



AIR EMISSIONS TESTING FOR INDUSTRY

***Relative Accuracy Test Audit
and Emissions Compliance Test***

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

**on the
CCR Interheater (CCRPLINTHTR)
(EU14-CCRPLINTHTR-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
Petroleum Company LP**

**Test Date: May 29, 2024
Erthwrks Project No. 9565.1.B6**



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 Specialist

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.

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- A. Detailed Results of Emissions Test
- B. Quality Control Documentation
- C. Field Sampling Datasheets
- D. Example Calculations
- E. Raw Datalog Records
- F. Calibrations and Certifications
- G. CEMS and Operational Data
- H. Laboratory Report

1.0 INTRODUCTION

1.1 Identification, location and dates of tests

Erthwrks, Inc. was contracted to conduct an emissions compliance test and a relative accuracy test audit (RATA) on the continuous emissions monitor system (CEMS) that is installed on the CCR Interheater exhaust in operation at the Marathon Detroit Refinery in Detroit, MI. The testing was conducted on May 29, 2024.

1.2 Purpose of Testing

This RATA was conducted to demonstrate the accuracy and reliability of the CEMS installed on the CCR Interheater. The purpose of this test program was to evaluate the relative accuracy of the oxides of nitrogen (NO_x), carbon monoxide (CO), and oxygen (O₂) CEMS.

In addition, a compliance test was conducted to determine mass emission rates of filterable particulate matter (PM) and volatile organic compounds (VOCs).

1.3 Contact Information

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2.0 SUMMARY OF RESULTS

Table 2.1: CCR Interheater CEMS RATA Results

Pollutant Measured	Performance Specification	Relative Accuracy	Applicable Limit	Pass/Fail
NO _x (lb/MMBtu)	Performance Spec. 2	16.1% RA_{RM}	<20%	Pass
CO (ppmvd)	Performance Spec. 4A	0.3 ppm	<5 ppm	Pass
O ₂ (%vd)	Performance Spec. 3	0.2% RA_{MD}	<1%	Pass

Table 2.2: CCR Interheater Emissions Compliance Results

Pollutant Measured	Measured Result	Applicable Limit	Pass/Fail
PM	0.0011 lb/MMBtu	0.0019 lb/MMBtu	Pass
VOC	0.0004 lb/MMBtu	0.0055 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 Continuous Catalytic Regeneration Platformer Unit (EG14-CCRPLATFORMER) is a catalytic reformer that rearranges the structure of low octane naphtha feed into higher octane reformates. Hydrogen is produced as a product of the reaction and is used in other refinery processes. The CCR Charge Heater (EG14-CCRPLCHARHTR) is the stack for Heater 14H8 and Heater 14H9. The CCR Interheater (EU14-CCRPLINTHTR) is the stack for Heater 14H1-4. Both units are fired by refinery fuel gas. Emissions are vented to the atmosphere via the CCR Charge Heater (SV14-H6) and CCR Interheater Stack (SV14-H4A).

The table below details the CEMS analyzer specifications.

Table 3.1: CCR Interheater CEMS Description

Pollutant Measured	Analyzer Manufacturer	Analyzer Model	Serial Number
NO _x	ABB	Uras 26	3.345725.1
CO	ABB	Uras 26	3.248567.4
O ₂	ABB	Magnos 106	3.248610.4

3.2 Applicable permit and source designation

The CCR Interheater 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 May 29, 2024, at the Marathon Petroleum Company LP refinery, the CCR Interheater 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 – NO_x, CO, O₂, and CO₂

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

- EPA Method 3A for the determination of O₂ and CO₂ concentration
- EPA Method 7E for the determination of NO_x 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 (NO₂) 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 NO₂) directly to the NO_x analyzer and recording the NO value. The NO₂-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.

4.2 Gaseous Sampling – VOC as THC (Method 25A)

The determination of the VOC concentration was determined by measuring total hydrocarbon compound (THC) and followed all QAQC procedures as specified in the US EPA 40 CFR 60 Appendix A, Method 25A with the exception of the EGLE requirement to adjust the final results for drift using Equation 7E-5B. The calibration error (CE) test was conducted following the procedures specified in EPA Method 25A §8.4. In accordance with this requirement, a four-point analyzer calibration error test was conducted prior to exhaust sampling. This CE test was conducted by introducing the zero, low, mid, and high-level calibration gases (as defined by EPA Method 25A §7.1.2-5) and the response recorded. The results of the CE test are acceptable if the results for the low and mid-level calibration gasses are within $\pm 5.0\%$ of the predicted responses as defined by the linear curve from the zero and high-level results. The sample system response time was also recorded at this time in accordance with EPA Method 25A §8.5.

Immediately following the completion of each test run, the drift determination was conducted to validate the test data in accordance with EPA Method 25A §8.6.2. The test data is valid if the calculated drift is within $\pm 3.0\%$ of the span value (EPA Method 25A §13.1.2). See Figure 1 below for a sample system diagram.

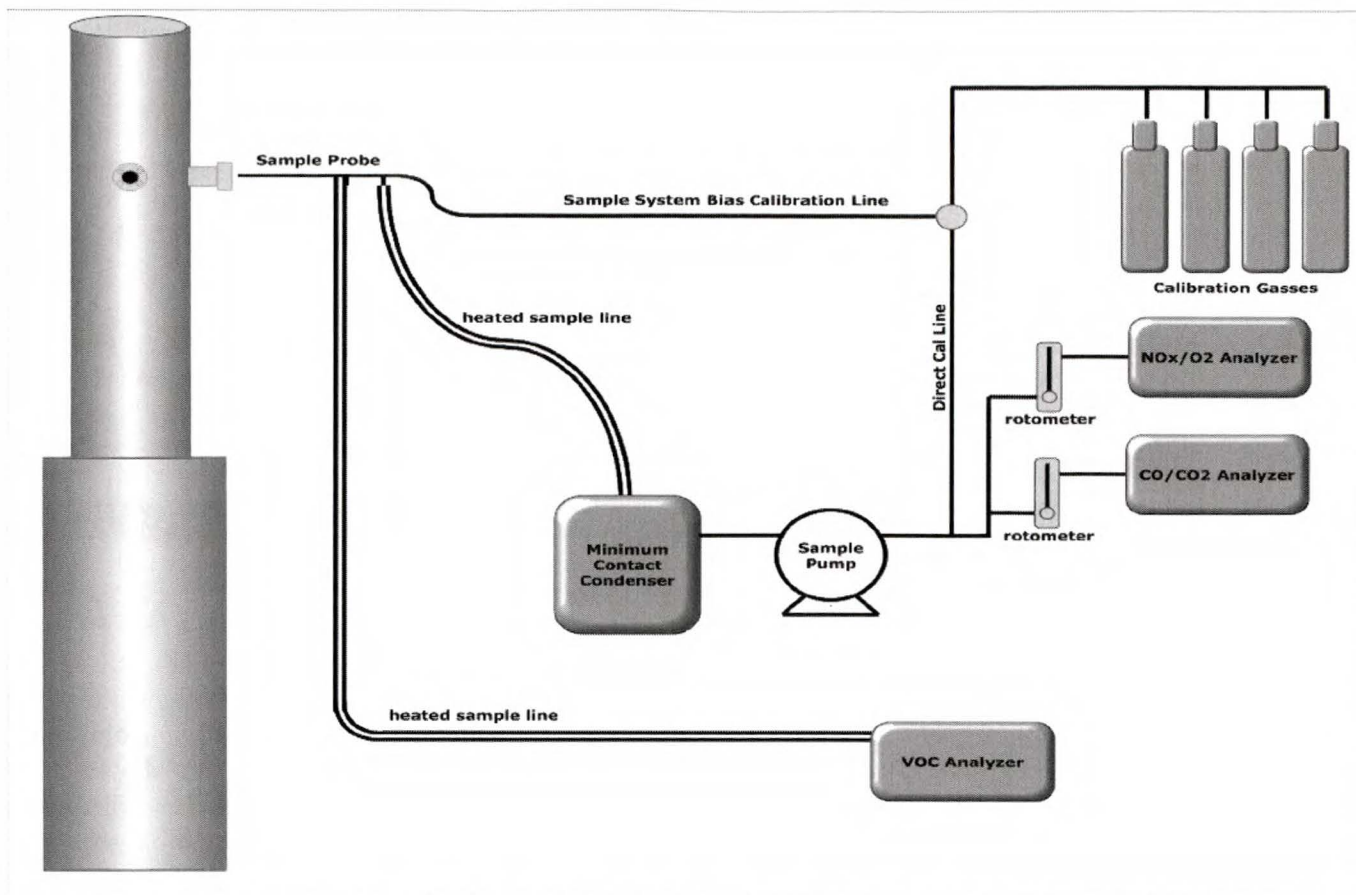


Figure 1: Example Erthwrks Gaseous Sampling System Diagram

4.3 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 NO_x relative accuracy
- EPA Performance Specification 3 for O₂ 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 NO_x, 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 O₂, 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.

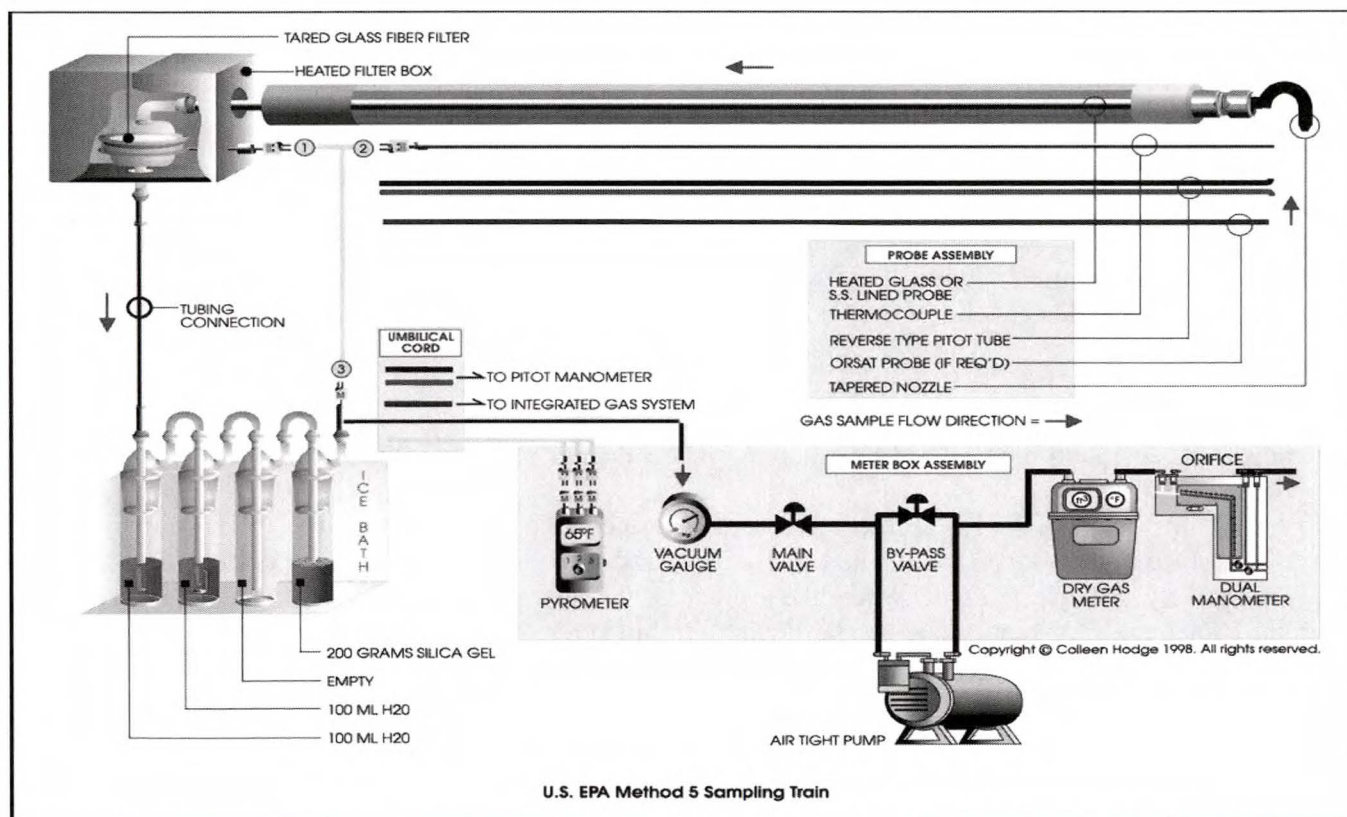
The reference method sampling locations are defined in the Erthwrks QA/QC worksheet located in Attachment B. Three sampling points were used in accordance with the EPA Performance Specification 2, §8.1.3.2, located at 16.7, 50.0 and 83.3 percent of the stack inner diameter from

the port location. Erthwrks sampled at each traverse point individually for 7-minutes per point for each 21-minute test run.

4.4 Filterable Particulate Matter Sampling – EPA Method 5

EPA Test Method 1 was 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 $120 \pm 14^{\circ}\text{C}$. Upon completion of each test run, the nozzle and probe liner were rinsed and brushed with acetone. The acetone rinse catch was 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 was 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.



4.5 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.