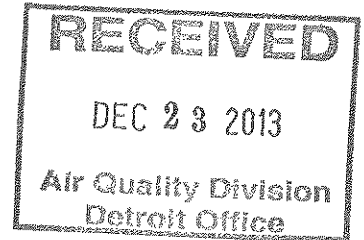




Marathon Petroleum Company  
1300 South Fort Street  
Detroit, MI 48217



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**REPORT ON COMPLIANCE TESTING**

Performed for:  
**MARATHON PETROLEUM COMPANY  
DETROIT REFINERY**

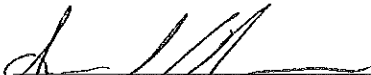
**COMPLEX 6 SRU INCINERATOR STACK (SV72-V22)**

Client Reference No: CN00081321  
CleanAir Project No: 12374-1  
Revision 0: December 19, 2013

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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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**REVISION HISTORY**

**REPORT ON COMPLIANCE TESTING**

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## PROJECT OVERVIEW

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### INTRODUCTION

Marathon Petroleum Company (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 (USEPA) 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. 63-08C, issued January 11, 2012.

### *Key Project Participants*

Individuals responsible for coordinating and conducting the test program were:

Crystal Davis – MPC  
Joe Reidy – MPC  
Thomas Gasloli – DEQ  
John Rooney – CleanAir

### *Test Program Parameters*

The testing was performed at the Complex 6 SRU Incinerator Stack (Emission Unit ID No. EG72-SULRBLOCK2; Stack ID No. SV72-V22) on October 22-23, 2013, and included the following emissions measurements:

- sulfur dioxide (SO<sub>2</sub>)
- carbon monoxide (CO)
- flue gas composition (e.g., O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O)
- flue gas flow rate

**PROJECT OVERVIEW**

1-2

**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	Complex 6 SRU Incinerator Stack	USEPA Method 4	Moisture	10/22/13	14:39	15:39
2	Complex 6 SRU Incinerator Stack	USEPA Method 4	Moisture	10/22/13	16:03	17:03
3	Complex 6 SRU Incinerator Stack	USEPA Method 4	Moisture	10/23/13	11:45	12:45
4	Complex 6 SRU Incinerator Stack	USEPA Method 4	Moisture	10/23/13	14:07	15:07
5	Complex 6 SRU Incinerator Stack	USEPA Method 4	Moisture	10/23/13	15:25	16:25
1	Complex 6 SRU Incinerator Stack	USEPA Method 2	Flow Rate	10/22/13	14:00	14:30
2	Complex 6 SRU Incinerator Stack	USEPA Method 2	Flow Rate	10/22/13	15:53	15:59
3	Complex 6 SRU Incinerator Stack	USEPA Method 2	Flow Rate	10/23/13	11:34	11:41
4	Complex 6 SRU Incinerator Stack	USEPA Method 2	Flow Rate	10/23/13	13:52	14:05
5	Complex 6 SRU Incinerator Stack	USEPA Method 2	Flow Rate	10/23/13	15:16	15:23
6	Complex 6 SRU Incinerator Stack	USEPA Method 2	Flow Rate	10/23/13	17:00	17:09
1	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/22/13	14:01	14:22
2	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/22/13	14:36	14:57
3	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/22/13	15:21	15:46
4	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/23/13	11:23	11:44
5	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/23/13	12:05	12:26
6	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/23/13	12:44	13:05
7	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/23/13	13:22	13:43
8	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/23/13	14:01	14:22
9	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/23/13	14:42	15:03
10	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/23/13	15:19	15:40
11	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/23/13	15:59	16:20
12	Complex 6 SRU Incinerator Stack	USEPA Method 3A/6C/10	O <sub>2</sub> /CO <sub>2</sub> /SO <sub>2</sub> /CO	10/23/13	16:36	16:57

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**PROJECT OVERVIEW**

1-3

**Results Summary**

Table 1-2 and Table 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 2-6.

**Table 1-2:  
Summary of Emission Compliance Test Results**

<u>Source</u>			Average Emission	Permit Limit <sup>1</sup>
Constituent (Units)		Sampling Method		
<u>Complex 6 SRU Incinerator Stack</u>				
CO	(lb/MMBtu)	USEPA M-10	0.02	0.04
SO <sub>2</sub>	(ppmdv @ 0% O <sub>2</sub> )	USEPA M-6C	49	250

<sup>1</sup> Permit limits obtained from MDEQ Permit To Install No. 63-08C.

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**Table 1-3:  
Summary of RATA Results**

<u>Source</u>	Reference Method (USEPA)	Applicable Specification	Relative Accuracy (%)	Specification Limit <sup>1</sup>
Constituent (Units)				
<u>Complex 6 SRU Incinerator Stack</u>				
O <sub>2</sub> (% dv)	M-3A	PS3	0.52	±1.0% dv
SO <sub>2</sub> (ppmdv @ 0% O <sub>2</sub> )	M-6C	PS2	6.4%	20% of RM or

<sup>1</sup> Specification limits obtained from 40 CFR 60, Appendix B, Performance Specifications.

**PROJECT OVERVIEW**

1-4

***Discussion of Test Program******O<sub>2</sub>, SO<sub>2</sub>, and CO Emissions / RATA Testing - USEPA Methods 3A, 6C, and 10; Performance Specifications 2 and 3***

Minute-average data points for O<sub>2</sub>, CO<sub>2</sub>, and SO<sub>2</sub> (dry basis) were collected over a period of 21 minutes for each RATA Reference Method (RM) run. The average result for each RM run was calculated and compared to the average result from the facility CEMs over an identical time interval in order to calculate relative accuracy (RA). RATA results are expressed using nine (9) of the twelve (12) test runs performed. During Run 3, CleanAir's data acquisition system malfunctioned and paused. Run 3 was not used in the RATA results calculations because the 21 minutes of data collected were not consecutive.

- For O<sub>2</sub>, RA is expressed as the average absolute difference between the RM and facility CEMs runs. The final result was below the limit of  $\pm 1.0\%$ dv set by PS3.
- For SO<sub>2</sub>, RA is expressed as the percent difference between RM and facility CEMs runs. The final result was below the limit of 20% of the RM set by PS2.
- CO<sub>2</sub> data was collected only as supplemental information.

CO testing was performed concurrently with the RATA testing.

SO<sub>2</sub> and CO results from the RATA were converted from units of dry volume-based concentration (ppmdv) to mass-based emission rate units (lb/hr, Ton/yr, and lb/MMBtu) to demonstrate compliance with permit limits. The final results for CO were expressed as the average of eleven (11) RATA runs. Run 3 was not used for the average CO results because no final upscale bias was performed. The Run 3 CO results found in Table 2-1 were calculated without using an upscale bias. The final results for SO<sub>2</sub> were expressed as the average of all twelve (12) RATA runs. The final results were below the permit limits.

***Calculation of Final Results***

Emission results in units of dry volume-based concentration (lb/dscf, ppmdv) were converted to mass-based emission results in units of pounds per hour (lb/hr) and tons per year (Ton/yr), then converted to units of pounds per million Btu (lb/MMBtu) using the heat input from auxiliary fuel (natural gas) to the unit.

## PROJECT OVERVIEW

1-5

Gas flow rate data (used in calculation of mass-based emissions) was obtained from bracketing USEPA Method 2 runs. On October 22, 2013, a Method 2 run was performed prior to RATA Run 1 and following RATA Run 3. On October 23, 2013, a Method 2 run was performed prior to Run 4 and following Runs 6, 9, and 12. The flow rate applied to each RATA run was the average of the nearest Method 2 runs prior to and following each RATA run respectively.

Moisture data was obtained from nearly concurrent modified USEPA Method 4 sampling trains.

- Sample gas was extracted using an unheated stainless steel tube set at a single point at least one (1) meter from the stack wall. Moisture stratification is not expected at test locations without free water droplets present in the flue gas.
- After passing through the tube, the sample gas was drawn through gum rubber tubing and into four (4) iced knock-out jars. The knock-out jars were arranged in a series and contained identical contents as the impinger train prescribed by Method 4, but with gum rubber connections and stainless-steel internal components.
- Sample gas was extracted at a constant rate. At least 21 scf of flue gas was sampled.

---

*End of Section 1 – Project Overview*



**RESULTS**

2-1

**Table 2-1:  
C6 SRU Incinerator Stack – SO<sub>2</sub> and CO Emissions (USEPA M-6C/10)**

Run No.		1	2	3*	4
Date (2013)		Oct 22	Oct 22	Oct 22	Oct 23
Start Time (approx.)		14:01	14:36	15:21	11:23
Stop Time (approx.)		14:22	14:57	15:46	11:44
<b>Process Conditions</b>					
H <sub>i</sub>	Actual heat input (MMBtu/hr)	29.9	30.7	31.7	29.5
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	8,760
T	Incinerator Temperature (°F)	1,310	1,309	1,310	1,311
<b>Gas Conditions</b>					
O <sub>2</sub>	Oxygen (dry volume %)	3.4	3.4	3.4	3.8
CO <sub>2</sub>	Carbon dioxide (dry volume %)	4.5	4.6	4.6	4.8
B <sub>w</sub>	Actual water vapor in gas (% by volume) <sup>1</sup>	10.5	10.5	10.5	10.5
<b>Gas Flow Rate<sup>2</sup></b>					
Q <sub>std</sub>	Volumetric flow rate, dry standard (dscfm)	16,600	16,600	16,600	20,000
<b>Sulfur Dioxide Results</b>					
C <sub>sd</sub>	Concentration (ppmdv)	41.9	39.7	43.8	40.4
C <sub>sd-x</sub>	Concentration @ 0% O <sub>2</sub> (ppmdv)	50.0	47.3	52.2	49.5
C <sub>sd</sub>	Concentration (lb/dscf)	6.97E-06	6.59E-06	7.28E-06	6.72E-06
E <sub>lb/hr</sub>	Emission Rate (lb/hr)	6.95	6.58	7.26	8.05
E <sub>T/yr</sub>	Emission Rate (Ton/yr)	30.5	28.8	31.8	35.2
E <sub>Hi</sub>	Emission Rate - Heat input-based (lb/MMBtu)	0.233	0.214	0.229	0.273
<b>Carbon Monoxide Results</b>					
C <sub>sd</sub>	Concentration (ppmdv)	12.6	12.3	13.8	7.66
C <sub>sd</sub>	Concentration (lb/dscf)	9.17E-07	8.94E-07	1.00E-06	5.57E-07
E <sub>lb/hr</sub>	Emission Rate (lb/hr)	0.915	0.892	1.00	0.667
E <sub>T/yr</sub>	Emission Rate (Ton/yr)	4.01	3.91	4.39	2.92
E <sub>Hi</sub>	Emission Rate - Heat input-based (lb/MMBtu)	0.0306	0.0290	0.0317	0.0226

\* Run 3 CO results were calculated without a final upscale bias.

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<sup>1</sup> Moisture data from nearly-concurrent M-4 runs.

<sup>2</sup> Flow data used in lb/hr calculations was obtained from the average of M-2 traverses that bracketed runs.

**RESULTS**

2-2

**Table 2-1 (Continued):  
C6 SRU Incinerator Stack – SO<sub>2</sub> and CO Emissions (USEPA M-6C/10)**

Run No.		5	6	7	8
Date (2013)		Oct 23	Oct 23	Oct 23	Oct 23
Start Time (approx.)		12:05	12:44	13:22	14:01
Stop Time (approx.)		12:26	13:05	13:43	14:22
<b>Process Conditions</b>					
H <sub>i</sub>	Actual heat input (MMBtu/hr)	29.7	29.9	29.7	29.4
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	8,760
T	Incinerator Temperature (°F)	1,311	1,314	1,312	1,315
<b>Gas Conditions</b>					
O <sub>2</sub>	Oxygen (dry volume %)	3.8	3.8	3.8	3.9
CO <sub>2</sub>	Carbon dioxide (dry volume %)	4.8	4.8	4.8	4.8
B <sub>w</sub>	Actual water vapor in gas (% by volume) <sup>1</sup>	10.5	10.5	10.8	10.8
<b>Gas Flow Rate<sup>2</sup></b>					
Q <sub>std</sub>	Volumetric flow rate, dry standard (dscfm)	20,000	20,000	16,400	16,400
<b>Sulfur Dioxide Results</b>					
C <sub>sd</sub>	Concentration (ppmdv)	40.2	38.6	37.9	38.8
C <sub>sd-x</sub>	Concentration @ 0% O <sub>2</sub> (ppmdv)	49.3	47.1	46.3	47.7
C <sub>sd</sub>	Concentration (lb/dscf)	6.69E-06	6.42E-06	6.29E-06	6.46E-06
E <sub>lb/hr</sub>	Emission Rate (lb/hr)	8.01	7.69	6.20	6.36
E <sub>T/yr</sub>	Emission Rate (Ton/yr)	35.1	33.7	27.1	27.9
E <sub>Hi</sub>	Emission Rate - Heat Input-based (lb/MMBtu)	0.269	0.257	0.208	0.216
<b>Carbon Monoxide Results</b>					
C <sub>sd</sub>	Concentration (ppmdv)	8.24	7.06	7.34	6.85
C <sub>sd</sub>	Concentration (lb/dscf)	5.99E-07	5.13E-07	5.33E-07	4.98E-07
E <sub>lb/hr</sub>	Emission Rate (lb/hr)	0.718	0.615	0.525	0.490
E <sub>T/yr</sub>	Emission Rate (Ton/yr)	3.14	2.69	2.30	2.15
E <sub>Hi</sub>	Emission Rate - Heat input-based (lb/MMBtu)	0.0241	0.0205	0.0177	0.0167

<sup>1</sup> Moisture data from nearly-concurrent M-4 runs.

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<sup>2</sup> Flow data used in lb/hr calculations was obtained from the average of M-2 traverses that bracketed runs.

**RESULTS**

2-3

**Table 2-1 (Continued):  
C6 SRU Incinerator Stack – SO<sub>2</sub> and CO Emissions (USEPA M-6C/10)**

Run No.		9	10	11	12	Average
Date (2013)		Oct 23	Oct 23	Oct 23	Oct 23	
Start Time (approx.)		14:42	15:19	15:59	16:36	
Stop Time (approx.)		15:03	15:40	16:20	16:57	
<b>Process Conditions</b>						
H <sub>i</sub>	Actual heat input (MMBtu/hr)	29.3	30.1	30.8	30.1	30.1
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	8,760	8,760
T	Incinerator Temperature (°F)	1,315	1,309	1,309	1,317	
<b>Gas Conditions</b>						
O <sub>2</sub>	Oxygen (dry volume %)	3.8	3.8	3.9	3.8	3.7
CO <sub>2</sub>	Carbon dioxide (dry volume %)	4.9	5.0	5.0	5.0	4.8
B <sub>w</sub>	Actual water vapor in gas (% by volume) <sup>1</sup>	10.8	10.5	10.5	10.5	10.6
<b>Gas Flow Rate<sup>2</sup></b>						
Q <sub>std</sub>	Volumetric flow rate, dry standard (dscfm)	16,400	15,600	15,600	15,600	17,200
<b>Sulfur Dioxide Results</b>						
C <sub>sd</sub>	Concentration (ppmdv)	40.1	37.2	38.7	42.2	40.0
C <sub>sd-x</sub>	Concentration @ 0% O <sub>2</sub> (ppmdv)	48.9	45.5	47.6	51.5	48.6
C <sub>sd</sub>	Concentration (lb/dscf)	6.66E-06	6.18E-06	6.44E-06	7.02E-06	6.64E-06
E <sub>lb/hr</sub>	Emission Rate (lb/hr)	6.56	5.80	6.04	6.58	6.84
E <sub>T/yr</sub>	Emission Rate (Ton/yr)	28.7	25.4	26.4	28.8	30.0
E <sub>Hi</sub>	Emission Rate - Heat Input-based (lb/MMBtu)	0.224	0.192	0.196	0.219	0.227
<b>Carbon Monoxide Results</b>						
C <sub>sd</sub>	Concentration (ppmdv)	6.46	7.60	8.15	5.68	8.18
C <sub>sd</sub>	Concentration (lb/dscf)	4.70E-07	5.52E-07	5.92E-07	4.13E-07	5.94E-07
E <sub>lb/hr</sub>	Emission Rate (lb/hr)	0.462	0.518	0.556	0.387	0.613
E <sub>T/yr</sub>	Emission Rate (Ton/yr)	2.03	2.27	2.43	1.70	2.69
E <sub>Hi</sub>	Emission Rate - Heat Input-based (lb/MMBtu)	0.0158	0.0172	0.0180	0.0129	0.0205

Average includes 11 Runs for CO Results and 12 Runs for all other results.

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<sup>1</sup> Moisture data from nearly-concurrent M-4 runs.<sup>2</sup> Flow data used in lb/hr calculations was obtained from the average of M-2 traverses that bracketed runs.