CONTINUOUS EMISSIONS MONITORING SYSTEM RELATIVE ACCURACY TEST AUDIT DETERMINATION

Performed At
Otsego Paper, Inc.
Otsego Facility
EUTURBINE1 (North) and EUTURBINE2 (South)
Otsego, Michigan

Test Date
April 15, 2014

Report No.
TRC Environmental Corporation Report 214112A

Report Submittal Date
May 15, 2014

TRC Environmental Corporation
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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).

Paul Coleman
Project Manager

Nizar Hindi
Principal Consultant

May 15, 2014
Date

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

Jeffrey W. Burdette
TRC Air Measurements Technical Director

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CONTINUOUS EMISSIONS MONITORING SYSTEM RELATIVE ACCURACY TEST AUDIT DETERMINATION

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed an oxides of nitrogen (NO_x) and oxygen (O_2) relative accuracy test audit (RATA) determination of the continuous emission monitoring system (CEMS) associated with the natural gas fired combustion turbines EUTURBINE1 (North) and EUTURBINE2 (South) on April 15, 2014 at the Otsego Paper, Inc. facility located in Otsego, Michigan. The tests were authorized by and performed for Otsego Paper, Inc.

This test program was performed to demonstrate compliance with Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. MI-ROP-A0023-2013 and the CAIR Ozone Nitrogen Oxide Budget Permit No. MI-NOO-55799-2013 in Appendix 9 of the ROP.

1.1 Project Contact Information

Participants		
Test Facility	Otsego Paper, Inc. Otsego Facility 320 N. Farmer Street Otsego, Michigan 49078	Gary Roys Environmental Compliance Manager 269-384-6345 groys@usg.com
Air Emissions Testing Body (AETB)	TRC Environmental Corporation 7521 Brush Hill Road Burr Ridge, Illinois 60527	Benigno Cacao Field Team Leader 312-533-2042 bcacao@trcsolutions.com
State Representative	MDEQ Kalamazoo District Office 7953 Adobe Road Kalamazoo, Michigan 49009	Dale Turton, P.E. 269-567-3554 turtond@michigan.gov

The tests were coordinated through Gary Roys, Environmental Compliance Manager, of Otsego Paper and conducted by Ryan Novosel and Benigno Cacao of TRC. Dale Turton of Michigan Department of Environmental Quality (MDEQ) observed the testing. Documentation of the on-site ASTM D7036-04 Qualified Individual(s) (QI) can be found in the appendix to this report.

2.0 FACILITY DESCRIPTION

Otsego Paper, Inc is a subsidiary of the United States Gypsum Company. The facility manufactures gypsum paper.

The Otsego Paper facility produces electricity from two (2) Mars T-15000 gas turbines, designated as EUTURBINE1 and EUTURBINE2, with a maximum heat input rate of 141.5 million British thermal unit per hour (MMBtu/hr) at low temperature operating conditions as measured on a higher heating value (HHV) basis. Energy is generated at the combustion turbine by drawing in ambient air by means of burning fuel and expanding the hot combustion gases in the turbine. The hot exhaust gases of each turbine are directed to a multi-pressure ABCO heat recovery steam generator (HRSG). There are also natural gas-fired duct burners associated with each HRSG and coupled to a turbine, designated as EUDUCTBURNER1 and EUDUCTBURNER2, respectively.

The facility has one paper machine, No. 1 Paper Machine (EUPAPERMACHINE1), used to produce paper from 100 percent recycle stock and corrugated material. The paper machine has three fourdriniers and is capable of producing a triple ply sheet.

Plant capacity for base load operations is 11 megawatts (MW) for each turbine and 160,000 pounds per hour (lb/hr) of steam for each HRSG.

EUTURBINE1 and EUTURBINE2 each have a maximum heat input rate of 141.5 MMBtu/hr at low temperature operating conditions.

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3.0 SUMMARY OF RESULTS

3.1 CEMS RATA Test Matrix

Parameter	Reference Methods (RM)	No. of Test Runs	Test Run Length (min)
NO_X	7E, 3A	10	21
O_2	3A	10	21

3.2 CEMS RATA Results

EUTURBINE1

Load (MW)	Parameter	Units	Performance Specifications (40CFR75)		CEMS Performance	
			Semi-Annual	Annual	Relative Accuracy	Bias Adjustment Factor
~10.8	NO_X	lb/MMBtu	7.5% < RA ≤ 10.0%	RA ≤ 7.5%	7.30 %	1.072

Load (MW)	Parameter	Units	Performance Specifications (40CFR60)		CEMS Performance
			Specification No.	Acceptance Criteria	Relative Accuracy
~10.8	NO_X	ppmvd @ 15% O2	2	RA ≤ 20%	7.57 %
	O_2	%	3	RA ≤ 1.0% difference for %O2	0.022 %

EUTURBINE2

Load (MW)	Parameter	Units	Performance Specifications (40CFR75)		CEMS Performance	
			Semi-Annual	Annual	Relative Accuracy	Bias Adjustment Factor
~10.6	NO_X	lb/MMBtu	7.5% < RA ≤ 10.0%	RA ≤ 7.5%	6.58 %	1.057

Load (MW)	Parameter	Units	Performance Specifications (40CFR60)		CEMS Performance
			Specification No.	Acceptance Criteria	Relative Accuracy
~10.6	NO_X	ppmvd @ 15% O2	2	RA ≤ 20%	6.18 %
	O_2	%	3	RA ≤ 1.0% difference for %O2	0.056 %

Based on the above summary of results, the facility CEMS passed the RATA. The complete test results from this program are tabulated in Section 7.0

4.0 DISCUSSION OF RESULTS

The data acquisition and handling system (DAHS) computer printout for the same time periods as TRC's reference method (RM) testing was used to determine the relative accuracy (RA) of the CEMS. The watches of the test crew were synchronized with the facility's CEM system prior to the commencement of and during each test run. A total of ten (10) RATA runs, each 21-minutes in duration, were performed at each turbine unit location while operating within 90% of maximum load. The CEMS RATA data, comprised of twenty-two (22) minutes of data points for each test run, was provided to TRC by the facility. The comparison of the collected 22-minute data points from the facility's CEMS versus the 21-minute data points from the RM for the purpose of performing the relative accuracy calculations was discussed and agreed to on site by representatives of Otsego Paper, MDEQ and TRC. That agreement was further confirmed during a follow-up conversation between Paul Coleman of TRC and Tom Gasloli of MDEQ.

No problems were encountered with the testing equipment during the course of the test program. Source operation appeared normal during the entire test program. Each turbine was operated near base load during the RATA.

Data collected from the O_2 and NO_x analyzers were averaged for each test run. A standard fuel factor of 8,710 dscf/MMBtu was used to calculate the NO_x emission rates on a pound per million Btu basis (lb/MMBtu) following the guidelines of USEPA Method 19.

5.0 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.

5.1 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 40CFR75 Appendix A, Section 6.5.6. Sampling was performed at three points (16.7%, 50%, and 83.3%) across one diameter of each turbine exhaust stack.

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.

The Low Concentration Analyzers (those that routinely operate with a calibration span of less than 20 ppm) used by TRC are ambient-level analyzers. Per Section 3.12 of Method 7E, a Manufacturer's Stability Test is not required for ambient-level analyzers. Analyzer interference tests were conducted in accordance with the regulations in effect at the time that TRC placed an analyzer model in service.

5.1.1 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.

5.1.2 NOx Determination by USEPA Method 7E

This method is applicable for the determination of NOx concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The NOx analyzer used a photomultiplier tube to measure the light emitted from the chemiluminescent decomposition of NO_2. A NOx converter efficiency test was performed on site. The results show the NOx analyzer passed. Results are appended.

5.1.3 Determination of F-Factors by USEPA Method 19

This method is applicable for the determination of the pollutant emission rate using oxygen (O_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.

6.0 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:

- Louisiana Environmental Lab Accreditation Program (LELAP) accreditation;
- Interim accreditation from the Stack Testing Accreditation Council (STAC) that our operations conform with the requirements of ASTM D 7036-04

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.

7.0 TEST RESULTS SUMMARIES

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RATA Type: **Nitrogen Oxides (NO_X), lb/MMBtu**
Regulation: **40CFR75**
RM Used: **3A, 7E**

Customer:	Otsego Paper, Inc.			Project #:	214112		
Unit ID:	EUTURBINE1 (North)			CEM Model:	Horiba/CMA-EC622		
Sample Loc:	Stack			CEM Serial #:	41678240071		
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)
1	1	4/15/14	16:23	16:44	0.077	0.072	0.005
1	2	4/15/14	17:01	17:22	0.077	0.071	0.006
1	3	4/15/14	17:39	18:00	0.075	0.071	0.004
1	4	4/15/14	18:16	18:37	0.076	0.071	0.005
1	5	4/15/14	18:55	19:16	0.076	0.071	0.005
1	6	4/15/14	19:33	19:54	0.076	0.070	0.006
1	7	4/15/14	20:10	20:31	0.076	0.071	0.005
0	8	4/15/14	20:49	21:10	0.076	0.070	0.006
1	9	4/15/14	21:28	21:49	0.077	0.072	0.005
1	10	4/15/14	22:06	22:27	0.077	0.072	0.005

n	9	
t(0.025)	2.306	
Mean RM Value	0.076	RM avg
Mean CEM Value	0.071	CEM avg
Mean Difference	0.0051	d avg
Standard Deviation	0.001	sd
Confidence Coefficient	0.000	CC
RA based on RM	7.30	%
Bias Adjustment Factor	1.072	BAF

RATA Type: Nitrogen Oxides (NO_X), ppmvd at 15% Oxygen
Regulation: 40CFR60
RM Used: 7E

Customer:	Otsego Paper, Inc.	Project #:	214112
Unit ID:	EUTURBINE1 (North)	CEM Model:	Horiba/CMA-EC622
Sample Loc:	Stack	CEM Serial #:	41678240071

Use? 1 = Y 0 = N	Test Run	Date	Start Time	End Time	RM NO_X ppmvd at 15% Oxygen	CEM NO_X ppmvd at 15% Oxygen	(RM-CEM) Difference (di)
1	1	4/15/14	16:23	16:44	20.8	19.4	1.400
1	2	4/15/14	17:01	17:22	20.8	19.3	1.500
1	3	4/15/14	17:39	18:00	20.4	19.2	1.200
1	4	4/15/14	18:16	18:37	20.6	19.1	1.500
1	5	4/15/14	18:55	19:16	20.7	19.1	1.600
1	6	4/15/14	19:33	19:54	20.6	19.1	1.500
1	7	4/15/14	20:10	20:31	20.7	19.1	1.600
0	8	4/15/14	20:49	21:10	20.7	19.0	1.700
1	9	4/15/14	21:28	21:49	21.0	19.5	1.500
1	10	4/15/14	22:06	22:27	21.0	19.5	1.500

n	9	
t(0.975)	2.306	
Mean RM Value	20.733	RM avg
Mean CEM Value	19.256	CEM avg
Mean Difference	1.478	d avg
Sum of Differences^2	19.770	di^2
Standard Deviation	0.120	sd
Confidence Coefficient	0.092	CC
RA based on RM	7.57	%

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

Customer:	Otsego Paper, Inc.	Project #:	214112
Unit ID:	EUTURBINE1 (North)	CEM Model:	Horiba/CMA-EC622
Sample Loc:	Stack	CEM Serial #:	41678240071

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)
1	1	4/15/14	16:23	16:44	13.7	13.8	-0.100
1	2	4/15/14	17:01	17:22	13.7	13.8	-0.100
1	3	4/15/14	17:39	18:00	13.7	13.8	-0.100
1	4	4/15/14	18:16	18:37	13.7	13.7	0.000
1	5	4/15/14	18:55	19:16	13.8	13.7	0.100
1	6	4/15/14	19:33	19:54	13.8	13.7	0.100
1	7	4/15/14	20:10	20:31	13.8	13.7	0.100
1	8	4/15/14	20:49	21:10	13.9	13.8	0.100
1	9	4/15/14	21:28	21:49	13.4	13.3	0.100
0	10	4/15/14	22:06	22:27	13.5	13.3	0.200

n	9	
t(0.975)	2.306	
Mean RM Value	13.722	RM avg
Mean CEM Value	13.700	CEM avg
Mean Difference	0.022	d avg
Standard Deviation	0.097	sd
Confidence Coefficient	0.075	CC
RA (Absolute Mean Difference)	0.022	%vol diff.

RATA Type: Nitrogen Oxides (NO_X), lb/MMBtu
Regulation: 40CFR75
RM Used: 3A, 7E

Customer:	Otsego Paper, Inc.	Project #:	214112
Unit ID:	EUTURBINE2 (South)	CEM Model:	Horiba/CMA-EC622
Sample Loc:	Stack	CEM Serial #:	41678240073

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)
1	1	4/15/14	8:00	8:21	0.066	0.064	0.002
1	2	4/15/14	8:44	9:05	0.067	0.064	0.003
1	3	4/15/14	9:24	9:44	0.068	0.065	0.003
1	4	4/15/14	10:06	10:27	0.068	0.065	0.003
1	5	4/15/14	10:46	11:07	0.068	0.064	0.004
1	6	4/15/14	11:25	11:46	0.068	0.064	0.004
1	7	4/15/14	12:03	12:24	0.066	0.062	0.004
1	8	4/15/14	12:43	13:04	0.068	0.063	0.005
1	9	4/15/14	13:21	13:42	0.068	0.063	0.005
0	10	4/15/14	13:59	14:20	0.067	0.062	0.005

n	9	
t(0.025)	2.306	
Mean RM Value	0.067	RM avg
Mean CEM Value	0.064	CEM avg
Mean Difference	0.0037	d avg
Standard Deviation	0.001	sd
Confidence Coefficient	0.001	CC
RA based on RM	6.58	%
Bias Adjustment Factor	1.057	BAF

RATA Type: **Nitrogen Oxides (NO_X), ppmvd at 15% Oxygen**
Regulation: **40CFR60**
RM Used: **7E**

Customer:	Otsego Paper, Inc.	Project #:	214112
Unit ID:	EUTURBINE2 (South)	CEM Model:	Horiba/CMA-EC622
Sample Loc:	Stack	CEM Serial #:	41678240073

Use? 1 = Y 0 = N	Test Run	Date	Start Time	End Time	RM NO_X ppmvd at 15% Oxygen	CEM NO_X ppmvd at 15% Oxygen	(RM-CEM) Difference (di)
1	1	4/15/14	8:00	8:21	18.0	17.2	0.800
1	2	4/15/14	8:44	9:05	18.3	17.4	0.900
1	3	4/15/14	9:24	9:44	18.5	17.6	0.900
1	4	4/15/14	10:06	10:27	18.5	17.5	1.000
1	5	4/15/14	10:46	11:07	18.5	17.3	1.200
1	6	4/15/14	11:25	11:46	18.3	17.3	1.000
1	7	4/15/14	12:03	12:24	17.9	16.8	1.100
1	8	4/15/14	12:43	13:04	18.3	17.1	1.200
1	9	4/15/14	13:21	13:42	18.3	17.2	1.100
0	10	4/15/14	13:59	14:20	18.3	16.9	1.400

n	9	
t(0.975)	2.306	
Mean RM Value	18.289	RM avg
Mean CEM Value	17.267	CEM avg
Mean Difference	1.022	d avg
Sum of Differences^2	9.560	di^2
Standard Deviation	0.139	sd
Confidence Coefficient	0.107	CC
RA based on RM	6.18	%

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

Customer:	Otsego Paper, Inc.			Project #:	214112		
Unit ID:	EUTURBINE2 (South)			CEM Model:	Horiba/CMA-EC622		
Sample Loc:	Stack			CEM Serial #:	41678240073		
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)
1	1	4/15/14	8:00	8:21	13.1	13.0	0.100
1	2	4/15/14	8:44	9:05	13.0	13.2	-0.200
1	3	4/15/14	9:24	9:44	13.0	13.0	0.000
1	4	4/15/14	10:06	10:27	13.0	12.9	0.100
1	5	4/15/14	10:46	11:07	13.3	13.2	0.100
1	6	4/15/14	11:25	11:46	13.5	13.4	0.100
1	7	4/15/14	12:03	12:24	14.0	13.9	0.100
1	8	4/15/14	12:43	13:04	13.7	13.6	0.100
1	9	4/15/14	13:21	13:42	13.6	13.5	0.100
0	10	4/15/14	13:59	14:20	14.0	13.9	0.100

n	9	
t(0.975)	2.306	
Mean RM Value	13.356	RM avg
Mean CEM Value	13.300	CEM avg
Mean Difference	0.056	d avg
Standard Deviation	0.101	sd
Confidence Coefficient	0.078	CC
RA (Absolute Mean Difference)	0.056	%vol diff.