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# *Relative Accuracy Test Audit*

**Demonstration of Performance**
**of the Continuous Emission Monitoring System**

**on the**

## DHT Heater
## Unit: EU77-DHTHTR-S1

**at the**

## Marathon Detroit Refinery

**in**

## Detroit, MI

**subject to**

## Permit No. MI-ROP-A9831-2012c
## Title 40 CFR Part 60, Appendix F

**prepared for**

MARATHON

**Marathon Petroleum Company LP**

**Test Date: April 19, 2023**
**Erthwrks Project No. 9284.1.B1**

STAC STACK TESTING ACCREDITATION COUNCIL

A2LA ACCREDITED TO ASTM D7036 ONLY CERT #6147.01

LELAP Louisiana Environmental Laboratory Accreditation Program

CARB

A9831-TEST-20230419

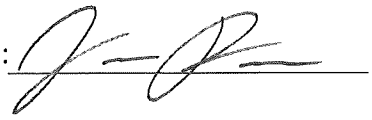
# Endorsement Page

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: Jason Dunn

Title: QAQC Manager

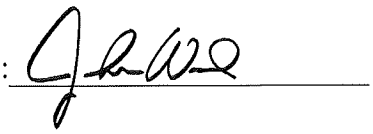
Signature: 

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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# 1.0 INTRODUCTION

## 1.1 Identification, location and dates of tests

Erthwrks, Inc. was contracted to conduct a relative accuracy test audit (RATA) on a continuous emissions monitor system (CEMS) installed on the DHT Heater exhaust in operation at the Marathon Detroit Refinery in Detroit, MI. The RATA test was conducted on April 19, 2023.

## 1.2 Purpose of Testing

This RATA was conducted to demonstrate the accuracy and reliability of the CEMS monitors installed on the DHT Heater. The purpose of this test program was to evaluate the relative accuracy of the oxides of nitrogen (NOx), carbon monoxide (CO), and oxygen ($O_2$) CEMS. All testing and audit procedures were conducted in accordance with the requirements set forth in the 40, CFR, Part 60, Appendix B and F, which defines the CEMS performance specifications and testing procedures.

## 1.3 Contact Information

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# 2.0 SUMMARY OF RESULTS

**Table 2.1: DHT Heater CEMS RATA Results**

| Pollutant Measured | Performance Specification | Relative Accuracy | Applicable Limit | Pass/Fail |
|---|---|---|---|---|
| NOx (lb/mmBTU) | Performance Spec. 2 | 4.97% $RA_{AS}$ | <20% | Pass |
| CO (ppmvd) | Performance Spec. 4A | 0.32 ppm | <5 ppm | Pass |
| $O_2$ (%vd) | Performance Spec. 3 | 0.10% $RA_{MD}$ | <1% | 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 Distillate Hydrotreater Unit (EU77-DHTHYTREAT) reacts with sour distillate (and occasionally gas oil) streams with hydrogen over a catalyst bed to remove sulfur. The DHT unit consists of process vessels (reactors, distillation tower, absorbing towers, stripper tower), heater (EU77-DHTHTR-S1), cooling tower, compressors, pumps, piping, drains, and various components (pumps and compressor seals, process valves, pressure relief valves, flanges, connectors, etc.). The DHT Heater is fired by refinery fuel gas. Emissions are vented to the atmosphere via the DHT Heater Stack (SV77-H1), where testing was performed.

**Table 3.1: DHT Heater CEMS Description**

| Pollutant Measured | Analyzer Manufacturer | Analyzer Model | Serial Number |
|---|---|---|---|
| NOx | ABB | Limas 11 | 3.342734.1 |
| CO | ABB | Uras 26 | 3.34279.1 |
| $O_2$ | ABB | Magnos 206 | 3.342731.1 |

## 3.2 Applicable permit and source designation

The DHT Heater is operated under Permit No. MI-ROP-A9831-2012c. The emission test was conducted pursuant to annual test requirements.

## 3.3 Type and quantity of materials processed during tests

During the emission testing on April 19, 2023, at the Marathon Petroleum Company LP refinery, the DHT Heater 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 Sampling – NOx, CO & $O_2$

The following EPA reference methods were utilized to complete this testing program:

- EPA Method 3A for the determination of $O_2$ concentration
- EPA Method 7E for the determination of NOx concentration
- EPA Method 10 for the determination of CO concentration

A calibration error (CE) test was conducted as specified in US EPA Method 7E §8.2.3. In accordance with this requirement, a three-point analyzer calibration error test was conducted prior to exhaust sampling. The CE test was conducted by introducing the low, mid, and high-level calibration gasses (as defined by EPA Method 7E §3.3.1-3) sequentially and the response was recorded.

The initial system bias and system calibration error check were conducted in accordance with EPA Method 7E §8.2.5. The upscale calibration gas will be introduced at the probe upstream of all sample system components and the response will be recorded. The procedure was repeated with the low-level gas concentration and response recorded.

After each test run, the sample system bias check was conducted to validate the run data. The low-level and upscale drift was calculated using equation 7E-4. The arithmetic average of all valid concentration values was adjusted for bias using equation 7E-5B.

The nitrogen dioxide ($NO_2$) to nitric oxide (NO) conversion efficiency test was conducted prior to each field test in accordance with EPA Method 7E §8.2.4.1. This was conducted by introducing the converter efficiency gas (~50 ppm $NO_2$) directly to the NOx analyzer and recording the NO value. The $NO_2$-NO Conversion Efficiency test was within acceptable limits.

All gaseous sampling was done utilizing three appropriate traverse points. The three traverse points were selected to ensure acquisition of a representative sample over the stack cross section as required by 40 CFR Part 60, Appendix B, Performance Specification 2 §8.1.3.2.

See Figure 1 below for a sample system diagram.

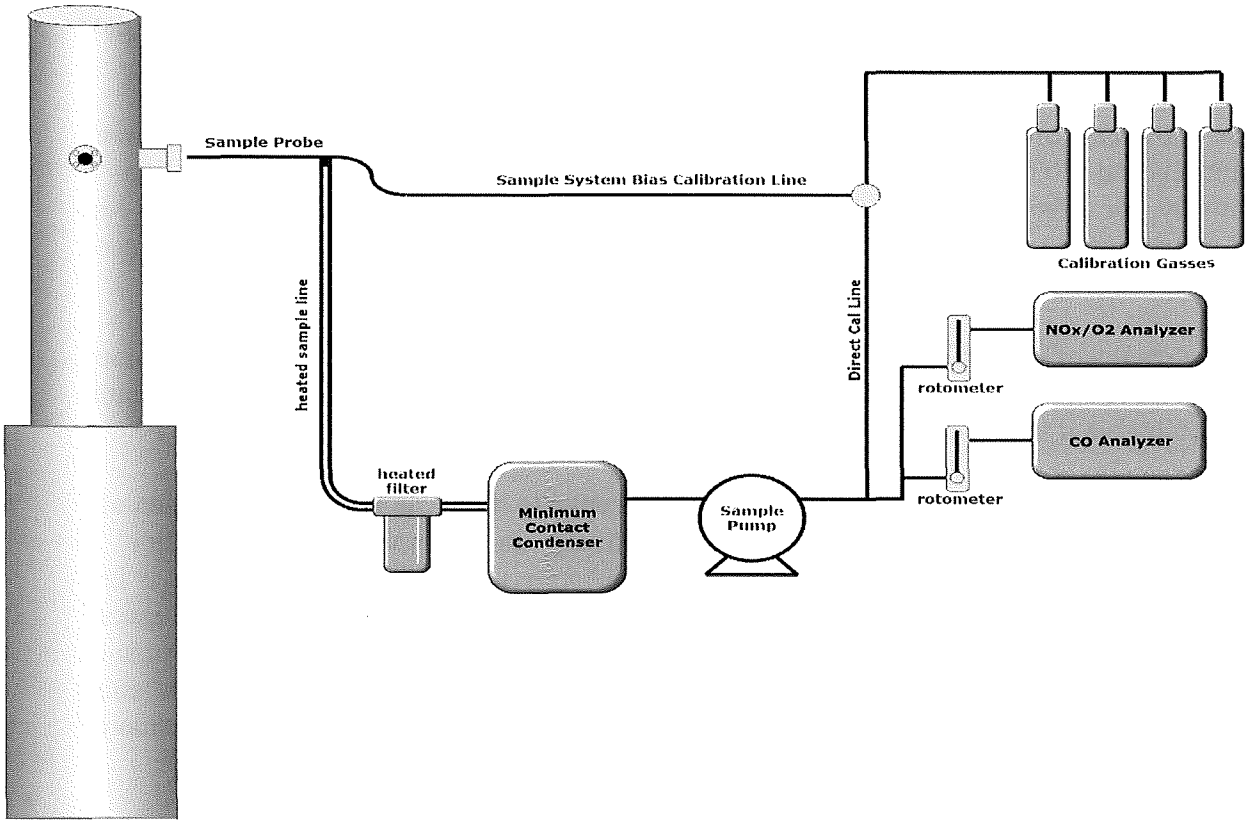


**Figure 1: Example Erthwrks Gaseous Sampling System Diagram**

## 4.2 RATA Procedures

The RATA testing was conducted following the sampling and measurement procedures found in the EPA Part 60, Appendix B, Performance Specifications which requires that EPA Reference Methods, from EPA Part 60, Appendix A, be utilized to conduct independent stack emissions measurements for comparison with installed CEMS readings. The following performance specifications will be used during this testing program.

- EPA Performance Specification 2 for NOx relative accuracy
- EPA Performance Specification 3 for $O_2$ relative accuracy
- EPA Performance Specification 4A for CO relative accuracy

As required by these methods, the use EPA Protocol 1 gases are mandatory and were used for this portion of the project.

A minimum of nine (9) RATA test runs were conducted at each exhaust stack for a minimum duration of twenty-one (21) minutes for each run. A 3-point traverse located at 16.7%, 50.0%, and 83.3% of the way across the stack (or 0.4, 1.2, and 2.0 meters from the stack wall) was conducted during each RATA test run (7 minutes per point). A maximum of twelve (12) RATA test runs will be conducted and up to three test runs may be discarded and not used to determine relative

accuracy. The results of the reference method tests were compared to CEMS measurement data from the same time periods to determine the relative accuracy of the CEMS.

For NOx, the results of the RATA test are considered acceptable if the calculated relative accuracy does not exceed 20.0% as calculated by Equation 2-6 in Performance Specification 2. Alternatively, for affected units where the average of the reference method measurements is less than 50 percent of the emission standard (emission limit), the relative accuracy must not exceed 10% when the applicable emission standard is used in the denominator of Eq. 2-6.

For $O_2$, the results of the RATA test are considered acceptable if the calculated relative accuracy does not exceed 20.0% as calculated by Equation 3.1 in Performance Specification 3. The results are also acceptable if the result of Equation 3-2 is less than or equal to 1.0 percent.

For CO, the results of the RATA test are considered acceptable if the calculated relative accuracy does not exceed 10.0% as calculated by Equation 2-6 in Performance Specification 2. Alternatively, for affected units where the average of the reference method measurements is less than 50 percent of the emission standard (emission limit), the relative accuracy must not exceed 5% when the applicable emission standard is used in the denominator of Eq. 2-6. Performance Specification 4A criteria may be used to determine relative accuracy for CEMS with low emission standards (less than 200 ppmv). In these cases, the results of the RATA test are considered acceptable if the absolute average difference between the RM and CEMS is within 5 ppmv.

The reference method sampling locations are defined in the Erthwrks QA/QC worksheet located in Attachment B. Three sampling points were used in accordance with the EPA Performance Specification 2, §8.1.3.2, located at 16.7, 50.0 and 83.3 percent of the stack inner diameter from the port location. Erthwrks sampled at each traverse point individually for 7-minutes per point for each 21-minute test run.

## 4.3 Discussion of sampling procedure or operational variances

Erthwrks, Inc. conducted the emission testing with no sampling or procedural variances. The process unit tested and operated with no operational variances.