erthwrks

AIR EMISSIONS TESTING FOR INDUSTRY

Emissions Performance Test Report

for

CITGO Petroleum Company

at the

Ferrysburg Terminal in Ferrysburg, MI

on a

Vapor Combustion Unit (VCU)

subject to

EPA Title 40 CFR Part 63 Subpart BBBBBB

Permit No.: 201-03

Facility ID B6258

Prepared for:

CITGO

Test Date: June 15, 2023

Erthwrks Project No. 9199

STAC STACK TESTING ACCREDITATION COUNCIL

A2LA ACCREDITED TO ASTM D7036 ONLY CERT #6147.01

Louisiana Environmental Laboratory Accreditation Program LELAP

CARB

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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: Patrick Deschner

Title: VP Terminal Operations

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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Signature: 

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1.0 INTRODUCTION

1.1 Identification, location and dates of tests

One vapor combustion unit (VCU) was tested for CITGO Petroleum Company at their Ferrysburg Terminal in Ferrysburg, MI. The emission testing was conducted on June 15, 2023.

Table 1: Facility Unit Information

Unit	Make	Model
VCU-1	John Zink	VCU

1.2 Purpose of Testing

The purpose of the test was to determine the collection and destruction efficiency of the VCU associated with the truck loading rack. The testing was conducted in accordance with the conditions in Title 40 Code of Federal Regulations (CFR) Part 63 Subpart BBBBBB, 40 CFR 60 Subpart XX, and the Permit No.: 201-03.

Testing was conducted for the determination of the total organic compound (TOC) mass emission rate. The exhaust carbon monoxide (CO) and carbon dioxide (CO_2) concentration was also measured to calculate exhaust flow rate.

1.3 Description of Source

CITGO Petroleum Company owns and operates the Ferrysburg Terminal in Ferrysburg, MI. This bulk fuel terminal is designed to receive, store, and deliver fuel to tank trucks. Within this facility, the VCU, in conjunction with all components of the vapor collection system, is in place in order to minimize the emissions of TOC during the loading of tank trucks.

The emissions are vented to the atmosphere from an exhaust stack approximately 35 feet above ground level. The unit is in operation only while trucks are being loaded and vapors are entering the combustion zone. When this occurs, the combustion products will include hydrocarbons, carbon monoxide, oxides of nitrogen, and carbon dioxide.

1.4 Contact Information

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Facility Location:
Ferrysburg Loading Terminal
524 Third Street
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2.0 SUMMARY OF RESULTS

Results of the stack test on the VCU are summarized in Table 2. The sampling results indicate the facility is in compliance with the limits set forth in the 40 CFR 63 Subpart BBBBBB, 40 CFR 60 Subpart XX, and Permit No.: 201-03.

Table 2: Summary of Results

Test Parameter	Measured Results	Applicable Limit
Method 21—Vapor Leak	0 ppm	500 ppm
Rack Back Pressure	257 mmH_2O	450 mmH_2O
TOC Emissions	8.35 mg/Liter loaded	10 mg/Liter loaded
Volume Loaded	941,295 Liters of gasoline	300,000 Liters of gasoline
Compliance Test Time	>6 hours	Minimum 6 hours

3.0 SOURCE DESCRIPTION

3.1 Description of the process

This bulk fuel terminal is designed to receive, store, and deliver fuel to tank trucks. These tank trucks then deliver the fuel to various service stations for consumer distribution. Within this facility, the VCU operates in conjunction with all components of the vapor collection system in order to minimize the emissions of TOC during the loading of tank trucks.

As tank truck loading is being performed at the loading rack, gasoline products are transferred from the storage tanks into the tank trucks. The tank trucks are loaded with product at approximately 500-600 gallons per minute per loading arm. As gasoline product is loaded into the trucks, the headspace inside the tank trucks, which contains gasoline vapors, are vented into the vapor collection system. This system includes vapor hoses that connect the tank truck to the vapor collection system piping. The piping then vents the vapors, through various valves and flame arrestors, to the VCU. At the VCU, the hydrocarbon vapors are destroyed and the combustion products are vented to the atmosphere through the VCU emission stack.

3.2 Applicable permit and source designation

The CITGO Petroleum Company Ferrysburg Terminal is subject to the regulations set forth in Permit No.: 201-03, 40 CFR 60 Subpart XX, and 40 CFR 63 Subpart BBBBBB.

3.3 Type and quantity of materials processed during tests

During the emission testing on June 15, 2023, the Ferrysburg Terminal loaded 248,691 gallons, or 941,295 liters of gasoline during the six-hour test period. US EPA Title 40 CFR, Part 60 Subpart XX §60.503 (c)(1) requires a minimum of 300,000 liters of gasoline during a six-hour period.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 Description of sampling and field procedures

Erthwrks Inc. conducted the VCU emission test following all procedures set forth in the US EPA 40 CFR 63 Subpart BBBBBB. As specified by this performance standard, Erthwrks utilized the following methods for the emission rate determination:

EPA Method 2A for VCU inlet flow rate
EPA Method 2B for VCU exhaust flow rate
EPA Method 3A for CO_2 concentration
EPA Method 10 for CO concentration
EPA Method 21 for VCU leak checks
EPA Method 25B for TOC inlet concentration
EPA Method 25A for TOC exhaust concentration
EPA Method 205 calibration gas dilution

Erthwrks Inc. utilized a mobile laboratory on site to conduct the emission testing. The Method 21 leak determination was conducted utilizing an RKI Eagle™ portable gas detector. This test was conducted at the beginning of the test period when tank trucks began loading. This analyzer employs a strong sample pump and meets all quality assurance specifications required by the method. Vapor at all potential leak sources in the terminal's vapor collection system were monitored while trucks were being loaded.

The rack back pressure determination was conducted using Testo 510i Bluetooth digital manometers. These manometers were installed between the truck and the vapor collection hose utilizing leak-tight adapting connections. Every loading position was tested at least once during the performance test as specified in US EPA 40 CFR 60 Subpart XX §60.503 (d)(2).

Inlet TOC concentration and flow rates were measured utilizing an American® turbine meter and an inlet sample system designed to continuously monitor the gas TOC concentration upstream of

the VCU. The inlet flow rate determination was conducted following all procedures and quality assurance as specified by Method 2A. The calibrated turbine meter, also known as an inferential meter, utilizes a rotor in the gas stream that turns at a speed proportional to the flow rate of the gas. This gas flow and the meter's temperature and static pressure were monitored and recorded on Erthwrks' data logging system. This data, along with the inlet TOC concentration measured with a Horiba NDIR Hydrocarbon Analyzer following all procedures set forth in Method 25B, allowed Erthwrks to determine the TOC mass flow rate to the VCU. The Method 25B sample line was not heated on this non-combustion, ambient, flammable source. This source meets the specification of Method 25A, Section 5.2 as an explosive atmosphere.

TOC emission rates were quantified using the procedures set forth in Subpart XX along with the other methods listed above. Utilizing US EPA Method 2B (Eq. 2B-1), in conjunction with US EPA Methods 3A and 10 for CO_2 and CO concentrations, exhaust flow rate was determined. TOC exhaust emissions were determined with Method 25B. The Method 25B sample line was not heated on this non-combustion, ambient, flammable source. This source meets the specification of Method 25A, Section 5.2 as an explosive atmosphere. Sample was extracted from the exhaust stack through a stainless-steel probe and Teflon sample line and analyzed with a NDIR Hydrocarbon Analyzer following all procedures and equipment set forth in the method. Using this TOC concentration, the exhaust flow rate, the density factor for the calibration gas given in US EPA 40 CFR 60 Subpart XX §60.503(c)(3), and the terminal bills of ladings, Erthwrks calculated the TOC emission rate in mg of total TOC per liters of gasoline loaded.

4.2 Description of Analytical Procedures (QAQC)

The TOC concentration determination followed all QAQC procedures as specified in the US EPA 40 CFR 60, Appendix A, Method 25A. 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 was recorded. The results of the CE test are acceptable if the responses for the low and mid-level calibration gasses are within ±5.0% of the predicted responses. The sample system response time was also recorded.

EPA Method 7E, Equation 7E-5B for Effluent Gas Concentration is applied to each of the 5-minute averages for CO and CO2. The data is valid if the calculated drift is within ±3.0% of the span value.

Table 3: Analytical Instrumentation

Effluent Tested	Analyzer Make/Model	Range	Detection Principle
Inlet TOC	Sick Maihak S710	60%	Non-Dispersive Infrared (NDIR)
Exhaust TOC	Sick Maihak S710	1000 ppm	Non-Dispersive Infrared (NDIR)
CO	Teledyne Model 300EM	1000 ppm	Non-Dispersive Infrared (NDIR)
CO_2	Teledyne Model 300EM	10 %	Non-Dispersive Infrared (NDIR)
Turbine Meter	American 8" GTX	60,000 SCFH	N/A

All supporting documentation used to quantify the results of this emission test is attached. The detailed results of emissions test are located in Appendix A. These detailed results include all the 5-min average results from Erthwrks' data logging system converted into the proper units and also includes the calculations for the formulation of the results. Erthwrks quality control documentation is found in Appendix B. This documentation demonstrates that the gaseous analyzers meet all the QA/QC specifications of the method. Appendix C contains all example calculations used to formulate the emission test results. The Erthwrks Sample System Diagram and the field data sheets used are located in Appendix D. Appendix E contains the raw data log records. These records show the 1-min average record of all data collected on Erthwrks' data logging system while the 5-min average records are located in Appendix F. All calibrations and certifications can be found in Appendix G. Appendix H contains the bills of ladings that document the total gasoline loaded during the testing period.

4.3 Discussion of sampling procedures or operational variances

A stratification test was not conducted for EPA Methods 3A and 10 as stratification was not expected due to the mechanical construction of the combustion zone and the exhaust stack. Conducting a representative stratification test on a unit with a constantly dynamic combustion zone is not possible. As specified in section US EPA Method 25A §6.1.2, sampling of the exhaust was conducted from the centrally located 10 percent area of the stack cross-section.

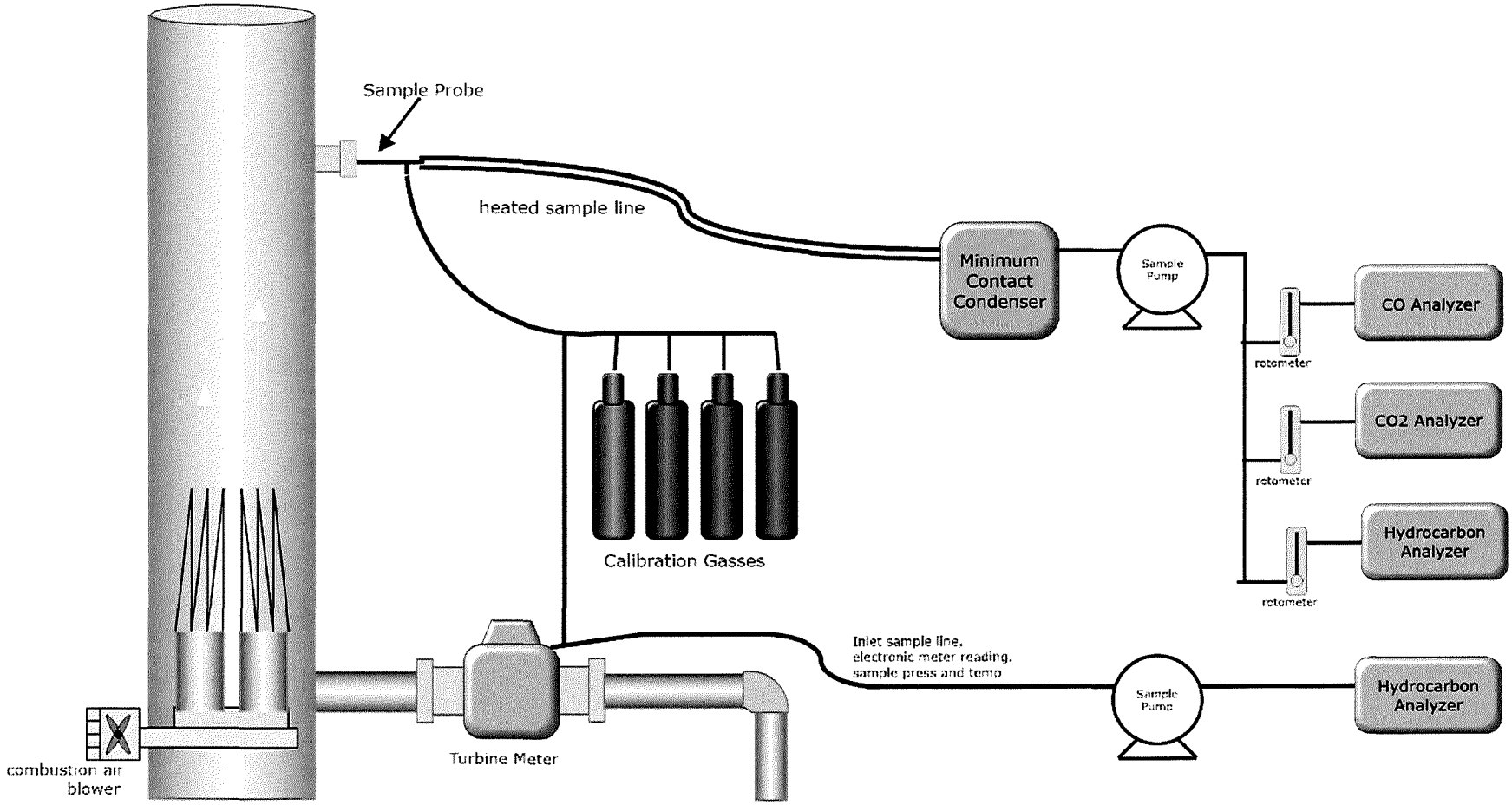

Figure 1: Sample System Diagram