEPA Method 5	FPM	03/30/16	12:32	14:42
3	GOHT Heater Stack	USEPA Method 5	FPM	03/30/16	15:15	17:26

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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 and 2-2.

Table 1-2:
Summary of Emission Compliance Results

Source Constituent (units)	Sampling Method	Average Emission	Permit Limit[1]
GOHT Heater Stack			
PM (lb/MMBtu)	USEPA 5	0.0005	0.0019

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

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Discussion of Test Program

FPM Testing - USEPA Method 5

For this test program, PM emission rate is assumed equivalent to FPM emission rate. Three (3) 120-minute Method 5 test runs were performed on March 30. The final result was expressed as the average of three (3) valid 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 an oxygen-based fuel factor (F_d) for refinery gas per USEPA Method 19 specifications. 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:
GOHT Heater Stack – FPM Emissions (USEPA M5)

Run No.		1	2	3	Average
Date (2016)		Mar 30	Mar 30	Mar 30	
Start Time (approx.)		09:43	12:32	15:15	
Stop Time (approx.)		11:54	14:42	17:26	
Process Conditions					
P_1	Fuel Gas Flow Rate (Mscf/day)	2,417	2,486	2,488	**2,464**
P_2	Charge Rate (bpd)	46,292	46,404	46,450	**46,382**
F_d	Oxygen-based F-factor (dscf/MMBtu)	7,279	7,279	7,279	**7,279**
H_i	Heat input (MMBtu/hr)	82	84	84	**83**
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	**8,760**
Gas Conditions					
O_2	Oxygen (dry volume %)	4.2	4.3	4.9	**4.5**
CO_2	Carbon dioxide (dry volume %)	7.0	7.2	7.3	**7.2**
T_s	Sample temperature (°F)	296	295	303	**298**
B_w	Actual water vapor in gas (% by volume)	18.7	19.9	18.7	**19.1**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	28,300	31,000	32,700	**30,700**
Q_s	Volumetric flow rate, standard (scfm)	19,500	21,400	22,300	**21,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	15,800	17,100	18,100	**17,000**
Sampling Data					
V_{mstd}	Volume metered, standard (dscf)	73.04	79.92	78.93	**77.30**
%I	Isokinetic sampling (%)	107.3	108.6	101.4	**105.8**
Laboratory Data					
m_{filter}	Matter collected on filter(s) (g)	0.00092	0.00095	0.00105	
m_s	Matter collected in solvent rinse(s) (g)	0.00132	0.00064	0.00068	
m_n	Total FPM (g)	0.00224	0.00159	0.00173	
DLC	Detection level classification	ADL	ADL	ADL	
FPM Results					
C_{sd}	Particulate Concentration (lb/dscf)	6.76E-08	4.39E-08	4.83E-08	**5.33E-08**
$E_{lb/hr}$	Particulate Rate (lb/hr)	0.0642	0.0450	0.0525	**0.0539**
$E_{T/yr}$	Particulate Rate (Ton/yr)	0.281	0.197	0.230	**0.236**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	6.16E-04	4.02E-04	4.60E-04	**4.93E-04**

Average includes 3 runs.

Detection level classifications are defined as follows:

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

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RESULTS

Table 2-2:
GOHT Heater Stack – Uncertainty Analysis – FPM (USEPA M5)

		FPM Results (lb/dscf)		FPM Results (lb/hr)		FPM Results (lb/MMBtu)
Method		**5**		**5**		**5**
Run No.	**1**	6.76E-08	**1**	0.0642	**1**	6.16E-04
	2	4.39E-08	**2**	0.0450	**2**	4.02E-04
	3	4.83E-08	**3**	0.0525	**3**	4.60E-04
SD		1.26E-08		0.00969		1.11E-04
AVG		**5.33E-08**		**0.0539**		**4.93E-04**
RSD		23.7%		18.0%		22.5%
N		3		3		3
SE		7.29E-09		0.00559		6.39E-05
RSE		13.7%		10.4%		13.0%
P		95.0%		95.0%		95.0%
TINV		4.303		4.30		4.30
CI +		8.46E-08		0.0780		7.68E-04
AVG		**5.33E-08**		**0.0539**		**4.93E-04**
CI -		2.19E-08		0.0298		2.17E-04
TB +		1.50E-07		0.128		1.34E-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-distrubution 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).

End of Section 2 – Results