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Emission Test Report

for

Buckeye Terminals, LLC

at the

Woodhaven Terminal in Woodhaven, MI
John Zink Vapor Combustor Unit (VCU)

subject to
EPA Title 40 CFR Part 63, Subpart BBBBBB
MDEQ Permit No. 21-14A

Prepared for:

BUCKEYE TERMINALS, LLC

Test Date: May 11, 2017
Erthwrks Project No. 7653c

1.0 INTRODUCTION

1.1 Identification, location and dates of tests

One John Zink Vapor Combustor Unit (VCU) was tested for Buckeye Terminals, LLC at their Woodhaven Terminal in Woodhaven, MI. The emission testing was conducted on May 11, 2017.

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 system 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 and the MDEQ Permit No. 21-14A.

Testing was conducted for the determination of Total Organic Compounds (TOC) mass emission rate. Exhaust Carbon Dioxide (CO_2) and Carbon Monoxide (CO) concentrations were also measured to calculate exhaust flow rate.

1.3 Description of Source

Buckeye Terminals, LLC owns and operates the Woodhaven Terminal in Woodhaven, MI. This bulk fuel terminal is designed to receive, store, and deliver fuel to tank trucks. Within this facility, the vapor combustor unit (VCU), in conjunction with all components of the vapor collection system, is in place in order to minimize the emissions of volatile organic compounds (VOC) during the loading of tank trucks.

The vapor combustor unit is a John Zink Vapor Combustor (VCU). The emissions are vented to the atmosphere from an exhaust stack approximately 35 feet above ground level (AGL). The VCU is used as the backup vapor control device at the Woodhaven Terminal and is only in operation when the primary vapor control device (VRU) is out of operation for maintenance or repairs. When in operation, the VCU is combusting vapors 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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2.0 SUMMARY OF RESULTS

Results of the stack testing on the VCU are summarized in Table 2. The sampling results indicate the facility is currently in compliance with the limits set forth in the 40 CFR 63 Subpart BBBBBB and in the MDEQ Permit No. 21-14A.

Table 2: Summary of Results

Regulation	Measured Results	Applicable Limit
Method 21—Vapor Leak	0 ppm	500 ppm Subpart BBBBBB
Rack Back Pressure	Highest Pressure: 5.50" H_2O	17.72" H_2O
TOC Emissions	5.66 mg/Liters loaded	6.0 mg/Liters loaded
Volume Loaded	721,353 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 vapor combustor unit, in conjunction with all components of the vapor collection system, is in place in order to minimize the emissions of volatile organic compounds (VOC) 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 head-space 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 Buckeye Woodhaven terminal also uses a vacuum assist or VAVAC™ technology, which uses a vapor blower to maintain a controlled vacuum inside the vapor collection arm connected to the loading rack header, eliminating/reducing fugitive emissions. The piping then vents the vapors, through various valves and flame arrestors, to the vapor combustor unit. 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 Buckeye Terminals, LLC Woodhaven Terminal is subject to the regulations set forth in the MDEQ Permit No. 21-14A and 40 CFR 63, Subpart BBBBBB.

3.3 Type and quantity of materials processed during tests

During the emission testing on May 11, 2017 of the Woodhaven Terminal, the VCU was operated with no assist gas for the duration of the test. The average stack temperature during active loading was 501 F. During the six-hour test period, 190,582 gallons, or 721,353 liters of gasoline product was loaded. **US EPA Title 40 CFR, Part 60, Subpart XX §60.503(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 CO2 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

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 Dwyer® Series 476A 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 NDIR Hydrocarbon Analyzer following all procedures set forth in Method 25B, allowed Erthwrks to determine the TOC mass flow rate to the VCU.

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 utilizing a sample system as specified by Method 25A. Sample was extracted from the exhaust stack through a heated sample line and analyzed with a FID 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 loading terminal bill 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 volatile organic compounds (VOC) 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 gasses (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.

After each compliance test run, the drift determination was conducted to validate the run data in accordance with **EPA Method 25A §8.6.2**. The run data is valid if the calculated drift is within ±3.0% of the span value (**EPA Method 25A §13.1.2**)

Table 3: Analytical Instrumentation

Effluent Tested	Analyzer Make/Model	Range utilized	Detection Principle
Inlet TOC	Horiba VIA-510	60%	Non-Dispersive Infrared (NDIR)
Exhaust TOC	CAI Model 600	1000 ppm	Flame Ionization Detector (FID)
CO	Teledyne Model 300EM	1000 ppm	Non-Dispersive Infrared (NDIR)
CO2	Teledyne Model 300EM	10 %	Non-Dispersive Infrared (NDIR)
Turbine Meter	American SN 122905	60,000 SCFH	NA

All supporting documentation used to quantify the results of this emission test are 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 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 the 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 bill of ladings that document the total gasoline loaded during the testing period.

4.3 Discussion of sampling procedures or operational variances

For consistency, the gaseous procedures for the determination CO_2 and CO followed all quality control procedures specified in EPA Method 25A. 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 of the stack.

The assist gas actuator is set to maintain temperatures in the VCU at a minimum of 800°F. During the test, the stack temperature did not achieve the minimum stack temperature and the assist gas actuator remained 100% open for the duration of the testing event.

Erthwrks experienced a sampling system malfunction during the test. As noted in Appendix A, the sample conditioner malfunctioned and sampling was suspended until the conditioner was repaired. The conditioner ensures that a dry sample is delivered to the CO and CO_2 analyzers. Upon completion of the repairs, sampling ensued and both the vapor volume and the fuel volume loaded during the tests delay were noted, and not included in any calculation.

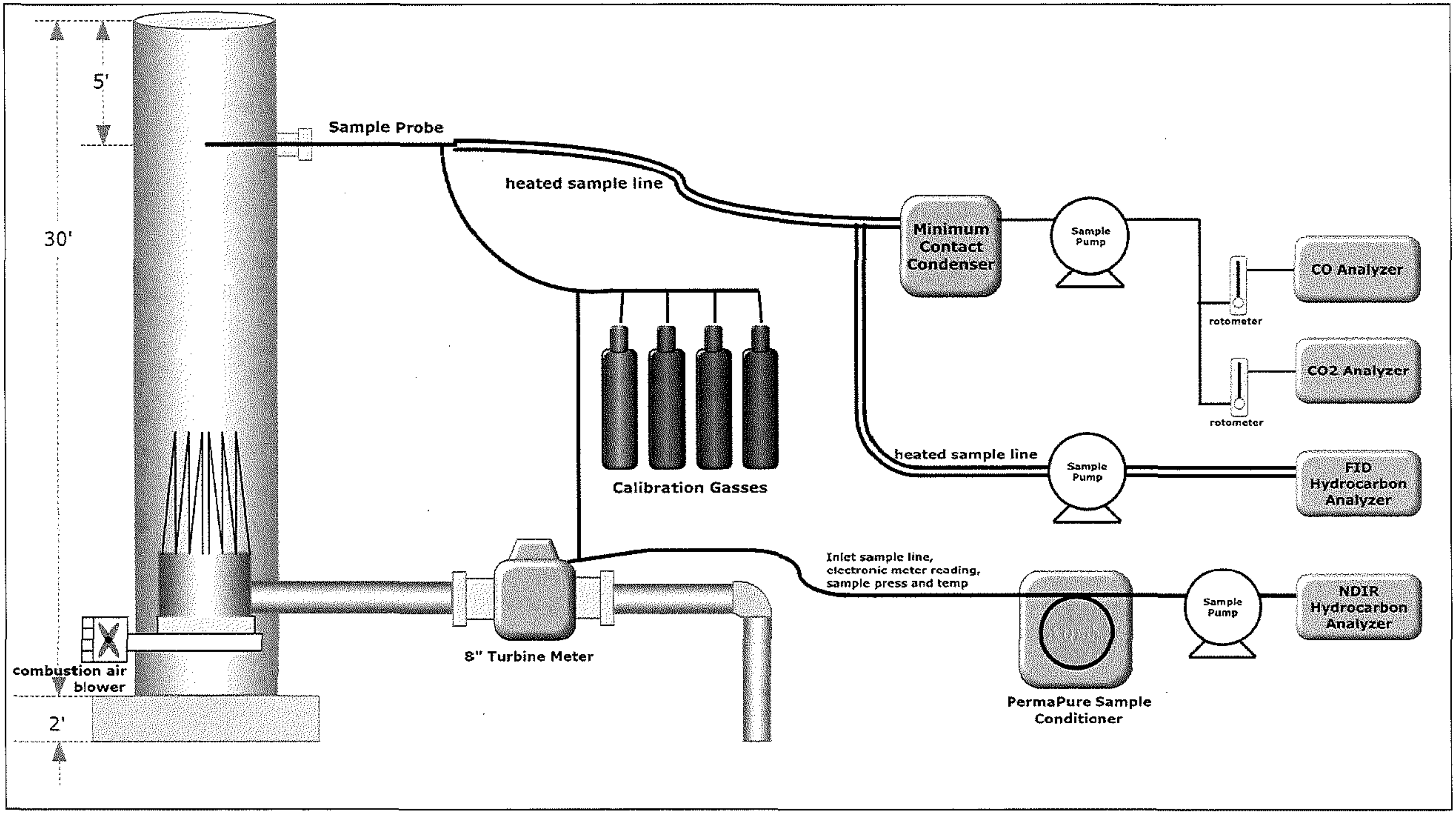

Figure 1: Sample System Diagram