BTEC Inc.

Main Stack RAA
Test Summary Report

Prepared for:

Marysville Ethanol

Marysville, Michigan

Marysville Ethanol LLC
2512 Busha Highway
Marysville, Michigan

Project No. 049AS-226600
August 24, 2017

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Executive Summary

BT Environmental Consulting, Inc. (BTEC) was retained by Marysville Ethanol to conduct a Relative Accuracy Audit (RAA) of the nitrogen oxides (NOx) Predictive Emissions Monitoring Systems (PEMS) serving the boiler \ regenerative thermal oxidizer \ heat steam recovery generator (Main Stack). The Main Stack fires natural gas (NG) and is designated as (EU-RTO&HSRG, Stack No. S-10). The RAA testing was conducted on August 9, 2017.

The RAA testing was conducted to satisfy the requirements of Performance Specification 16 (PS-16, *"Specifications and Test Procedures for Predictive Emission Monitoring Systems in Stationary Sources"*) codified at Title 40, Part 60, Appendix B of the Code of Federal Regulations. Testing of the main stack consisted of three, 30-minute test runs at normal load conditions.

The results of the RAA test program are summarized in the following Executive Summary Table E-1.

Table E-1

Summary of Marysville Ethanol Main Stack

NOx Lb/MMBtu PEMS RAA Results

Test Date: August 9, 2017

Source Name	RM NOx Lb/MMBtu	PEMS NOx Lb/MMBtu	% Relative Accuracy Audit	40 CFR Part 60 % Relative Accuracy Limit
Main Stack	0.075	0.070	6.2	20

1.0 Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Marysville Ethanol to conduct a Relative Accuracy Audit (RAA) at the Marysville Ethanol facility located in Marysville, Michigan. The RAA was performed on an individual Predictive Emission Monitoring Systems (PEMS) serving the boiler \ regenerative thermal oxidizer \ heat steam recovery generator (Main Stack). The process fires natural gas (NG) and is designated as EU-RTO&HSRG, (Stack No. S-10).

The testing was performed to demonstrate compliance with Michigan Department of Natural Resources and Environment Air Quality Division (MDNRE) Permit to Install No. 175-05D and in accordance with Appendix A, 40 CFR, Part 60, subpart Db, U.S. EPA Reference Methods 3A and 7E found in 40 CFR, Part 60, Appendix A and Performance Specifications (PS) 2, 3 and 16 stipulated in 40 CFR, Part 60, Appendix B. The testing on the main stack consisted of three, 30-minute test runs while combusting pipeline NG. The test runs were performed to also be in accordance with Performance Specification 16 "Specifications and Test Procedures for Predictive Emission Monitoring Systems in Stationary Sources".

The RAA testing was conducted on August 9, 2017. Mr. Matthew Young and Mr. Dave Trahan with BTEC performed the testing.

2.0 Process Description

The Marysville Ethanol facility located in Marysville, Michigan operates two NG fired 45 MMBtu/hr dryers and a 125 MMBtu/hr natural gas fired recuperative thermal oxidizer (RTO) with a heat recovery steam generator (HRSG). The RTO controls emissions from several emission units. Low-NOx combustors minimize the emissions of nitrogen oxides from the process.

2.1 Predictive Emissions Monitoring System (PEMS) Description

The SmartCEMS™ -60 PEMS provides continuous data recording and report generation for compliance with 40 CFR Part 60 regulations. The data acquisition system provides a secure and reliable means of collecting and retrieving compliance data. This application has been customized to meet the requirements of gas-fired boiler under 40 CFR Part 60, Subpart Db; and as a predictive emissions monitoring system (PEMS), an alternative to continuous emissions monitoring under 40 CFR Part 60, Appendix B, PS-16.

SmartCEMS™-60 was designed to operate on a personal computer with a standard interface to the boiler and a relational database such as the one provided with Trace Environmental Systems installed at Marysville Ethanol. The application itself actually consists of two independent databases and three configurable application modules. The first database is secured and contains only data (both raw collected data that is not editable and historical data formatted as specified by the applicable regulations) as well

as a compliance message archive with operator comments. The second database contains compliance reporting data including collections statuses, summarized and calculated fields, and formatted electronic data reports (EDR) components.

The first application is the data acquisition module that runs on startup of the system and collects the data continuously providing compliance emissions data for reporting purposes. There are two other independent SmartCEMS™ components that work with the data acquisition service. The second application provides the operator interface for display of real-time data, display and acknowledgement of compliance alarms, and input of operator data including gas sampling results and certification test results. The third application provides the reporting and EDR generation capacities. Both of these applications support the operator and interface with the data and the data acquisition services and can be run from any workstation on the local area network providing information on the compliance status of the units in real-time.

The following Serial Numbers apply to the SmartCEMS™-60 Analyzers at Marysville Ethanol:

Unit	Model	Serial Number
EU-RTO&HSRG	SmartCEM-60™ Analyzer	1.30696

Process data includes NOx ppm, O_2%, fuel flow rate, and steam load. The process data can be found in Appendix B.

3.0 Sampling and Analytical Methodologies

Sampling and analytical methodologies are summarized in Sections 3.1 through 3.3. A Schematic drawing of BTEC's continuous emissions monitoring system is presented as Figure 1. Traverse point locations for the Main Stack are illustrated in Figure 2.

3.1 Continuous Emissions Monitoring

Measurement of exhaust gas concentrations was conducted utilizing the following reference test methods codified at 40 CFR 60, Appendix A:

- Method 3A- Determinations of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources;
- Method 7E - Determination of Nitrogen Oxides Emissions From Stationary Sources;
- Performance Specification 2 – Specifications and Test Procedures for SO_2 and NO_x Continuous Emission Monitoring Systems in Stationary Sources;

- Performance Specification 3 – Specifications and Test Procedures for O_2 and CO_2 Continuous Emission Monitoring Systems in Stationary Sources; and,
- Performance Specification 16 – Specifications and Test Procedures for Predictive Emission Monitoring Systems in Stationary Sources.

BTEC's extractive monitors require that the effluent gas sample be conditioned to eliminate any possible interference (i.e., water vapor and/or particulate matter) before being transported and injected into each analyzer. All components of the sampling system that contact the sample were constructed of Type 316 stainless steel, Pyrex glass or Teflon®. The output signal from each monitor was recorded at 10-second intervals on a PC equipped with Labview® II data acquisition software (DAS). The samples were extracted from the stack using a heated sample probe/filter assembly, heated sample line, stack gas conditioner with a Teflon diaphragm pump and routed through a distribution manifold for delivery to the analyzers. The configuration of the sampling system allowed for the injection of calibration gases directly to the analyzers or through the sampling system. All monitors in use were calibrated with U.S. EPA Protocol No. 1 calibration gases and operated to insure that zero drift, calibration gas drift, and calibration error met the specified method requirements. Copies of the Protocol gas certificates can be found in Appendix C.

The sample gas was extracted at three points through a heated stainless steel probe positioned at approximately 16.7%, 50% and 83.3% of the sample stream diameter as described by 40 CFR Part 60, Appendix B Performance Specification 2 Section 8.1.3.2 and illustrated in Figure 2. Three 30-minute test runs were conducted on the PEM system. A diagram of the reference monitoring system is illustrated in Figure 1.

The boiler NO_X concentrations were measured in parts per million (ppm), converted to an emission rate and reported as Lb/MMBtu, using equation 19-1 of U.S. EPA Method 19 of Appendix A, 40 CFR 60. Oxygen concentrations are reported in percent (%).

3.2 Oxygen (USEPA Method 3A)

A M&C PMA 100L non-dispersive infra-red (NDIR) analyzer was used to measure O_2 concentrations following the guidelines of U.S. EPA Method 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from a Stationary Source (Instrumental Analyzer Procedure)", in conjunction with Performance Specification No. 3 of Appendix B, 40 CFR 60. The analyzers were set at 25% instrument span and calibrated before the RAA with zero nitrogen and high range USEPA Protocol 1 span gas (80 to 100% of span). Following calibration, a mid range USEPA Protocol 1 gas (40 to 60% of span) was introduced. The response error did not exceed 2% of the instrument span, as required by the method. Calibration error results are presented in Appendix A. Calibration drift checks were performed at the completion of each test run.

3.3 Nitrogen Oxides (USEPA Method 7E)

A Thermo Environmental Model 42i-HL Chemiluminescence analyzer was used to measure parts per million of nitrogen oxides in the dry sample gas following the guidelines of U.S. EPA Method 7E, "Determination of Nitrogen Oxides from Stationary Sources (Instrumental Analyzer Procedure)", in conjunction with Performance Specification No. 2 of Appendix B, 40 CFR 60. The analyzer measures the concentration of NO_x by converting NO_x to NO and then measuring the light emitted by the reaction of NO with ozone. The NO_x analyzer was set at 0-100 ppm instrument span during the RAA. The NO_x sampling system was calibrated at three points: zero, mid range (40-60% of span), and high range (80-100% of span) with USEPA Protocol 1 calibration gases. BTEC conducted a NO_2 to NO conversion efficiency tests, as specified in U.S. EPA Method 7E on the analyzer. The results of the NO_2 to NO conversion efficiency test can be found on the enclosed compact disk.

4.0 Test Results

All PEMS associated with the Main Stack tested at Marysville Ethanol passed the Relative Accuracy Audit.

The Main Stack PEMS results are expressed in Lb/MMBtu. The 40 CFR Part 60 requires that relative accuracy for the NO_x system be less than or equal to 20% when expressed as a percentage of the average reference method result in Lb/MMBtu. PS-16, section 13.1 states that "The RA must not exceed 20% if the PEMS measurements are between 100 (or 0.20 Lb/MMBtu) and 10 ppm (or 0.05 Lb/MMBtu)." The percent relative accuracy for the Main Stack PEMS NOx Lb/MMBtu was 6.2. Relative Accuracy was calculated utilizing equation 16-9 contained in PS-16.

The results of all testing are presented in Table 1. The following information is appended:

A BTEC Calibration Error and Drift Correction Data
B Marysville Ethanol PEMS RAA Data
C BTEC Field Data and Span Gas Certification Documentation
D Compact Disk with all BTEC's CEMS Data Files

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Limitations

The information and opinions rendered in this report are exclusively for use by Marysville Ethanol. BTEC will not distribute or publish this report without Marysville Ethanol's consent except as required by law or court order. BTEC accepts responsibility for the competent performance of its duties in executing the assignment and preparing reports in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages.

This report was prepared by: _____
Matthew Young
Project Manager

This report was reviewed by: _____
Brandon Chase
QA/QC Manager

Table 1
Main Stack PEMS RAA Results Summary
Marysville Ethanol, LLC
Marysville, Michigan
Test Date: August 9, 2017

Test Run	RM NOx Concentration (ppmv)	PEMS NOx Concentration (ppmv)	RM O_2 Concentration (%)	PEMS O_2 Concentration (%)	RM NOx Emission Rate (lbs/MMBtu)	PEMS NOx Emission Rate (lbs/MMBtu)	Run Differences NOx Emission Rate (lbs/MMBtu)
1	60.08	55.15	3.86	3.864	0.077	0.070	0.006
2	58.97	54.59	3.67	3.95	0.074	0.070	0.004
3	58.49	55.55	3.76	3.849	0.074	0.071	0.003
Averages:	59.18	55.10	3.76	3.89	0.075	0.070	0.005

Parameter	Relative Accuracy (RA)
NOx Emission Rate	6.2

F-Factor = 8710

40 CFR 60, Appendix B, Performance Specification 16, Equation 16-9:

$$RAA = \frac{(PEMS\ Avg. - RM\ Avg.)}{(RM\ Avg.)} \times 100$$

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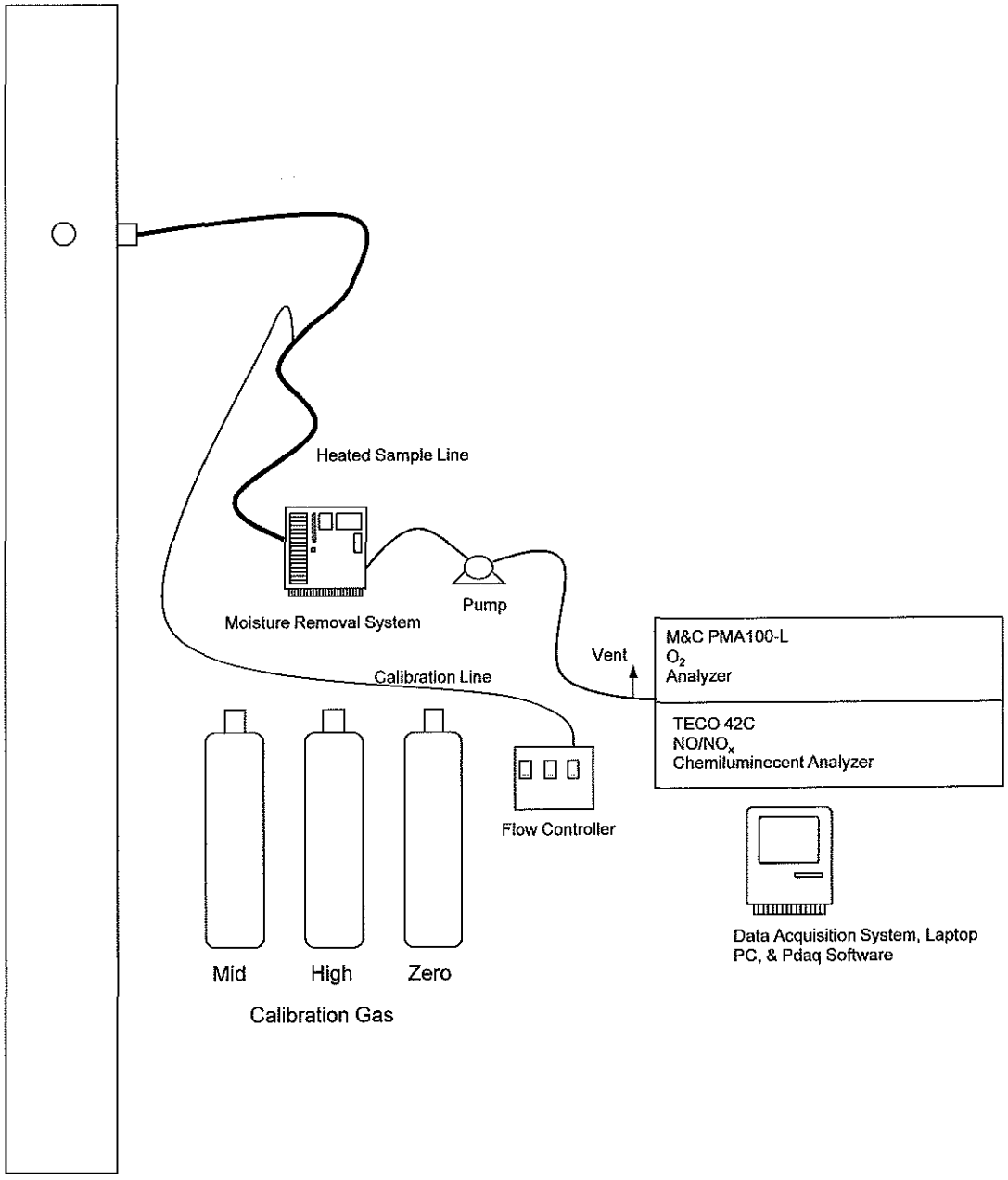

Figure No. 1

Site:	Sampling Date:	
USEPA Method 3A and 7E Marysville Ethanol, LLC Marysville, Michigan	August 9, 2017	BT Environmental Consulting Inc. 4949 Fernlee Ave Royal Oak, MI 48073

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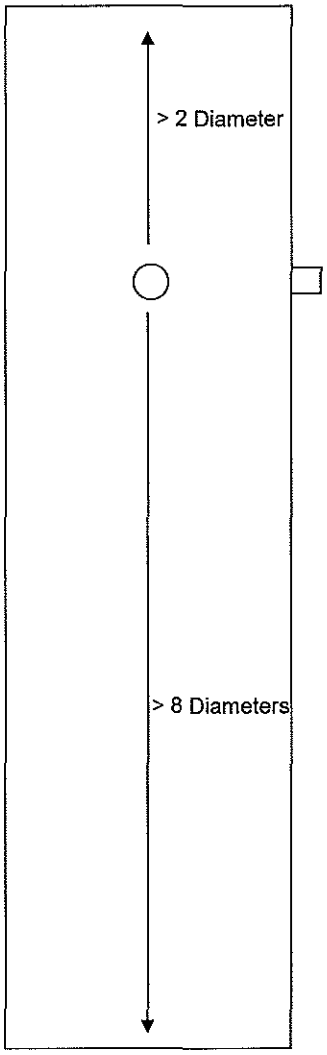
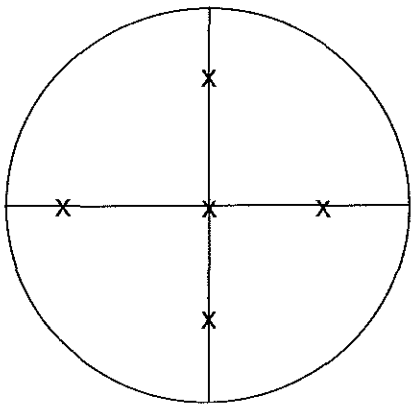
diameter = 83 inches





Not to Scale

Points	Distance "
1	9.0
2	27.0
3	45.0

Figure No. 2

Site: **Main Stack** **Marysville Ethanol, LLC** **Marysville, Michigan**	**Sampling Date:** **August 9, 2017**	**BT Environmental Consulting, Inc.** **4949 Fernlee** **Royal Oak, Michigan 48073**