CONTINUOUS EMISSIONS MONITORING SYSTEM
RELATIVE ACCURACY DETERMINATION

Performed For
Teledyne Monitor Labs

Performed At
Resolute Forest Products
Utility Boiler 1 (EUBOILER)
Menominee, Michigan

Test Date
May 11, 2022

Report No.
TRC Environmental Corporation Report 487931

Report Submittal Date
June 13, 2022

TRC Environmental Corporation
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USA

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Report Certification

I certify that to the best of my knowledge:

- Testing data and all corresponding information have been checked for accuracy and completeness.
- Sampling and analysis have been conducted in accordance with the approved protocol and applicable reference methods (as applicable).
- All deviations, method modifications, or sampling and analytical anomalies are summarized in the appropriate report narrative(s).

David A. Wells

Dave Wells
Project manager

June 13, 2022
Date

TRC was operating in conformance with the requirements of ASTM D7036-04 during this test program.

Bruce Randall
TRC Emission Testing Technical Director

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CONTINUOUS EMISSIONS MONITORING SYSTEM
RELATIVE ACCURACY DETERMINATION

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed a continuous emissions monitoring system (CEMS) relative accuracy test on May 11, 2022, at the Resolute Forest Products Utility Boiler in Menominee, Michigan. The tests were authorized by and performed for Teledyne Monitor Labs.

The purpose of this test program was to evaluate the relative accuracy (RA) of the nitrogen oxides (NO_x), and oxygen (O_2) CEMS on Utility Boiler 1 (EUBOILER) during normal operating conditions. The test program was conducted according to the TRC site-specific test plan.

1.1 Project Contact Information

Participants		
Test Facility	Resolute Forest Products 701 Fourth Avenue Menominee, Michigan 49858	Mr. David Spitzer Midwest Regional Service Manager 859-322-8032 (phone) David.spitzer@teledyne.com
Test Coordinator	Teledyne Monitor Labs 7493 Crestwood Ct Florence, KY 41042	
Air Emissions Testing Body (AETB)	TRC Environmental Corporation 7521 Brush Hill Road Burr Ridge, Illinois 60527	Mr. David A. Wells Senior Project Manager 312-533-2037 (phone) 312-533-2070 (fax) dwells@trccompanies.com

The tests were conducted by David Wells and Ted Kalisz of TRC. Documentation of the on-site ASTM D7036-04 Qualified Individual (QI) can be located in the appendix to this report.

Nobody from the Michigan Department of Environmental, Great Lakes, and Energy (EGLE) of Air Quality Division observed the testing.

1.2 Process Description

Resolute Forest Products operates a 162 MMBtu/hr natural gas fired boiler using low NO_x burners and flue gas recirculation at its facility in Menominee, Michigan. The boiler provides steam for building heating and process use within the plant. Flue gases generated in the boiler, exhaust through a duct breaching and then a stack to atmosphere.

2.0 SUMMARY OF RESULTS

The relative accuracies of the CEMS are as follows:

			Performance Specifications (40CFR60)		CEMS Performance
Load	Parameter	Units	Specification No.	Acceptance Criteria	Relative Accuracy
> 50%	NO_X	ppmvd	2	RA ≤ 20%	6.40 %
> 50%	NO_X	lb/MMBtu	2	RA ≤ 20%	6.05 %
> 50%	O_2	%	3	RA ≤ 1.0% difference	0.00 %

3.0 DISCUSSION OF RESULTS

The complete test results from this program are tabulated in Section 6.0.

The data acquisition and handling system (DAHS) computer printout for the same time periods as the RM testing was used to determine the relative accuracy. The watches of the test crew were synchronized with the CEMS prior to testing.

No problems were encountered with the testing equipment during the course of the test program. Source operation appeared normal during the entire test program and operated at more than 50 percent of normal load. The CEMS operation appeared normal with no apparent problems during sampling. No changes or problems were encountered that required modification of any procedures presented in the test plan. No adverse test or environmental conditions were encountered during the conduct of this test program. Operating data was recorded by plant personnel and is appended to this report.

4.0 TEST PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed in accordance with the methods presented in the following sections. Where applicable, the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 was used to supplement procedures.

4.1 Determination of the Concentration of Gaseous Pollutants Using a Multi-Pollutant Sampling System

Concentrations of the pollutants in the following sub-sections were determined using one sampling system. The number of points at which sample was collected was determined in accordance with Method 40CFR60 specifications.

A straight-extractive sampling system was used. A data logger continuously recorded pollutant concentrations and generated one-minute averages of those concentrations. All calibrations and system checks were conducted using USEPA Protocol gases. Three-point linearity checks were performed prior to sampling, and in the event of a failing system bias or drift test (and subsequent corrective action). System bias and drift checks were performed using the low-level gas and either the mid- or high-level gas prior to and following each test run.

Analyzer interference tests were conducted in accordance with the regulations in effect at the time that TRC placed an analyzer model in service.

4.1.1 O_2 Determination by USEPA Method 3A

This method is applicable for the determination of O_2 concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The O_2 analyzer was equipped with a paramagnetic-based detector.

4.1.2 NO_x Determination by USEPA Method 7E

This method is applicable for the determination of NO_x concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The NO_x analyzer utilized a photomultiplier tube to measure the linear and proportional luminescence caused by the reaction of nitric oxide and ozone.

4.2 Determination of F-Factors by USEPA Method 19

This method is applicable for the determination of the pollutant emission rate using oxygen (O_2) or carbon dioxide (CO_2) concentrations and the appropriate F factor (the ratio of combustion gas volumes to heat inputs) and the pollutant concentration. The appropriate F-Factor was selected from Table 19-2 of Method 19.

5.0 QUALITY ASSURANCE PROCEDURES

TRC integrates our Quality Management System (QMS) into every aspect of our testing service. We follow the procedures specified in current published versions of the test Method(s) referenced in this report. Any modifications or deviations are specifically identified in the body of the report. We routinely participate in independent, third party audits of our activities, and maintain:

- Accreditation from the Louisiana Environmental Laboratory Accreditation Program (LELAP);
- Accreditation from the Stack Testing Accreditation Council (STAC) and the American Association for Laboratory Accreditation (A2LA) that our operations conform with the requirements of ASTM D 7036 as an Air Emission Testing Body (AETB).

These accreditations demonstrate that our systems for training, equipment maintenance and calibration, document control and project management will fully ensure that project objectives are achieved in a timely and efficient manner with a strict commitment to quality.

All calibrations are performed in accordance with the test Method(s) identified in this report. If a Method allows for more than one calibration approach, or if approved alternatives are available, the calibration documentation in the appendices specifies which approach was used. All measurement devices are calibrated or verified at set intervals against standards traceable to the National Institute of Standards and Technology (NIST). NIST traceability information is available upon request.

ASTM D7036-04 specifies that: *"AETBs shall have and shall apply procedures for estimating the uncertainty of measurement. Conformance with this section may be demonstrated by the use of approved test protocols for all tests. When such protocols are used, reference shall be made to published literature, when available, where estimates of uncertainty for test methods may be found."* TRC conforms with this section by using approved test protocols for all tests.

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6.0 TEST RESULTS SUMMARIES

RATA Type: Nitrogen Oxides (NO_X), ppm
Regulation: 40CFR60
RM Used: 7E

Customer:		Resolute Forrest Products			Project #:	487931		
Unit ID:		Boiler 1			CEM Model:	Teledyne		
Sample Loc:		Stack			CEM Serial #:	861		
Use? 1 = Y 0 = N	Test Run	Date	Start Time	End Time	RM NO_X ppmvd	CEM NO_X ppmvd	(RM-CEM) Difference (di)	Unit Load (lb/hr)
1	1	5/11/22	6:35	6:55	42.6	39.9	2.700	70,872.0
1	2	5/11/22	7:03	7:23	40.6	38.8	1.800	71,936.5
0	3	5/11/22	7:31	7:51	45.4	42.5	2.900	73,297.6
1	4	5/11/22	7:58	8:18	43.1	40.6	2.500	72,591.3
1	5	5/11/22	8:26	8:46	42.9	40.4	2.500	71,731.1
1	6	5/11/22	8:53	9:13	42.9	40.3	2.600	71,648.8
1	7	5/11/22	9:20	9:40	42.9	40.3	2.600	71,138.9
1	8	5/11/22	9:47	10:07	42.9	40.4	2.500	70,917.7
1	9	5/11/22	10:14	10:34	42.7	40.0	2.700	70,156.7
1	10	5/11/22	10:41	11:01	42.8	40.1	2.700	71,463.3

n	9	
t(0.975)	2.306	
Mean RM Value	42.600	RM
Mean CEM Value	40.089	CEM avg
Mean Difference	2.511	d avg
Standard Deviation	0.280	sd
Confidence Coefficient	0.216	CC
RA based on RM	6.40	%

RATA Type: Nitrogen Oxides (NO_X), lb/MMBtu
Regulation: 40CFR60
RM Used: 3A, 7E

Customer:	Resolute Forrest Products	Project #:	487931
Unit ID:	Boiler 1	CEM Model:	Teledyne
Sample Loc:	Stack	CEM Serial #:	861

Use? 1 = Y 0 = N	Test Run	Date	Start Time	End Time	RM NO_X lb/MMBtu	CEM NO_X lb/MMBtu	(RM-CEM) Difference (di)	Unit Load (lb/hr)
1	1	5/11/22	6:35	6:55	0.056	0.052	0.004	70,872.0
1	2	5/11/22	7:03	7:23	0.053	0.050	0.003	71,936.5
0	3	5/11/22	7:31	7:51	0.059	0.055	0.004	73,297.6
1	4	5/11/22	7:58	8:18	0.056	0.053	0.003	72,591.3
1	5	5/11/22	8:26	8:46	0.056	0.053	0.003	71,731.1
1	6	5/11/22	8:53	9:13	0.056	0.053	0.003	71,648.8
1	7	5/11/22	9:20	9:40	0.056	0.053	0.003	71,138.9
1	8	5/11/22	9:47	10:07	0.056	0.053	0.003	70,917.7
1	9	5/11/22	10:14	10:34	0.056	0.053	0.003	70,156.7
1	10	5/11/22	10:41	11:01	0.056	0.053	0.003	71,463.3

n	9	
t(0.975)	2.306	
Mean RM Value	0.056	RM avg
Mean CEM Value	0.053	CEM avg
Mean Difference	0.0031	d avg
Standard Deviation	0.000	sd
Confidence Coefficient	0.000	CC
RA based on RM	6.05	%

RATA Type: Oxygen (O_2), % by volume
Regulation: 40CFR60
RM Used: 3A

Customer:		Resolute Forrest Products			Project #:	487931		
Unit ID:		Boiler 1			CEM Model:	Teledyne		
Sample Loc:		Stack			CEM Serial #:	861		
Use? 1 = Y 0 = N	Test Run	Date	Start Time	End Time	RM O_2 % v/v dry	CEM O_2 % v/v dry	(RM-CEM) Difference (di)	Unit Load (lb/hr)
1	1	5/11/22	6:35	6:55	4.3	4.3	0.000	70,872.0
1	2	5/11/22	7:03	7:23	4.1	4.1	0.000	71,936.5
1	3	5/11/22	7:31	7:51	4.1	4.1	0.000	73,297.6
0	4	5/11/22	7:58	8:18	4.1	4.2	-0.100	72,591.3
1	5	5/11/22	8:26	8:46	4.3	4.3	0.000	71,731.1
1	6	5/11/22	8:53	9:13	4.3	4.3	0.000	71,648.8
1	7	5/11/22	9:20	9:40	4.3	4.3	0.000	71,138.9
1	8	5/11/22	9:47	10:07	4.3	4.3	0.000	70,917.7
1	9	5/11/22	10:14	10:34	4.4	4.4	0.000	70,156.7
1	10	5/11/22	10:41	11:01	4.4	4.4	0.000	71,463.3

n	9	
t(0.975)	2.306	
Mean RM Value	4.278	RM avg
Mean CEM Value	4.278	CEM avg
Mean Difference	0.000	d avg
Standard Deviation	0.000	sd
Confidence Coefficient	0.000	CC
RA based on RM	0.00	%
RA (Absolute Mean Difference)	0.00	%vol diff.

APPENDIX

AETB and QI Information Summary

Facility Name:	Resolute Forest Products
Location:	Utility Boiler 1
Test Date:	May 11, 2022

Test Parameters:	Methods 3A and 7E
QI Last Name:	Wells
QI First Name:	David
QI Middle Initial:	A.
AETB Name:	TRC Environmental Corporation
AETB Phone No:	312-533-2037
AETB Email:	Dwells@trccompanies.com
Group 3 Exam Date:	10-31-2017
Provider Name:	Source Evaluation Society
Provider Email:	qstiprogram@gmail.com
Provider Name:	TRC Environmental Corporation
Provider Email:	emackinnon@trccompanies.com