AECOM

Relative Accuracy Test Audit (RATA) 2023

Graphic Packaging, International, LLC

Boiler 9 (EUBOILER#9)

Project number: 60703778

May 17, 2023

Graphic Packaging International, LLC
1500 N Pitcher Street
Kalamazoo, Michigan 49007

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Quality information

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		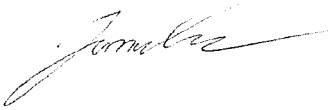
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1.2 Key Personnel

Names and affiliations of personnel, including their roles in the test program, are summarized in the following table (Table 1-2).

Table 1-2. Key Personnel

Role	Name	Address	Contact Information
Process Focal Point	Steven Smock	Graphic Packaging, International, LLC	269-491-6055 steven.smock@graphicpkg.com
Regulatory Agency	Trevor Drost	EGLE	517-245-5781 Drostt@michigan.gov
Field Team Leader	Rob Sava	AECOM	234-425-8440 Rob.sava@aecom.com
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2. Plant and Sampling Location Description

2.1 Facility Description

Boiler 9 is a natural gas fired boiler equipped with low NOx burners and flue gas recirculation with a maximum heat input of approximately 227 MMBtu/hr.

2.2 Flue Gas Sampling Locations

Sampling is conducted on the Boiler 9 outlet stack. The Reference Test methods for NOx and O_2 are performed through a port that is in accordance with Performance Specification 2. The samples are withdrawn from the stack for a period of 21 minutes at the three traverse points of the measurement line that passes through the centroidal area of the stack or duct cross section. Prior to utilizing a three point traverse, a twelve point traverse was performed to verify the absence of stratification. The cross-sectional diagrams can be found in Section 7.

3. Sampling and Analysis Procedures

3.1 Objectives and Test Matrix

This testing was performed to meet the requirements of 40 CFR Part 60, Appendix B, Performance Specifications 2 and 3. The specific objectives of this test were:

- Determine the Relative Accuracy of the continuous O_2 monitor system on the Boiler 9 outlet stack.
- Determine the Relative Accuracy of the continuous NO_x monitor system on the Boiler 9 outlet stack.

Tables 3-1 and 3-2 present a summary of the results for the Performance Specification Test for CEMS RATA.

3.2 Facility Operations

During the relative accuracy test, the plant is operated Boiler 9 greater than 50 percent load. The operating rate for this unit is determined based on the steam lb/hr rate presented in Table 3-3.

3.3 Comments / Exceptions

As allowed by 40 CFR Part 60, this Performance Specification Test consisted of a minimum of 9 RM tests used for RA calculations. Ten sets of RM tests were performed. Since this option was selected, a maximum of one set of the test results may be rejected so long as the total number of test results used to determine the RA was greater than or equal to nine. All data was reported, including the rejected data.

3.4 Summary of Results

Table 3-1. NO_x Monitoring

Test Type	NO_x Monitor Results (%)	Allowable	Pass/Fail
Relative Accuracy	2.7%	No greater than 20.0% of mean value of RM	Pass

Table 3-2. O_2 Monitoring

Test Type	O_2 Monitor Results (%)	Allowable	Pass/Fail
Relative Accuracy	4.8%	No greater than 20.0% of mean value of RM	Pass

Table 3-3. Boiler 9 Steam Flow

Boiler 9	
RATA Run #	Run Average Steam (lb/hr)
RATA 1	110900.00
RATA 2	119800.00
RATA 3	117400.00
RATA 4	115600.00
RATA 5	117000.00
RATA 6	117238.00
RATA 7	116600.00
RATA 8	115800.00
RATA 9	119100.00
RATA 10	118000.00
Average	116743.80

4. Sampling and Analytical Procedures

4.1 Test Methods

The relative accuracies of Graphic Packaging's CEMS was determined by comparison to EPA methods for measurement of each component gas. The performance specifications (PS) required the use of the following methods:

- PS 2 – Method 7E for NOx; and
- PS 3 – Method 3A for O_2.

4.2 Procedures

The above methods were performed using mobile continuous emission monitors. Gas was withdrawn from the stack and transported to monitors located at ground level. A stainless-steel probe was inserted into the stack and used to collect sample gas. A Teflon sample line, heated at an adequate temperature to keep water in vapor form, transported sample gas from the probe to the gas conditioner followed by the analyzers. The analyzers were kept at a constant temperature inside the mobile laboratory.

Sample gas was collected continuously from the stack for a period of 21 minutes per run. Samples were taken at three traverse points of the measurement line that passes through the centroidal area of the stack or duct cross section. At the mobile laboratory, the stack gas was routed to a condenser and then transported to the analyzers for analysis.

The Relative Accuracy Tests were conducted by comparison of the CEMS response to a value measured by a Performance Test Method (PTM) which, in this case, was Method 7E for NOx and Method 3A for O_2.

EPA Method 3A (Gas Analysis for the Determination of Dry Molecular Weight)

EPA Method 3A (Instrumental Method) was utilized to determine the diluent during each run on the outlet.

An analyzer measured O_2 content on the basis of the strong paramagnetic properties of O_2 relative to other compounds present in combustion gases. In the presence of a magnetic field, O_2 molecules become temporary magnets. The analyzer determines the sample gas O_2 concentration by detecting the displacement torque of the sample test body in the presence of a magnetic field.

EPA Method 7E (Determination of Nitrogen Oxides)

EPA Method 7E was utilized to determine NOx concentrations during each run on the outlet.

A NOx analyzer was used to monitor the concentration of NOx during each run. A sample of the effluent gas was continuously sampled and conveyed to an analyzer for measuring the concentration of NOx. The gas stream was directed through a NO_2 convertor to convert NO_2 to NO concentration. The analyzer yielded results of a total result of NOx. See Figure 4-1 for a sampling train schematic.

4.3 List of Sampling Equipment

Tables 4-1 and 4-2 list the reference method analyzers used for the test and Boiler 9 analyzers while Figure 4-1 displays the sample system diagram.

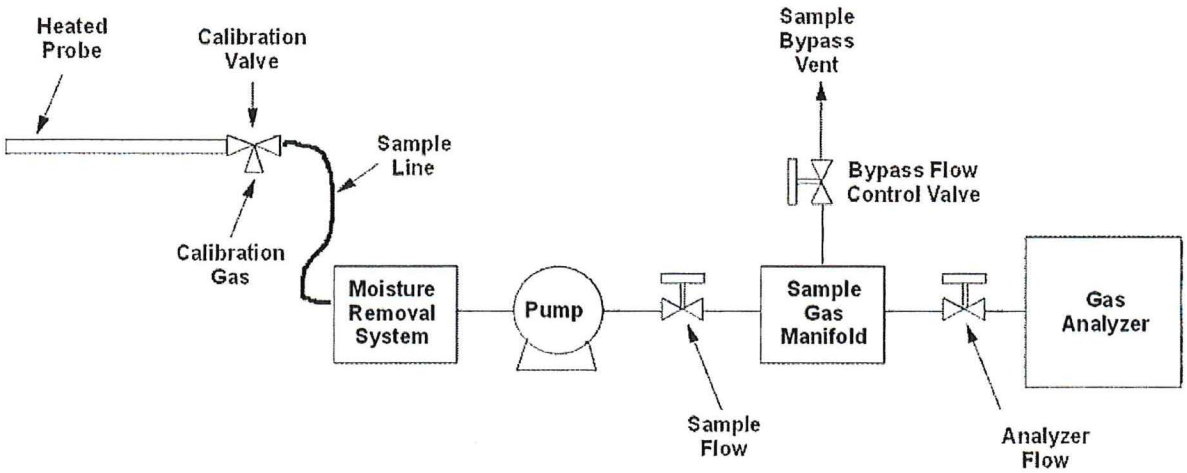
Table 4-1. Reference Method

Reference Method	Equipment	ID #	Span
Method 3A (O_2)	SERVOMEX 1440 Analyzer	OXC-A1603	18.95 %
Method 7E (NO_x)	THERMO 42i-HL Analyzer	NOX F1901	60.71 ppm

Table 4-2. Boiler 9 CEMS Analyzers

Constituent	Unit	Manuf.	Model	Serial #	Span
Nitrogen Oxides	ppmv	Horiba	CMA-EC622	42108510081	0-100
Carbon Dioxide	vol %	Horiba	CMA-EC622	42108510081	0-25

Figure 4-1. Sample Train Schematic



5. Calculations

5.1 Calibration Error - Equation 7E-1

$$ACE = \frac{C_{Dir} - C_V}{CS} \times 100_{\%}$$

C_{dir} = Measured concentration of a calibration gas (low, mid, or high) when introduced in direct calibration mode

C_V = Manufacturer certified concentration of a calibration gas (low, mid, or high)

CS = Calibration span

For oxygen, mid cal gas

C_{dir}	=	9.98	%
C_V	=	10.00	%
CS	=	21.41	%

$$\textbf{ACE} = \frac{(\ 9.98\ -\ 10.00\ )}{21.41} \times 100\ \%$$

ACE = -0.1 %