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erthwrks
AIR EMISSIONS TESTING FOR INDUSTRY

Emissions Performance Testing

for
Marathon Petroleum Company LP

at the
Marathon Detroit Refinery in Detroit, MI

on the
NHT Stripper Reboiler
Unit: EU16-NHTSTRIPREBOIL-S1
Permit No. MI-ROP-A9831-2012c

Prepared for:

Marathon Petroleum Company LP

Test Date: April 26, 2022
Erthwrks Project No. 9049.1.B1

A9831-TEST-20220426

STAC STACK TESTING ACCREDITATION COUNCIL
A2LA ACCREDITED TO ASTM D7036 ONLY CERT #6147.01
LELAP Louisiana Environmental Lab Accreditation Program
CARB

Endorsement Page

This report was developed in accordance with the requirements designated in the applicable regulatory permit(s) and or regulatory rules. To the best of my knowledge the techniques, instrumentation, and calculations presented in this report will serve to accurately and efficiently detail the results of the test campaign requirements.

Erthwrks, Inc.

Name: Jarrod Hoskinson

Title: Senior Project Manager

Signature:

This report has been reviewed for accuracy and completeness. The actions presented in this report are, to the best of my knowledge, an accurate representation of the results and findings of the test campaign. Erthwrks, Inc. operates in conformance with the requirements on ASTM D7036-04 Standard Practice for Competence of Air Emission Testing Bodies and is accredited as such by the Stack Testing Accreditation Council (STAC) and the American Association for Laboratory Accreditation (A2LA).

Erthwrks, Inc.

Name: John Wood

Title: Technical Director

Signature:

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ATTACHMENTS

1.0 INTRODUCTION

1.1 Identification, location and dates of tests

Erthwrks, Inc. was contracted to conduct emission testing on the NHT Stripper Reboiler in operation at the Marathon Detroit Refinery, located in Detroit Michigan. The testing program was conducted on April 26, 2022.

1.2 Purpose of Testing

This test program was conducted to determine the carbon monoxide (CO), particulate matter (PM) and sulfuric acid (H_2SO_4) emissions emitted from the NHT Stripper. The testing was conducted in accordance with the requirements in the Marathon Permit No. MI-ROP-A9831-2012c and the Title 40 CFR Part 60, Appendix B.

1.3 Description of Source

The NHT Stripper Reboiler (EU16-NHTSTRIPREBOIL-S1) heats the liquid from the bottom of the Naphtha Hydrotreater stripper column. The vapors that form are returned to the top of the stripper column; the liquid vapor is removed as a product stream. The unit is fired by refinery fuel gas. Emissions are vented to the atmosphere via the NHT Stripper Reboiler Heater Stack where testing was performed.

1.4 Contact Information

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2.0 SUMMARY OF RESULTS

Table 2.1—Marathon NHT Stripper Reboiler (EU16-NHTSTRIPREBOIL-S1) Compliance Results

Pollutant Measured	Methodology	Measured Results	Applicable Limit	Pass/Fail
CO	EPA Method 10	0.00008 lb/MMBtu	0.02 lb/MMBtu	***Pass***
H_2SO_4	EPA Method CTM-013	0.000254 lb/MMBtu	n/a	***n/a***
PM	EPA Method 5	0.0014 lb/MMBtu	0.0019 lb/MMBtu	***Pass***
PM/PM_{10}	EPA Method 5/202	0.0046 lb/MMBtu	0.0076 lb/MMBtu	***Pass***

3.0 SOURCE DESCRIPTION

3.1 Description of the process

Marathon Petroleum Company LP produces refined petroleum products from crude oil and is required to demonstrate that select process emission sources are operating in compliance with permitted emissions 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 Stripper Reboiler (EU16-NHTSTRIPREBOIL-S1) heats the liquid from the bottom of the stripper column. The vapors that form are returned to the top of the stripper column; the liquid vapor is removed as a product stream.

3.2 Applicable permit and source designation

Marathon Petroleum Company LP operates the NHT Stripper Reboiler (EU16-NHTSTRIPREBOIL-S1) under EGLE Renewable Operating Permit No. MI-ROP-A9831-2012c.

3.3 Type and quantity of materials processed during tests

During the emission testing on April 26, 2022, at the Marathon Petroleum Company LP Refinery, the NHT Stripper Reboiler was tested while operating at the maximum achievable load condition. This operational data was provided by MPC and is located in Attachment G of this report.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 Gaseous Emissions – CO, O_2, and CO_2

For the gaseous sampling, Erthwrks utilized a stainless-steel probe, of sufficient length to reach all sampling points, inserted into a sampling port that is located on the stack in accordance with EPA Method 1. The sample is extracted through the probe, a heated Teflon sampling line, to a heating filter. The sample then enters a minimum contact sample conditioner that cools and removes moisture from the gas matrix prior to entering the Erthwrks sampling manifold.

Erthwrks followed all quality assurance and quality control procedures as defined in US EPA 40 CFR 60 Appendix A. The Calibration Error (CE) Test was conducted as specified in EPA Method 7E §8.2.3. In accordance with this requirement, a three-point analyzer calibration error test was conducted prior to sampling. The CE test was conducted by introducing the low, mid, and high-level calibration gasses (as defined in EPA Method 7E §3.3.1-3) sequentially and the response was recorded. The results of the CE test are acceptable if the calculated calibration error is within ±2.0% of calibration span (or ≤ 0.5 ppmv).

The Initial System Bias and System Calibration Error Check was conducted in accordance with EPA Method 7E §8.2.5. The upscale calibration gas was introduced at the probe upstream of all sample system components and the response recorded. The procedure will was repeated with the low-level gas and the response recorded. During this activity, the sample system response time was also be recorded. This specification is acceptable if the calculated values of the system calibration error check are within ±5.0% of the calibration span value (or ≤0.5 ppmv).

After each test run, the sample system bias check is conducted to validate the run data. The low-level and upscale drift are calculated using Equation 7E-4. The run data is valid if the calculated drift is within ±3.0% of the calibration span value (or ≤0.5 ppmv).

After each test run, the corrected effluent gas concentration was calculated as specified in EPA Method 7E §12.6. The arithmetic average of all valid concentration values are adjusted for bias using equation 7E-5B.

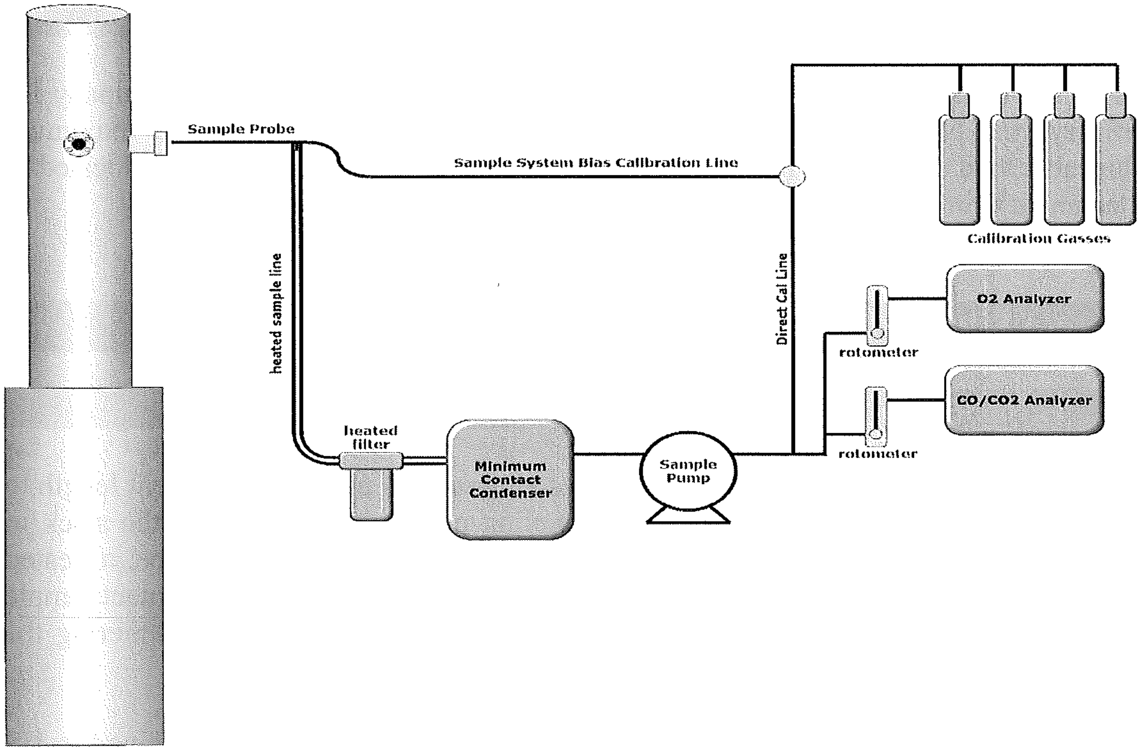
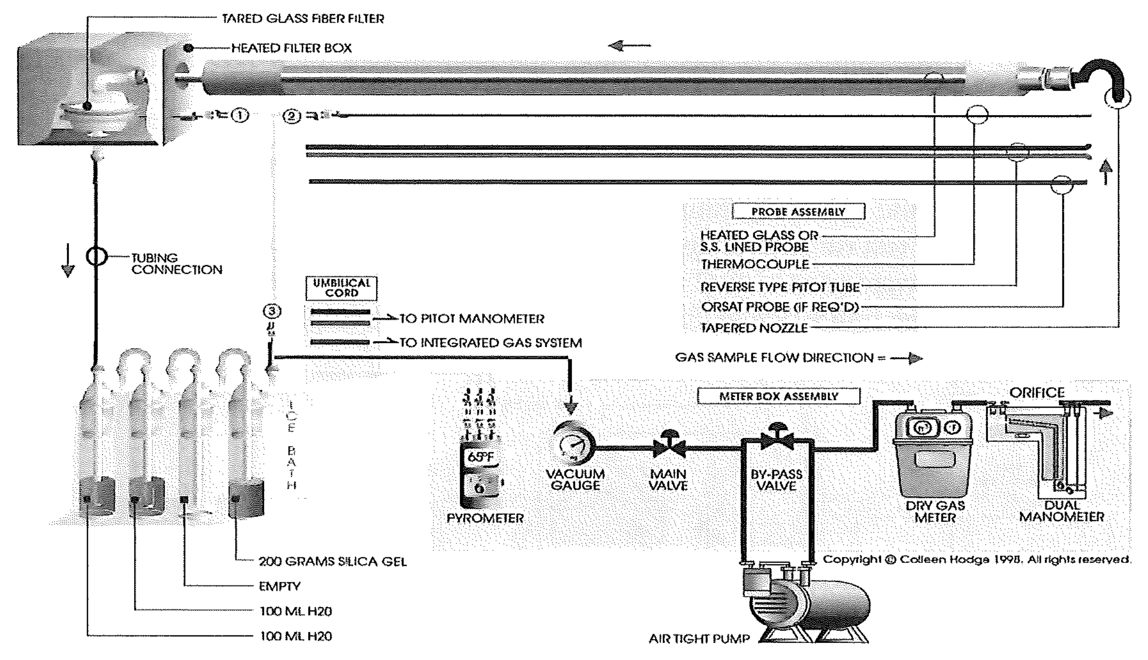


Figure 1: Example Erthwrks Gaseous Sampling System Diagram

4.2 Particulate Matter Sampling – EPA Method 5/202

EPA Test Method 1 will be used for the selection of sampling points. Stack dimensions, number of sample ports and sample port locations were confirmed prior to testing to determine the appropriate number of traverse points for the test.

EPA Test Method 5 was used to determine filterable particulate matter emission rates. Method 5 is the method at which particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter and on the lining of the isokinetic probe maintained at a temperature of 120 ± 14°C. Upon completion of each test run, the nozzle and probe liner were rinsed and brushed with acetone. The acetone rinse catch will be collected and combined with the filter holder rinse and labeled as "front half rinse". The total PM mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically. Filterable PM will be calculated by combining the net gravimetric gain of the filter and the net gravimetric gain of the evaporated front half rinse. Figure 2 below shows the Method 5 sampling system components.



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U.S. EPA Method 5 Sampling Train

Figure 2: Example Erthwrks PM System Diagram

For the determination of PM/PM_{10}, condensable particulate matter (CPM) was measured via EPA Method 202. The Method 202 components begin at the back half of the Method 5 filter housing. The filterable particulate matter is removed in these "front half" components. The condensable particulate matter is then collected by drawing the filtered gas through a water jacketed, spiral condenser maintained at 65° – 85° F. The cooled effluent gas is then passed through two empty impingers and finally through a hexane extracted Teflon filter. Upon completion of each test run, the moisture collected in this portion of the sampling train is purged with ultra-high purity (UHP) nitrogen gas for one hour to remove any dissolved sulfur dioxide. The moisture is collected in a container and combined with the deionized water used to rinse all Method 202 sampling glassware two times.

The glassware is next rinsed with hexane and acetone. These rinses are collected and combined in an additional container. The Teflon filter is removed from the filter housing, labeled, and collected. Gravimetric analysis is then conducted on the extracted, evaporated samples for each run.

4.3 EPA Method CTM-013 (ALT-133 Analysis) H_2SO_4 Determination

The H_2SO_4 emissions were determined utilizing the conditional test method 13 (CTM-013). The sample was extracted at a constant rate through a quartz lined heated probe (>350 °F), A heated quartz filter holder and filter (>500 °F), and through a Modified Grahm condenser (H_2SO_4 Condenser) with Type C glass frit and 200 cm of 5-mmID glass tubing condenser coil. The H_2SO_4 condenser is maintained between 167 to 185 °F. Because SO_2 was not to be determined via this method, the sample was then passed through four impingers with the specifications delineated in EPA Method 4.

The sampling was conducted at a single point at a constant rate of about 10 L/min and the DGM readings and all temperatures were recorded every five minutes. After the completion of the test run, the samples were recovered in accordance with the test method and the samples were sent to Enthalpy Analytical for analysis via Ion Chromatography (ALT-133). See the figure below that details the CTM-013 Sampling Train.

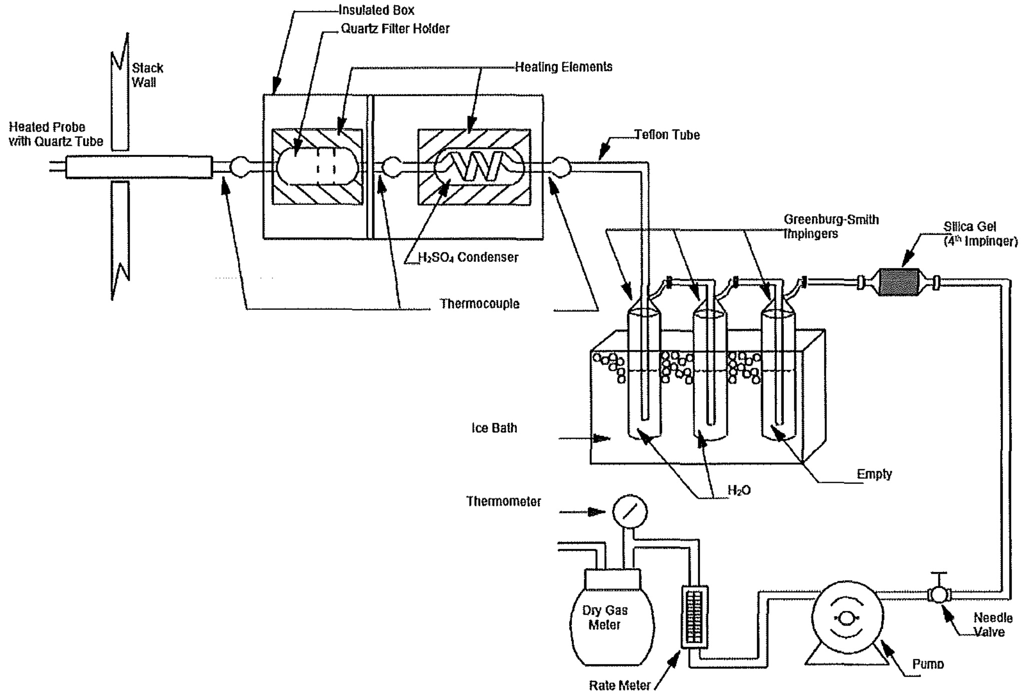

Figure 3: Example Erthwrks H_2SO_4 System Diagram

4.4 Discussion of sampling procedure or operational variances

Erthwrks, Inc. conducted the emissions testing with no sampling or procedural variances.