REPORT ON COMPLIANCE TESTING

Detroit Refinery
NHT Charge Heater Stack

Marathon Petroleum Company LP
1300 South Fort Street
Detroit, MI 48217
Client Reference No. 4101379616

CleanAir Project No. 13551-3
A2LA ISO 17025 Certificate No. 4342.01
A2LA / STAC Certificate No. 4342.02
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1. PROJECT OVERVIEW

Test Program Summary

Marathon Petroleum Company LP (MPC) contracted CleanAir Engineering (CleanAir) to successfully complete compliance testing at the Detroit Refinery. The test program included testing at the NHT Charge Heater (EU16-NHTCHARHTR-S-1) to demonstrate compliance with the Michigan Department of Environmental Quality (DEQ) Renewable Operating Permit No. MI-ROP-A9831-2012c.

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 on page 2.

Table 1-1:
Summary of Results

Source Constituent	Sampling Method (USEPA)	Average Emission	Permit Limit[1]
NHT Charge Heater			
NO_X (lb/MMBtu)	M-7E	0.17	0.20

[1] Permit limits obtained from MDEQ Renew able Operating Permit No. MI-ROP-A9831-2012c.

Test Program Details

Parameters

The test program included the following measurements:

- oxygen (O_2)
- carbon dioxide (CO_2)
- nitrogen oxide (NO_X)

Schedule

Testing was performed on May 25, 2018. 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	NHT Charge Heater	USEPA Method 3A / 7E	O_2 / NO_X	05/25/18	10:15	11:15
2	NHT Charge Heater	USEPA Method 3A / 7E	O_2 / NO_X	05/25/18	11:21	12:21
3	NHT Charge Heater	USEPA Method 3A / 7E	O_2 / NO_X	05/25/18	12:32	13:32

Discussion

Project Synopsis

NO_X Emission Testing

NO_X emissions were determined using EPA Method 7E in conjunction with EPA Method 3A. NO_X emissions results were calculated in units of pounds per million Btu (lb/MMBtu). Minute-average data points for O_2, CO_2, and NOx (dry basis) were collected over a period of 60 minutes for a total of three (3) runs. CO_2 concentrations were determined for supplemental purposes. A stratification check was performed during Run 1 and is presented in Appendix D of this report. The final results are expressed as an average of three (3) valid runs.

Fuel Analysis

Emission results in units of dry volume-based concentration (lb/dscf, ppmdv) were converted into units of pound per million Btu (lb/MMBtu) by calculating an oxygen-based fuel factor (F_d) for refinery gas per EPA Method 19 specifications. The F_d factor was calculated from percent volume composition analytical data provided by MPC and tabulated heating values for each of the measured constituents.

Test Conditions

The unit was operated at the maximum normal operating capacity during each of the emissions compliance test runs. MPC was responsible for logging any relevant process-related data and providing it to CleanAir for inclusion in the test report.

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:
NHT Charge Heater – NO_X Emissions

Run No.		1	2	3	Average
Date (2018)		May 25	May 25	May 25	
Start Time (approx.)		10:15	11:21	12:32	
Stop Time (approx.)		11:15	12:21	13:32	
Process Conditions					
P_1	NHT charge rate (bpd)	36,000	36,000	36,000	**36,000**
P_2	Fuel Gas Flow (MSCF/D)	1,280	1,250	1,290	**1,273**
F_d	Oxygen-based F-factor (dscf/MMBtu)	8,354	8,354	8,354	**8,354**
H_i	Actual heat input (MMBtu/hr)	56	57	57	**56**
Gas Conditions					
O_2	Oxygen (dry volume %)	4.0	4.1	4.1	**4.1**
CO_2	Carbon dioxide (dry volume %)	10.3	10.3	10.3	**10.3**
Nitrogen Oxides Results					
C_{sd}	Concentration (ppmdv)	134.7	135.5	136.3	**135.5**
C_{sd}	Concentration (lb/dscf)	1.61E-05	1.62E-05	1.63E-05	**1.62E-05**
E_{Fd}	Emission Rate - F_d-based (lb/MMBtu)	0.166	0.168	0.169	**0.168**

End of Section

3. DESCRIPTION OF INSTALLATION

Process Description

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 Naphtha Hydrotreater unit uses hydrogen to remove sulfur and nitrogen from straight-run and coker naphthas. This process, known as hydrotreating, uses a catalyst to promote the desulfurization reaction. The desulfurized or sweet naphtha is blended into gasoline or used for platformer feed. The NHT unit consists of process vessels (including exchangers, reactors, receivers, separators, and a stripper column), heaters, tanks, containers, pumps, piping, drains, and various components (pump seals, process valves, pressure relief valves, flanges, connectors, etc.).

The NHT Charge Heater (EU16-NHTCHARHTR-S1) preheats the feed to the reactor. The unit is fired by refinery fuel gas. Emissions are vented to the atmosphere via the NHT Charge Heater Stack (SV16-H4) where testing was performed.

Test Location

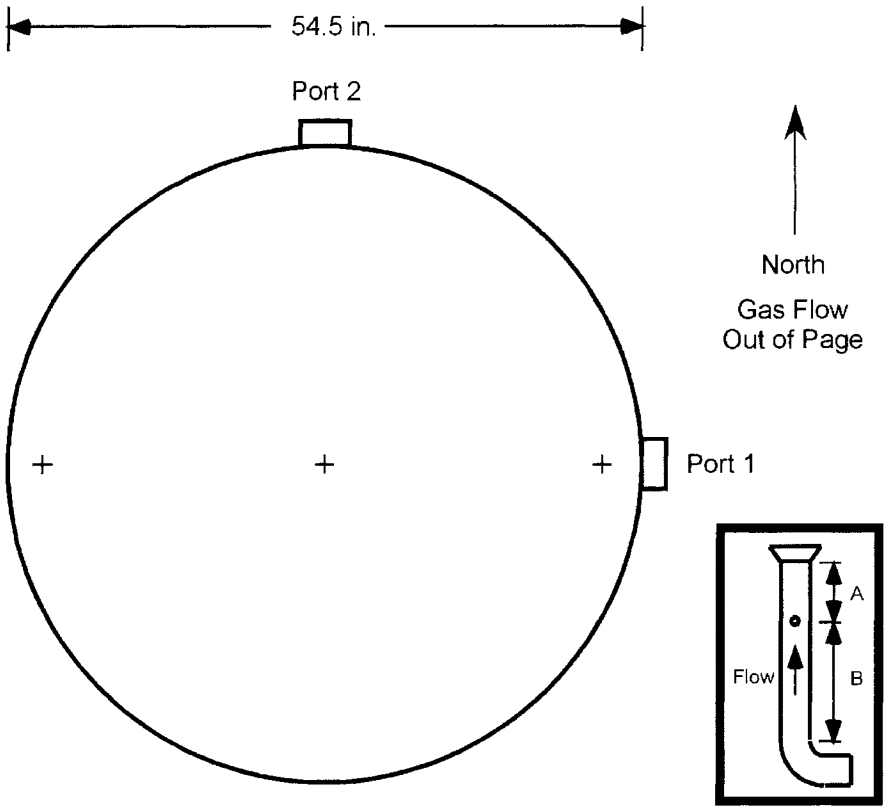
The sample point locations were determined by EPA Method 7E specifications. Table 3-1 presents the sampling information for the test location described in this report. The figure shown on page 5 represents the layout of the test location.

Table 3-1:
Sampling Information

Source Constituent	Method (USEPA)	Run No.	Ports	Points per Port	Minutes per Point	Total Minutes	Figure
NHT Charge Heater							
O_2 / NO_X	3A / 7E	1[1]	1	3	20	60	3-1
O_2 / NO_X	3A / 7E	2-3	1	1	60	60	3-1

[1] During Run 1, a stratification check was performed per Method 7E.

Figure 3-1:
NO_X Sample Point Layout (EPA Method 7E)



Sampling Point	% of Stack Diameter	Port to Point Distance (inches)
1	83.3	45.4
2	50.0	27.3
3	16.7	9.1

Duct diameters upstream from flow disturbance (A): 2.9 Limit: 0.5
Duct diameters downstream from flow disturbance (B): 3.1 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 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. Any modifications to standard test methods are explicitly indicated in this appendix.

In accordance with ASTM D7036 requirements, CleanAir included a description of any such modifications, along with the full context of the objectives and requirements of the test program in the test protocol submitted prior to the measurement portion of this project. Modifications to standard methods are not covered by the ISO 17025 and TNI portions of CleanAir's A2LA accreditation.

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
Method 7E	"Determination of Nitrogen Oxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)"
Method 19	"Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide and Nitrogen Oxide Emission Rates"

Methodology Discussion

O_2 and NO_X Testing – USEPA Methods 3A and 7E

Reference method O_2 emissions were determined using a paramagnetic analyzer per EPA Method 3A. NO_X emissions were determined using a chemiluminescent analyzer per EPA Method 7E.

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

Calibration error-checks were performed by introducing zero N_2, high range and mid-range calibration gases to the inlet of each analyzer. Bias checks were performed before and after each sampling run by introducing calibration gas to the inlet of the sampling system's heated filter. Minute-average data points for O_2 and NO_X (dry basis) were collected over a period of 60 minutes for each run. Per Methods 3A and 7E, the average results for each run were drift-corrected. An NO_2 conversion check was conducted per EPA Method 7E specifications.