



Source Test Report

Poet Biorefining – Caro, LLC
1551 Empire Drive
Caro, MI 48723

Sources Tested: EURTO, EUFBCOOLER,
EUTO & HRB, and EUDDGSSILO
Test Dates: October 21-24, 2024

Project No. AST-2024-4249

Prepared By
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Regulatory Information

Permit to Install (PTI) 39-19B & ROP N6996 b
Issuance Date July 31, 2024

Source Information

<i>Source Name</i>	<i>Source ID</i>	<i>Target Parameters</i>
Regenerative Thermal Oxidizer (RTO)	EURTO	SO ₂
Fluidized Bed Cooler	EUFB cooler	SO ₂ , PM, THC
Thermal Oxidizer and Heat Recovery Boiler	EUTO&HRB	SO ₂
Dried Distillers Grains and Solubles Silo	EUDDGSSILO	SO ₂

Contact Information

Test Location
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Alliance Technical Group, LLC (Alliance) has completed the source testing as described in this report. Results apply only to the source(s) tested and operating condition(s) for the specific test date(s) and time(s) identified within this report. All results are intended to be considered in their entirety, and Alliance is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Onsite testing was conducted in accordance with approved internal Standard Operating Procedures. Any deviations or problems are detailed in the relevant sections in the test report.

This report is only considered valid once an authorized representative of Alliance has signed in the space provided below; any other version is considered draft. This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.



Kenji Kinoshita
Alliance Technical Group, LLC

11/19/24

Date

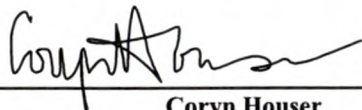


Tyler Branca
Alliance Technical Group, LLC

11/19/24

Date

I certify that I have personally examined the foregoing and am familiar with the information contained in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including possible fines and imprisonment.



Coryn Houser
POET Biorefining – Caro, LLC

11/19/24

Date

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Introduction

1.0 Introduction

Alliance Technical Group, LLC (Alliance) was retained by POET Biorefining – Caro, LLC (POET) to conduct compliance testing at the Caro, MI facility. The facility operates under the Michigan Department of Environment, Great Lakes, and Energy (EGLE) ROP N6996 b and Permit to Install No. 39-19B. Testing was conducted to determine the emission rates of sulfur dioxide (SO₂) from the EURTO, EUTO & HRB, and EUDDGSSILO. Testing was also conducted to determine the emission rates of SO₂, particulate matter (PM), and total hydrocarbons (THC) from the EUFBCOOLER.

1.1 Facility and Source Description

EURTO is a Regenerative Thermal Oxidizer that reduces particulate and VOC emissions from dryers. EUFBCOOLER is a Fluidized Bed Cooler. The baghouse recovers DDG product and reduces particulate emissions coming from the Fluid Bed. EUTO & HRB is a Thermal Oxidizer and Heat Recovery Boiler. This unit reduces particulate and VOC emissions from dryers. EUDDGSSILO is a silo for storage of DDG product. The baghouse recovers DDG product and reduces particulate emissions coming from the DDG Silo.

1.2 Project Team

Personnel involved in this project are identified in the following table.

Table 1-1: Project Team

Facility Personnel	Coryn Houser
Regulatory Personnel	Andrew Riley
Alliance Personnel	Tyler Branca Dennis Haynes Simon McCrary

1.3 Site Specific Test Plan/Test Protocol & Notification

Testing was conducted in accordance with the Site Specific Test Plan (SSTP) submitted to EGLE on September 17, 2024 by POET.

1.4 Test Program Notes

EUFBCOOLER Method 5/202 Run 2 was voided due to a plastic ice bag obstructing the filter holder at the end of the run. Due to this, a fourth run was conducted. The state observer requested that Run 2 is shown as a voided run in the report, see Appendix G.

Summary of Results

2.0 Summary of Results

Alliance conducted compliance testing at the Poet facility in Caro, MI October 23-25, 2024. Testing consisted of determining the emission rates of SO₂, PM, and THC at the exhaust of EURTO, EUTO & HRB, EUDDGSSILO, and EUFBCOOLER.

Tables 2-1 to 2-4 provide a summary of the emission testing results with comparisons to the applicable EGLE permit limits. Any difference between the summary results listed in the following tables and the detailed results contained in appendices is due to rounding for presentation.

Table 2-1: Summary of Results – EURTO

Run Number	Run 1	Run 2	Run 3	Average
Date	10/24/24	10/24/24	10/24/24	--
Volumetric Flow Rate, dscfm	11,923	11,872	11,830	11,875
Sulfur Dioxide Data				
Outlet Concentration, ppmvd	226.2	258.6	233.0	239.3
Outlet Emission Rate, lb/hr	26.9	30.6	27.5	28.4
Permit Limit, lb/hr	--	--	--	36
Percent of Limit, %	--	--	--	79

Table 2-2: Summary of Results – EUTO & HRB

Run Number	Run 1	Run 2	Run 3	Average
Date	10/23/24	10/23/24	10/23/24	--
Volumetric Flow Rate, dscfm	28,241	28,034	27,943	28,073
Sulfur Dioxide Data				
Outlet Concentration, ppmvd	43.5	40.2	43.3	42.3
Outlet Emission Rate, lb/hr	12.3	11.2	12.1	11.9
Permit Limit, lb/hr	--	--	--	12.5
Percent of Limit, %	--	--	--	95

Table 2-3: Summary of Results – EUDDGSSILO

Run Number	Run 1	Run 2	Run 3	Average
Date	10/25/24	10/25/24	10/25/24	--
Volumetric Flow Rate, dscfm	4,770	4,739	4,783	4,764
Sulfur Dioxide Data				
Outlet Concentration, ppmvd	0.74	0.85	0.74	0.78
Outlet Emission Rate, lb/hr	0.035	0.040	0.035	0.037
Permit Limit, lb/hr	--	--	--	1
Percent of Limit, %	--	--	--	4

Table 2-4: Summary of Results – EUFBCOOLER

Run Number	Run 1	Run 3	Run 4	Average
Date	10/23/24	10/23/24	10/23/24	--
Volumetric Flow Rate, dscfm	20,620	20,519	20,839	20,659
Sulfur Dioxide Data				
Outlet Concentration, ppmvd	14.8	14.7	14.2	14.5
Outlet Emission Rate, lb/hr	3.1	3.0	2.9	3.0
Permit Limit, lb/hr	--	--	--	3.81
Percent of Limit, %	--	--	--	79
Total Hydrocarbons Data				
Outlet Concentration, ppmvd	27.0	23.7	28.0	26.2
Outlet Emission Rate, lb/hr	3.8	3.3	4.0	3.7
Permit Limit, lb/hr	--	--	--	7.54
Percent of Limit, %	--	--	--	49
Filterable Particulate Matter Data				
Concentration, grain/dscf	0.0015	0.0011	0.0008	0.0011
Emission Rate, lb/hr	0.26	0.19	0.14	0.19
Permit Limit, lb/1000 lbs of gas	0.0028	0.0020	0.0015	0.0021
Permit Limit, lb/1000 lbs of gas	--	--	--	0.006
Percent of Limit, %	--	--	--	35
Condensable Particulate Matter Data				
Concentration, grain/dscf	0.0006	0.0005	0.0005	0.0005
Emission Rate, lb/hr	0.11	0.09	0.09	0.10
Total Particulate Matter Data				
Concentration, grain/dscf	0.002	0.002	0.001	0.002
Emission Rate, lb/hr	0.363	0.279	0.233	0.292
Permit Limit, lb/hr	--	--	--	0.65
Percent of Limit, %	--	--	--	45

Testing Methodology

3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix D.

Table 3-1: Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1 & 2	Full Velocity Traverses
Oxygen/Carbon Dioxide	3A	Instrumental Analysis
Moisture Content	4	Gravimetric Analysis
Particulate Matter	5 & 202	Isokinetic Sampling
Sulfur Dioxide	6C	Instrumental Analysis
Total Hydrocarbons	25A	Instrumental Analysis

3.1 U.S. EPA Reference Test Methods 1 and 2 – Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-1 (for isokinetic sampling) and/or Figure 1-2 (measuring velocity alone) in U.S. EPA Reference Test Method 1.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

Stack gas velocity pressure and temperature readings were recorded during each test run. The data collected was utilized to calculate the volumetric flow rate in accordance with U.S. EPA Reference Test Method 2.

3.2 U.S. EPA Reference Test Method 3A – Oxygen/Carbon Dioxide

The oxygen (O₂) and carbon dioxide (CO₂) testing were conducted in accordance with U.S. EPA Reference Test Method 3A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.7.

3.3 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content (BWS) was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of water or silica gel. Each impinger was analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

3.4 U.S. EPA Reference Test Methods 5 and 202 – Total Particulate Matter

The total particulate matter (filterable and condensable PM) testing was conducted in accordance with U.S. EPA Reference Test Methods 5 and 202. The complete sampling system consisted of a glass nozzle, glass-lined probe, pre-weighed quartz filter, coil condenser, un-weighed Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of a coiled condenser and four (4) chilled impingers. The first and second impingers were initially empty, the third contained 100 mL of de-ionized water and the last impinger contained 200-300 grams of silica gel. The un-weighed 90 mm Teflon filter was placed between the second and third impingers. The probe liner heating system was maintained at a temperature of $248 \pm 25^{\circ}\text{F}$, and the impinger temperature was maintained at 68°F or less throughout testing. The temperature of the Teflon filter was maintained greater than 65°F but less than or equal to 85°F .

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run. Condensate was collected in the first dry impinger, therefore the front-half of the sample train (the nozzle, probe, and heated pre-weighed filter) was removed in order to purge the back-half of the sample train (coil condenser, first and second impingers and CPM filter). A glass bubbler was inserted into the first impinger. If needed, de-ionized ultra-filtered (DIUF) water was added to the first impinger to raise the water level above the bubbler, then the coil condenser was replaced. Zero nitrogen was connected to the condenser, and a 60-minute purge at 14 liters per minute was conducted. After the completion of the nitrogen purge the impinger contents were measured for moisture gain.

The pre-weighed quartz filter was carefully removed and placed in container 1. The probe, nozzle and front half of the filter holder were rinsed three (3) times with acetone to remove any adhering particulate matter and these rinses were recovered in container 2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for filterable particulate matter analysis.

The contents of impingers 1 and 2 were recovered in container CPM Cont. #1. The back half of the filterable PM filter holder, the coil condenser, impingers 1 and 2 and all connecting glassware were rinsed with DIUF water and then rinsed with acetone, followed by hexane. The water rinses were added to container CPM Cont. #1 while the solvent rinses were recovered in container CPM Cont. #2. The Teflon filter was removed from the filter holder and placed in container CPM Cont. #3. The front half of the condensable PM filter holder was rinsed with DIUF water and then with acetone, followed by hexane. The water rinse was added to container CPM Cont. #1 while the solvent rinses were added to container CPM Cont. #2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for condensable particulate matter analysis.

3.5 U.S. EPA Reference Test Method 6C – Sulfur Dioxide

The sulfur dioxide (SO_2) testing was conducted in accordance with U.S. EPA Reference Test Method 6C. Data was collected online and reported in one-minute averages. The sampling system consisted of a heated stainless steel probe, Teflon sample line(s), gas conditioning system and the identified analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the source gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.7.

3.6 U.S. EPA Reference Test Method 25A – Total Hydrocarbons

The total hydrocarbons (THC) testing was conducted in accordance with U.S. EPA Reference Test Method 25A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, heated Teflon sample line(s) and the identified gas analyzer. The quality control measures are described in Section 3.8.

3.7 Quality Assurance/Quality Control – U.S. EPA Reference Test Methods 3A and 6C

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Low Level gas was introduced directly to the analyzer. After adjusting the analyzer to the Low-Level gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas. For the Calibration Error Test, Low, Mid, and High Level calibration gases were sequentially introduced directly to the analyzer. All values were within 2.0 percent of the Calibration Span or 0.5 ppmv/% absolute difference.

High or Mid-Level gas (whichever was closer to the stack gas concentration) was introduced at the probe and the time required for the analyzer reading to reach 95 percent or 0.5 ppmv/% (whichever was less restrictive) of the gas concentration was recorded. The analyzer reading was observed until it reached a stable value, and this value was recorded. Next, Low Level gas was introduced at the probe and the time required for the analyzer reading to decrease to a value within 5.0 percent or 0.5 ppmv/% (whichever was less restrictive) was recorded. If the Low-Level gas was zero gas, the response was 0.5 ppmv/% or 5.0 percent of the upscale gas concentration (whichever was less restrictive). The analyzer reading was observed until it reached a stable value and this value was recorded. The measurement system response time and initial system bias were determined from these data. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv/% absolute difference.

High or Mid-Level gas (whichever was closer to the stack gas concentration) was introduced at the probe. After the analyzer response was stable, the value was recorded. Next, Low Level gas was introduced at the probe, and the analyzer value recorded once it reached a stable response. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv/% absolute difference or the data was invalidated and the Calibration Error Test and System Bias were repeated.

Drift between pre- and post-run System Bias was within 3 percent of the Calibration Span or 0.5 ppmv/% absolute difference. If the drift exceeded 3 percent or 0.5 ppmv/%, the Calibration Error Test and System Bias were repeated.

To determine the number of sampling points, a gas stratification check was conducted prior to initiating testing. The pollutant concentrations were measured at three points (16.7, 50.0 and 83.3 percent of the measurement line). Each traverse point was sampled for a minimum of twice the system response time.

If the pollutant concentration at each traverse point did not differ more than 5 percent or 0.5 ppmv/0.3% (whichever was less restrictive) of the average pollutant concentration, then single point sampling was conducted during the test runs. If the pollutant concentration did not meet these specifications but differed less than 10 percent or 1.0 ppmv/0.5% from the average concentration, then three (3) point sampling was conducted (stacks less than 7.8 feet in diameter - 16.7, 50.0 and 83.3 percent of the measurement line; stacks greater than 7.8 feet in diameter - 0.4, 1.0, and 2.0 meters from the stack wall). If the pollutant concentration differed by more than 10 percent or 1.0

ppmv/0.5% from the average concentration, then sampling was conducted at a minimum of twelve (12) traverse points. Copies of stratification check data can be found in the Quality Assurance/Quality Control Appendix.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the Alliance server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at Alliance's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.

3.8 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 25A

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Within two (2) hours prior to testing, zero gas was introduced through the sampling system to the analyzer. After adjusting the analyzer to the Zero gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas, and the time required for the analyzer reading to reach 95 percent of the gas concentration was recorded to determine the response time. Next, Low and Mid-Level gases were introduced through the sampling system to the analyzer, and the response was recorded when it was stable. All values were less than +/- 5 percent of the calibration gas concentrations.

Mid-Level gas was introduced through the sampling system. After the analyzer response was stable, the value was recorded. Next, Zero gas was introduced through the sampling system, and the analyzer value recorded once it reached a stable response. The Analyzer Drift was less than +/- 3 percent of the span value.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the Alliance server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at Alliance's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.