AECOM

AECOM 60430382

Source Test Report

Delayed Coking Unit
Atmospheric Depressurization Vent

RECEIVED

AUG 2 6 2015

AIR QUALITY DIV.

Prepared for:

Marathon Petroleum Company
1300 South Fort Street
Detroit, Michigan 48217

Prepared by:

AECOM
9400 Amberglen Boulevard (78729)
PO Box 201088
Austin, TX 78720-1088

June 2015

AECOM
P.O. Box 201088
Austin, TX 78720-1088
9400 Amberglen Boulevard
Austin, TX 78729

MICHIGAN DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENT
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT
REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Natural Resources and Environment, Air Quality Division upon request.

Source Name: Marathon Petroleum Company LP | County: Wayne

Source Address: 1300 South Fort Street | City: Detroit

AQD Source ID (SRN): A9831 | ROP No.: MI-ROP-A9831-2012b | ROP Section No.: 01

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From 6/24/2015 To 6/26/2015

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Submittal of the Coke Drum Vent Compliance Testing results.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

David Roland	**MPC Investment LLC, its General Partner** **Deputy Assistant Secretary**	313-843-9100
Name of Responsible Official (print or type)	Title	Phone Number
[signature]		8/24/2015
Signature of Responsible Official		Date

* Photocopy this form as needed.

EQP 5736 (Rev 2-10)

1.0 Introduction

Marathon Petroleum Company LLC, Michigan Refining Division (MPC Detroit), operates a petroleum refinery in Detroit, Michigan. The MPC Detroit Refinery is a petroleum refinery with the capacity to convert approximately 120,000 barrels of crude oils per calendar day (bbl/cd) into finished products. The new EG70-Coker delayed coking unit (DCU) was commissioned in November 2012 and is covered under the Michigan Department of Environmental Quality (MDEQ) Permit 63-08D.

AECOM prepared a Test Plan that described the sampling and analytical methodologies to be employed to measure non-methane, non-ethane volatile organic compounds (NMNE VOCs), hydrogen sulfide (H_2S), and total filterable particulate matter (FPM) mass emission rates from the DCU Vent during a normal venting cycle (see Section 1.2). Molecular weight, moisture (H_2O) concentrations, and DCU Vent exhaust gas flow rate were also measured to develop target compound mass emission rates. The Test Plan was approved by the MDEQ in June 2015.

Because of the unique nature of this intermittent process vent, modifications to existing U.S. EPA-approved reference methods were made to collect accurate and precise data from this source. Due to the extremely high moisture content (greater than 99%) and the high velocity (greater than 200 mph) of the gas stream, the dynamic nature of the gas stream's characteristics, and the variable batch nature of the delayed coking process, AECOM implemented the modified reference methods and alternative quality assurance/quality control (QA/QC) criteria discussed in the Test Plan (see Section 5.0).

This *Source Test Report* presents the results of the 2015 Source Test in the following sections:

- Section 2.0 – Summary of Results;
- Section 3.0 – Sampling and Analytical Procedures;
- Section 4.0 – Calculations; and
- Section 5.0 – Quality Assurance Objectives for Measurement Data.

Report appendices provide copies of raw data, including chain-of-custody forms, sampling logs, raw analytical instrument output, laboratory reports, DCU process data, and sampling equipment calibration forms. General information regarding the testing is summarized in Table 1-1.

Table 1-1. Source Test Information

Facility Name	Marathon Petroleum Company, Michigan Refining Division
Contact Person(s)	Crystal Davis
Telephone Number	313-297-6115
Facility Address	1300 South Fort Street, Detroit, Michigan 48217
Types of Process Sampled	DCU Atmospheric Depressurization Vent Gas Stream
Person Responsible for Conducting Source Test	Jesse Rocha
Telephone Number	512-419-5726
Testing Company Name	AECOM Corporation
Testing Company Address	9400 Amberglen Boulevard Austin, Texas 78729
Person(s) Conducting Source Test	Jesse Rocha Kevin McGinn Jonathan Hilton Dave Maxwell Jeff Frady Levi Wolfe
Modified U.S. EPA Reference Methods Performed	U.S. EPA Methods 1, 2, 3, 4, 5, 18, and 25A U.S. EPA Other Test Method 12
Dates of Source Testing	June 24 through 26, 2015

1.1 Delayed Coking Unit – Process Description

The EG70 Delayed Coker converts Vacuum Resid (Crude Vacuum Tower Bottoms), a product normally sold as asphalt or blended into residual fuel oil, into lighter, more valuable products. The Vacuum Resid feedstock is heated before it enters the main fractionator, where lighter material vaporizes. The fractionator bottoms are routed through a fired heater (Coker Charge Heater) and then into a coke drum. The heat within the coke drum causes cracking reactions to produce the coke, which accumulates in the coke drum, and hydrocarbon vapors, which are carried overhead from the coke drum back to the fractionator. The fractionator produces gasoil, distillate, and naphtha streams which are sent to downstream units for additional processing. The fractionator overhead is directed to the Coker Gas Plant where it is separated into LPG and offgas streams. The LPG and offgas streams are sent to downstream units for additional processing.

Petroleum (pet) coke eventually fills the coke drum; subsequently the drum is isolated, purged of hydrocarbon vapors, cooled, and opened. A typical Delayed Coker uses at least two coking drums so that one can be filled while the other is being de-coked.

At the end of each coke drum filling cycle, the full coke drum is switched off-line, stripped with steam to remove residual hydrocarbons, flooded with quench water, and depressured. Coke is cut from the drum with high pressure water jets.

The MPC Detroit coker includes two redundant vapor recovery compressors. The compressors allow the coke drums to be vented to atmosphere only after the drum pressure decreases to two pounds per square inch gauge (psig).

1.2 Source Test Objectives

The objective of the source test is to quantify emissions from the DCU vent. The sampling and analytical methods employed during the source test and any modifications to the EPA-approved reference methods (RMs) are presented in subsequent sub-sections.

The DCU vent gas stream was sampled pursuant to the Test Plan using direct source testing methodologies to quantify the emissions of the following target compounds:

- NMNE VOC;
- Methane;
- Ethane;
- Hydrogen sulfide (H_2S); and
- Total particulate matter (Total PM).

Table 1-2 presents the sampling durations for each target compound during the batch cycle of the DCU vent.

Valid gas samples were collected during three (3) separate venting cycles of the DCU (Runs 2, 3, and 4). A complete set of valid results for Run 1 was not collected due to loss of data from the THC analyzers and problems with routing the vent gases to the sampling location.

1.3 Source Test Strategy

A venting cycle is defined in the Test Plan as the period of time between the activation of the vent (i.e., opening) and the optimal depressurization of a coke drum to atmosphere that is necessary before the draining and coke-cutting cycles can begin.

Table 1-2 presents the test run durations of each modified sampling system during a given test run. Modified sampling methods are described in detail in Section 3.0. AECOM began collecting all gas samples within one (1) minute of vent activation during each test run unless otherwise noted. Gas samples were collected until the coke drum reached optimal depressurization, for as long as the sampling equipment remained operable within acceptable performance ranges, or until health and safety limitations were encountered.

Results for Run 1 are not reported because a complete set of valid samples was not collected during this sampling interval.

Section 2.0 of this report presents the averages of target compound mass emission rates measured during each venting condition.

Table 1-2. Sampling Train Durations

Run No.	Date	Time	Sampling Duration (min)	Sampling Method
2	6/24/15	11:42-12:15	33	U.S. EPA Method 5
	6/24/15	11:42-12:15	33	U.S. EPA Methods 18/25A/OTM 12
3	6/25/15	11:29-12:15	46	U.S. EPA Method 5
	6/25/15	11:29-12:15	46	U.S. EPA Methods 18/25A/OTM 12
4	6/26/15	11:33-12:15	42	U.S. EPA Method 5
	6/26/15	11:33-12:15	42	U.S. EPA Methods 18/25A/OTM 12

1.4 Quality Assurance Summary

Any sampling and/or analytical QA/QC issues associated with the data obtained through the 2015 Source Test are described in Section 5.0. Table 1-3 presents QA summaries for each of the modified U.S. EPA reference methods performed on the DCU.

A review of the data quality associated with the measurements performed during all runs indicates that these data are supportable and usable for the purpose intended. A full set of data could not be obtained during Run 1 due to the loss of data from one of the THC analyzers.

Table 1-3. Quality Assurance Summary

Parameter	Deviations from the Test Plan and Quality Assurance/Quality Control Issues
Sampling Points, Velocity and Volumetric Flow Rate, Dry Gas Molecular Weight, and Moisture Concentration	None
Total Particulate Matter Determination	The Test Plan describes a single PM sampling train per vent cycle. During the 2015 Source Test, two PM sampling trains (A and B for each run) were collected simultaneously in order to minimize the potential for collecting an incomplete set of data for a given vent cycle. The replicate sample that resulted in the greater sample volume was chosen for analysis, and the other sample was archived by the laboratory. As a result, the reported PM results from Runs 2, 3, and 4 were derived using sample Train 2. Minor temperature excursions for probe temperature were experienced for Train 1 during Run 2 and Run 3. Minor temperature excursions for probe temperature were experienced for Train 1 during Run 2, Run 3, and Run 4.
Methane and Ethane Concentrations and Dilution Sampling System	None
Hydrogen Sulfide Concentrations and Dilution Sampling System	None
Total Hydrocarbon Concentration and Dilution Sampling System	During Run 1, the signal output of the THC analyzers was lost and vent gas was not entirely routed to the sample location. This run was not used in emissions calculations, and Run 4 was performed to replace it. Analyzer drift exceeded the allowable 3% of span for Run 3 – THC 1, Run 3 – THC 2, Run 4 – THC 1, and Run 4 – THC 2.

2.0 Summary of Results

This section presents a summary of process operations during the Source Test as well as selected methane, ethane, hydrogen sulfide, NMNE VOC, and PM emissions data. Valid NMNE VOC results could not be obtained during Run 1 due to the loss of data from the THC analyzers and the vent gas not being entirely routed to the sample location. The valid PM, methane, ethane, and hydrogen sulfide samples collected during Run 1 were archived as a complete data set could not be collected. Table 2-1 presents the summary of results for this test program.

Table 2-1. Summary of Results

Run No.	Date	Methane Mass Emission Rate (lbs/cycle)	Ethane Mass Emission Rate (lbs/cycle)	H_2S Mass Emission Rate (lbs/cycle)	NMNE VOC Mass Emission Rate (lbs/cycle)	Particulate Matter Mass Emission Rate (lbs/cycle)
2	6/24/15	5.8	8.7	<0.167	0.0	<0.011
3	6/25/15	20.7	3.5	0.781	3.6	<0.013
4	6/26/15	14.9	2.4	0.251	1.3	<0.008

2.1 DCU Process Operations

The DCU was operated at conditions reflective of "normal" unit operations during the source test. The DCU was vented to atmosphere after the internal pressure of the coke drum reached approximately 2 psig. This venting pressure is consistent with the normal operation of the DCU.

Sampling durations were determined using the venting cycle start and end times recorded by AECOM scientists. The venting cycle start times corresponded to the initial differential pressure increase within the vent duct, as reported by sampling instrumentation, rounded to the nearest whole minute. In many cases, the venting cycle end times corresponded to the measurement of zero (0) differential pressure in the vent pipe using U.S. EPA Method 2, "*Determination of Stack Gas Velocity and Flow Rate from Stationary Sources (Type-S Pitot Tube).*"

2.2 Data Reduction Approach

Mass emission rates are typically expressed using an industry standard of mass per unit time, such as pounds per hour (lbs/hr), by relating the average concentration of a target compound to the average volumetric flow rate of a gas stream through a stack or vent. However, the use of a simple average is inappropriate for developing an emissions profile for the

intermittent and dynamic characteristics of the atmospheric depressurization vent source, so the duration and profile of each complete venting cycle varied according to the batch process.

The data reduction approach used in this report integrates target compound mass emission rates as pounds per minute (lbs/min) throughout the complete venting cycle, starting at the point of vent activation and ending at the point of optimal depressurization of the coke drum. Total mass emission rates are expressed in this report as mass per batch cycle (lbs/cycle).

2.3 Results for Vent Gas Volumetric Flow Rate

Vent gas volumetric flow rate was measured according to modified U.S. EPA Methods 2, "*Determination of Stack Gas Velocity and Volumetric Flow Rate*," 3, "*Gas Analysis for the Determination of Dry Molecular Weight*," and 4, "*Determination of Moisture Content in Stack Gases*." These methods were performed in conjunction with each modified U.S. EPA Method 5 sampling train. Table 2-2 presents average volumetric flow rate and other operating data associated with the modified sampling train.

It was not practicable to measure the oxygen or carbon dioxide concentrations in the sample gas using U.S. EPA Method 3 due to the low dry gas percentage (less than 2% of the total). The molecular weight of the dry fraction of the DCU gas was therefore assumed to be equal to methane (16.0 g/g-mol), the most abundant compound detected in the vent gas stream after water. The estimated dry gas molecular weight had an insignificant impact on the calculation of wet gas molecular weight as the average moisture concentration was slightly in excess of 99%.