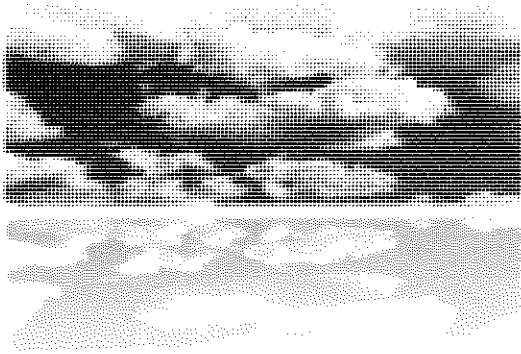




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REPORT ON RATA TESTING

Detroit Refinery

Complex 2 SRU Incinerator Stack

Marathon Petroleum Company LP
1300 South Fort Street
Detroit, MI 48217
Client Reference No. 4101004604

CleanAir Project No. 13375-2
STAC Certificate No. 2007.002.0113.1217
Revision 1, Final Report
November 10, 2017

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1. PROJECT OVERVIEW

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Test Program Summary

Marathon Petroleum Company LP (MPC) contracted CleanAir Engineering (CleanAir) to successfully complete testing at the Complex 2 SRU Incinerator (EU42-43SULRECOV-S1) at the Detroit Refinery located in Detroit, Michigan. The main objective of the test program was to perform a relative accuracy test audit (RATA) on the facility's continuous emissions monitoring system (CEMS) for oxygen (O₂) and sulfur dioxide (SO₂).

A summary of the test program results is presented below. Section 2 Results provides a more detailed account of the test conditions and data analysis. Test program information, including the test parameters, on-site schedule and a project discussion, begins below Table 1-1.

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

Source Constituent (Units)	Reference Method	Relative Accuracy (%) ¹	Applicable Specification	Specification Limit ²
<u>Complex2 SRU Incinerator</u>				
O ₂ (% dv)	USEPA 3A	0.01	PS3	±1.0% of RM
SO ₂ (ppm dv @ 0%O ₂)	USEPA 6C/3A	8.3	PS2	20% of RM

¹ Relative Accuracy is expressed in terms of comparison to the reference method (% RM).

² Specification limits obtained from 40 CFR 60, Appendix B, Performance Specifications.

Test Program Details

Parameters

The test program included the following emissions measurements:

- sulfur dioxide (SO₂)
- oxygen (O₂)
- carbon dioxide (CO₂)

Schedule

Testing was performed on September 29, 2017. The on-site schedule followed during the test program is outlined in Table 1-2.

**Table 1-2:
Test Schedule**

Run Number	Location	Method	Analyte	Date	Start Time	End Time
1	C2 SRU Incinerator	USEPA Method 3A/6C	O ₂ /CO ₂ /SO ₂	09/29/17	08:46	09:07
2	C2 SRU Incinerator	USEPA Method 3A/6C	O ₂ /CO ₂ /SO ₂	09/29/17	09:32	09:53
3	C2 SRU Incinerator	USEPA Method 3A/6C	O ₂ /CO ₂ /SO ₂	09/29/17	10:14	10:35
4	C2 SRU Incinerator	USEPA Method 3A/6C	O ₂ /CO ₂ /SO ₂	09/29/17	10:54	11:15
5	C2 SRU Incinerator	USEPA Method 3A/6C	O ₂ /CO ₂ /SO ₂	09/29/17	11:33	11:54
6	C2 SRU Incinerator	USEPA Method 3A/6C	O ₂ /CO ₂ /SO ₂	09/29/17	12:10	12:31
7	C2 SRU Incinerator	USEPA Method 3A/6C	O ₂ /CO ₂ /SO ₂	09/29/17	12:46	13:07
8	C2 SRU Incinerator	USEPA Method 3A/6C	O ₂ /CO ₂ /SO ₂	09/29/17	13:21	13:42
9	C2 SRU Incinerator	USEPA Method 3A/6C	O ₂ /CO ₂ /SO ₂	09/29/17	13:55	14:16
10	C2 SRU Incinerator	USEPA Method 3A/6C	O ₂ /CO ₂ /SO ₂	09/29/17	14:30	14:51

Discussion

Test Scope Synopsis

O₂ & SO₂ RATA Testing

Minute-average data points for O₂ and SO₂ (dry basis) were collected over a period of 21 minutes for each run utilizing EPA Methods 3A and 6C. Relative accuracy was determined based on nine (9) of ten (10) total runs conducted per procedures outlined in Performance Specification (PS) 2, Section 8.4.4. CO₂ was collected for supplemental purposes.

Sampling occurred at the three (3) points as specified in Section 8.1.3.2 of PS 2 during each run. The average result for each run was converted to identical units of measurement as the facility CEMs and compared for relative accuracy.

Test Conditions

The unit was operated at no less than 50% of the maximum normal operating capacity during RATA test runs. MPC was responsible for logging any relevant process-related data and providing it to CleanAir for inclusion in the test reports.

End of Section

2. RESULTS

This section summarizes the test program results. Additional results are available in the report appendices, specifically Appendix C Parameters.

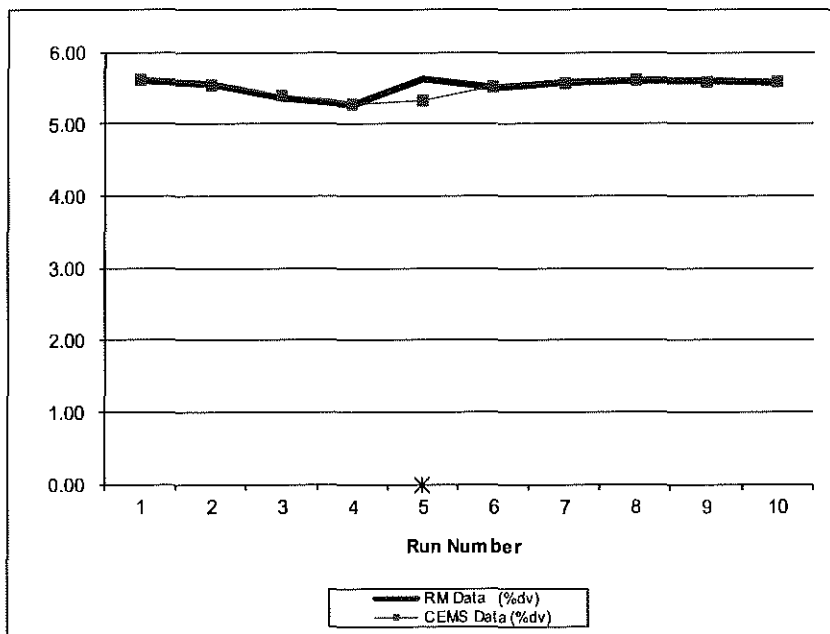
**Table 2-1:
 C2 SRU Incinerator – O₂ (% dv) RATA**

Run No.	Start Time	Date (2017)	RM Data (%dv)	CEMS Data (%dv)	Difference (%dv)	Difference Percent
1	08:46	Sep 29	5.62	5.63	-0.01	-0.2%
2	09:32	Sep 29	5.58	5.56	0.02	0.4%
3	10:14	Sep 29	5.38	5.41	-0.03	-0.6%
4	10:54	Sep 29	5.27	5.30	-0.03	-0.6%
5 *	11:33	Sep 29	5.65	5.33	0.32	5.7%
6	12:10	Sep 29	5.53	5.53	0.00	0.0%
7	12:46	Sep 29	5.60	5.59	0.01	0.2%
8	13:21	Sep 29	5.62	5.62	0.00	0.0%
9	13:55	Sep 29	5.61	5.61	0.00	0.0%
10	14:30	Sep 29	5.59	5.60	-0.01	-0.2%
Average			5.53	5.54	-0.01	-0.1%

Relative Accuracy Test Audit Results

Standard Deviation of Differences	0.0167	
Confidence Coefficient (CC)	0.0128	
t-Value for 9 Data Sets	2.306	
		Limit
Avg. Abs. Diff. (%dv)	0.01	1.0

RM = Reference Method (CleanAir Data) 10/20/17 11:12:53
 CEMS = Continuous Emissions Monitoring System (Marathon Petroleum Company Data)
 RATA calculations are based on 9 of 10 runs. * indicates the excluded run.



**Table 2-2:
 C2 SRU Incinerator – SO₂ (ppmdv @ 0%O₂) RATA**

Run No.	Start Time	Date (2017)	RM Data (ppm@0%O ₂)	CEMS Data (ppm@0%O ₂)	Difference (ppm@0%O ₂)	Difference Percent
1 *	08:46	Sep 29	104.23	118.27	-14.04	-13.5%
2	09:32	Sep 29	110.88	121.92	-11.04	-10.0%
3	10:14	Sep 29	120.36	130.84	-10.48	-8.7%
4	10:54	Sep 29	118.02	127.24	-9.22	-7.8%
5	11:33	Sep 29	120.73	127.63	-6.90	-5.7%
6	12:10	Sep 29	111.55	119.71	-8.16	-7.3%
7	12:46	Sep 29	111.47	119.16	-7.69	-6.9%
8	13:21	Sep 29	114.14	121.81	-7.67	-6.7%
9	13:55	Sep 29	116.05	124.01	-7.96	-6.9%
10	14:30	Sep 29	118.80	124.31	-5.51	-4.6%
Average			115.78	124.07	-8.29	-7.2%

Relative Accuracy Test Audit Results

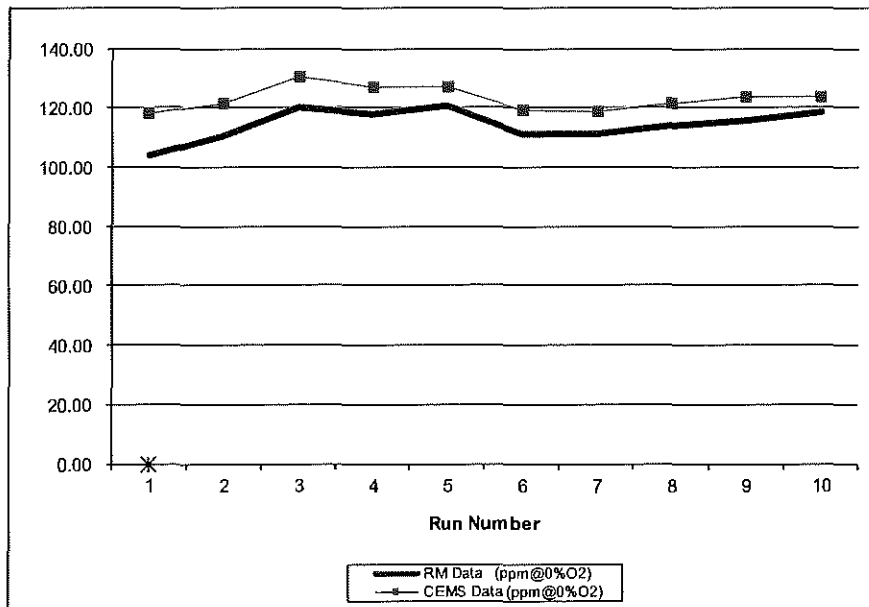
Standard Deviation of Differences	1.723	
Confidence Coefficient (CC)	1.325	
t-Value for 9 Data Sets	2.306	
		Limit
Relative Accuracy (as % of RM)	8.3%	20.0%
Relative Accuracy (as % of Appl. Std.)	5.5%	10.0%
Appl. Std. = 175 ppm@0%O ₂		

RM = Reference Method (CleanAir Data)

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CEMS = Continuous Emissions Monitoring System (Marathon Petroleum Company Data)

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



End of Section

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3. DESCRIPTION OF INSTALLATION

Process Description

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MPC's facility in Detroit, Michigan, produces refined petroleum products from crude oil. MPC must continue to demonstrate that select process units are in compliance with permitted emission limits.

The Sulfur Recovery Unit (EU42-43SULRECOV-S1) removes hydrogen sulfide (H₂S) from acid gas and converts it to elemental sulfur using the Claus Process (Trains A, B, and C), the SCOT Tail Gas Treating Unit process (Trains No. 1 and No. 2) and associated amine treating equipment. Tail gas is routed to a thermal oxidizer, or incinerator, which oxidizes the remaining H₂S in the tail gas to SO₂ before exhausting to the atmosphere via the SRU Incinerator Stack (SV43-H2). The emission group also consists of process vessels (including thermal reactors, an absorbing tower and a stripping tower), heaters, tanks, containers, compressors, seals, process valves, flanges, connectors, etc.

The testing reported in this document was performed at the Complex 2 SRU Incinerator Stack.

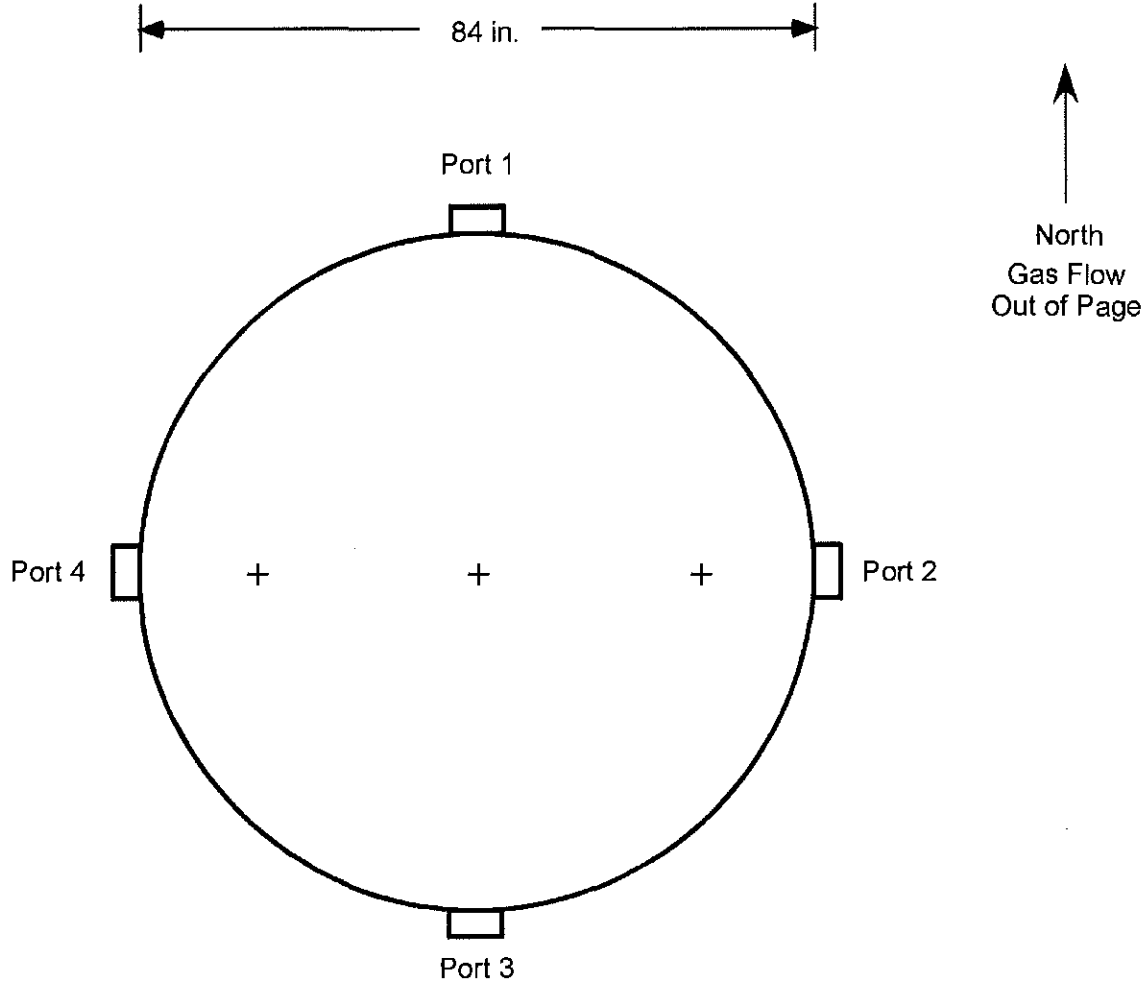
Test Location

The sample point locations were determined by PS 2 specifications. Table 3-1 presents the sampling information for the test location described in this report. The figure shown on page 6 represents the layout of the test location.

**Table 3-1:
Sampling Point Information**

<u>Source</u>				Points per	Minutes	Total	
Constituent	Method	Run No.	Ports	Port	per Point	Minutes	Figure
<u>Complex 2 SRU Incinerator</u>							
O ₂ /CO ₂ /SO ₂	3A/6C	1-10	1	3	7	21	3-1

Figure 3-1:
O₂, CO₂, & SO₂ Sample Point Layout (EPA Method 6C)



Sampling Point	% of Stack Diameter	Port to Point Distance (inches)
1	83.3	70.0
2	50.0	42.0
3	16.7	14.0

Duct diameters upstream from flow disturbance (A): 20 Limit: 0.5
 Duct diameters downstream from flow disturbance (B): 15 Limit: 2.0

End of Section

4. METHODOLOGY

Procedures and Regulations

The test program sampling measurements followed procedures and regulations outlined by the United States Environmental Protection Agency (USEPA) and the Michigan Department of Environmental Quality (DEQ). These methods appear in detail in Title 40 of the CFR and at <https://www.epa.gov/emc>. Appendix A includes diagrams of the sampling apparatus, as well as specifications for sampling, recovery and analytical procedures.

CleanAir follows specific QA/QC procedures outlined in the individual methods and in USEPA "Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III Stationary Source-Specific Methods," EPA/600/R-94/038C. Appendix D contains additional QA/QC measures, as outlined in CleanAir's internal Quality Manual.

Title 40 CFR Part 60, Appendix A

Method 3A "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"

Method 6C "Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)"

Title 40 CFR Part 60, Appendix B Performance Specifications

PS2 "Specifications and Test Procedures for SO₂ and NO_x Continuous Emission Monitoring Systems in Stationary Sources"

PS3 "Specifications and Test Procedures for O₂ and CO₂ Continuous Emission Monitoring Systems in Stationary Sources"

Methodology Discussion

O₂, CO₂, & SO₂ Testing – USEPA Methods 3A & 6C

Reference method O₂ and CO₂ emissions were determined using a paramagnetic/NDIR analyzer per EPA Method 3A. Reference method SO₂ emissions were determined using an ultraviolet-photometric analyzer per EPA Method 6C.

Sample gas was extracted at a constant rate, conditioned to remove moisture and delivered to an analyzer bank which measured the concentration of each pollutant on a dry basis (units of %dv or ppm_{dv}).

Calibration error checks were performed by introducing zero nitrogen (N₂), high range and mid-range calibration gases to the inlet of each analyzer during calibration error checks. Bias checks were performed before and after each sampling run by introducing calibration gas to the inlet of the sampling system's heated filter. Per Methods 3A and 6C, the average results for each run were drift-corrected.