SOURCE TEST REPORT 2020 COMPLIANCE EMISSION TESTING

GRAPHIC PACKAGING INTERNATIONAL KALAMAZOO, MICHIGAN

BOILER No. 9 (EUBOILER#9)

Prepared For:

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For Submittal To:

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REVIEW AND CERTIFICATION

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature:	BU.	_ Date:	3/10/2020
Name:	Brian Walling	_ Title:	Field Project Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature:	nobert j lisy jr	Date:	03/10/2020	
Name:	Robert J. Lisy, Jr.	Title:	District Manager	

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1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Graphic Packaging International contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on Boiler No. 9 (EUBOILER#9) at the Graphic Packaging International Facility located in Kalamazoo, Michigan. The test was conducted to satisfy the emissions testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division (AQD) Renewable Operating Permit (ROP) No. MI-ROP-B1678-2015. The specific objectives were to:

- Verify the nitrogen oxides (NO_x) (as NO₂) emission rates from EUBOILER#9
- Verify the non-methane organic compound (NMOC) emission rates from EUBOILER#9
- Conduct the test program with a focus on safety

Montrose performed the tests to measure the emission parameters listed in Table 1-1.

Test Date(s)	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
2/11/20	EUBOILER#9	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	60
2/11/20	EUBOILER#9	O ₂ , CO ₂	EPA 3	3	60
2/11/20	EUBOILER#9	NO _x	EPA 7E	3	60
2/11/20	EUBOILER#9	NMOC	EPA 25A	3	60

TABLE 1-1 SUMMARY OF TEST PROGRAM

To simplify this report, a list of Units and Abbreviations is included in Appendix D.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to their respective permit limits in Table 1-2. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The testing was conducted by the Montrose personnel listed in Table 1-3. The tests were conducted according to the test plan (protocol) dated January 6, 2020 that was submitted to EGLE.



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TABLE 1-2 SUMMARY OF AVERAGE COMPLIANCE RESULTS -EUBOILER#9 FEBRUARY 11, 2020

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO, as NO ₂)		
nnrogen exidee (nex as nex)	45 1	_
b/br	10.1	12 6
	12.3	13.0
ID/MMBtu	0.057	0.06
Total Non Mothana Organic Com	ounde as Mothano (NMOC)*	
Total Non-Wethane Organic Comp	Jounds, as methane (NMOC)	
ppmva	<2.5	-
lb/hr	<0.24	5.7
lb/MMBtu	<0.0011	0.025

* The "<" symbol indicates that the compound was below 2 percent of the span of the EPA Method 25A analyzer measured as total gaseous organic compounds. See Section 4.2 for details

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location:	Graphic Packaging International
	1500 North Pitcher Street
	Kalamazoo, MI 49007
Project Contact:	Donald Krug
Role:	Environmental Engineer
Company:	Graphic Packaging International
Telephone:	269-383-5000
Email:	donald.krug@graphicpkg.com

Agency Information

Regulatory Agency:	Michigan Department of Environme	ent, Great Lakes, and Energy
Agency Contact:	Monica Brothers	Karen Kajiya-Mills
Telephone:	269-567-3552	517-256-0880
Email:	brothersm@michigan.gov	kajiya-millsk@michigan.gov

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	Robert J. Lisy, Jr.	Brian Walling
Title:	District Manager	Field Project Manager
Telephone:	440-262-3760	440-262-3760
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Test personnel and observers are summarized in Table 1-3.

TABLE 1-3 TEST PERSONNEL AND OBSERVERS

Name	Affiliation	Role/Responsibility
Brian Walling	Montrose	Project Manager, QI
Matt McDivitt	Montrose	Field Technician, QI



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2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

Graphic Packaging International operates a natural gas-fired boiler (EUBOILER#7) and two natural gas- and fuel oil-fired boilers (EUBOILER#8 and EUBOILER#9) to generate steam for use in facility operations. EUBOILER#9 is equipped with low NO_x burners and flue gas recirculation. It has a maximum heat input rate of 227 MMBtu/hr and was in operation for this test event.

2.2 FLUE GAS SAMPLING LOCATION

Information regarding the sampling location is presented in Table 2-1.

	Stack Inside	Distance from Ne		
Sampling Location	Diameter (in.)	Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	Number of Traverse Points
SVBOILER#9 Exhaust Stack	63.4 X 64.1	366.0 / 5.7	300.0 / 4.7	Flow: 16 (8/port); Gaseous: 12 (Run 1) and 1 (Runs 2-3)

TABLE 2-1 SAMPLING LOCATION

The sampling location was verified in the field to conform to EPA Method 1. Acceptable cyclonic flow conditions were confirmed prior to testing using EPA Method 1, Section 11.4. In addition, a 12-point stratification test was performed at the SVBOILER#9 Exhaust Stack during Run 1. The sampling location was found to be within the range of Stratification Acceptance Criteria as specified in EPA Method 7E, Section 8.1.2. Therefore, a single point was used for Runs 2 and 3. See Appendix A.1 for more information.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed while EUBOILER#9 operated at greater than 90 percent of rate capacity.

Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B. Data collected includes the following parameters:

- Natural gas flow rate, kscfh
- Heat Input Rate, MMBtu/hr
- Steam flow rate, klb/hr



3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 TEST METHODS

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The test methods for this test program were presented previously in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

3.1.1 EPA Method 1, Sample and Velocity Traverses for Stationary Sources

EPA Method 1 is used to assure that representative measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or duct equivalent diameters downstream from a flow disturbance and one-half equivalent diameter upstream from a flow disturbance.

3.1.2 EPA Method 2, Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

EPA Method 2 is used to measure the gas velocity using an S-type pitot tube connected to a pressure measurement device, and to measure the gas temperature using a calibrated thermocouple connected to a thermocouple indicator. Typically, Type S (Stausscheibe) pitot tubes conforming to the geometric specifications in the test method are used, along with an inclined manometer. The measurements are made at traverse points specified by EPA Method 1.

3.1.3 EPA Method 3A, Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 3A is an instrumental test method used to measure the concentration of O_2 and CO_2 in stack gas. The effluent gas is continuously or intermittently sampled and conveyed to analyzers that measure the concentration of O_2 and CO_2 . The performance requirements of the method must be met to validate data.

This method was paired with EPA Methods 7E and 25A. The typical sampling system is detailed in Figure 3-2.

3.1.4 EPA Method 4, Determination of Moisture Content in Stack Gas

EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.





FIGURE 3-1 US EPA METHOD 4 SAMPLING TRAIN

3.1.5 EPA Method 7E, Determination of Nitrogen Oxides Emissions from Stationary Source (Instrumental Analyzer Procedure)

EPA Method 7E is an instrumental test method used to continuously measure emissions of NO_x as NO_2 . Conditioned gas is sent to an analyzer to measure the concentration of NO_x . NO and NO_2 can be measured separately or simultaneously together but, for the purposes of this method, NO_x is the sum of NO and NO_2 . The performance requirements of the method must be met to validate the data.

This method was paired with EPA Methods 3A and 25A. The typical sampling system is detailed in Figure 3-2.

3.1.6 EPA Method 19, Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates

EPA Method 19 is used to calculate mass emission rates in units of lb/MMBtu. EPA Method 19, Table 19-2 contains a list of assigned fuel factors for different types of fuels, which can be used for these calculations.



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3.1.7 EPA Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

EPA Method 25A is an instrumental test method used to measure the concentration of THC in stack gas. A gas sample is extracted from the source through a heated sample line and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

This method was paired with EPA Methods 3A and 7E. The typical sampling system is detailed in Figure 3-2.



FIGURE 3-2 US EPA METHOD 3A (O₂/CO₂), 7E, AND 25A SAMPLING TRAIN

3.2 PROCESS TEST METHODS

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.



4.0 TEST DISCUSSION AND RESULTS

4.1 FIELD TEST DEVIATIONS AND EXCEPTIONS

No field deviations or exceptions from the test plan or test methods occurred during this test program.

4.2 PRESENTATION OF RESULTS

The average results are compared to the permit limits in Table 1-2. The results of individual compliance test runs performed are presented in Table 4-1. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

Concentration values in Table 4-1 denoted with a '<' were measured to be below 2 percent of the span of the EPA Method 25A analyzer measured as total gaseous organic compounds. Mass emission rates denoted with a '<' in Table 4-1 were calculated utilizing the two percent of span concentration value instead of the "as measured" concentration value.

Run Number	1	2	3	Average			
Date	2/11/2020	2/11/2020	2/11/2020				
Time	9:37-10:45	11:52-13:00	13:16-14:28	an 10			
Process Data							
Actual Heat Input, MMBtu/hr	217.2	217.4	217.5	217.4			
Flue Gas Parameters							
O ₂ , % volume dry	3.05	3.00	3.02	3.02			
CO ₂ , % volume dry	10.18	10.23	10.19	10.20			
flue gas temperature, °F	331.4	331.1	330.9	331.1			
moisture content, % volume	16.38	16.64	15.54	16.19			
volumetric flow rate, dscfm	38,090	37,868	38,331	38,096			
Nitrogen Oxides (NO _x as NO ₂)							
ppmvd	45.0	44.9	45.2	45.1			
lb/hr	12.3	12.2	12.4	12.3			
lb/MMBtu	0.057	0.056	0.057	0.057			
Total Non-Methane Organic Compounds, as Methane (NMOC)							
ppmvd	<2.5	<2.5	<2.5	<2.5			
lb/hr	<0.24	<0.24	<0.24	<0.24			
lb/MMBtu	<0.0011	<0.0011	<0.0011	<0.0011			

TABLE 4-1 NO_X AND NMOC EMISSIONS RESULTS -EUBOILER#9



5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

The meter box and sampling train used during sampling performed within the requirements of their respective methods. All post-test leak checks, minimum metered volumes and minimum sample durations met the applicable QA/QC criteria.

EPA Method 3A and 7E calibration audits were all within the measurement system performance specifications for the calibration drift checks, system calibration bias checks, and calibration error checks.

EPA Method 25A FIA calibration audits were within the measurement system performance specifications for the calibration drift checks and calibration error checks.

The NO₂ to NO converter efficiency check of the analyzer was conducted per the procedures in EPA Method 7E, Section 8.2.4. The conversion efficiency met the criteria.

An EPA Method 205 field evaluation of the calibration gas dilution system was conducted. The dilution accuracy and precision QA specifications were met.

5.2 QA/QC DISCUSSION

All QA/QC criteria were met during this test program.

5.3 QUALITY STATEMENT

Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one Qualified Individual (QI) as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is included in the report appendices. The content of this report is modeled after the EPA Emission Measurement Center Guideline Document (GD-043).



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APPENDIX A FIELD DATA AND CALCULATIONS



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Appendix A.1 Sampling Locations



Graphic Packaging International Inc. February 2020 Bolier No. 9 (EUBOILER#9) Compliance Test

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EUBOILER#9 SAMPLING LOCATION SCHEMATIC

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SVBOILER#9 EXHAUST FLOW TRAVERSE POINT LOCATION DRAWING



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SVBOILER#9 EXHAUST CEMS (RUN 1) TRAVERSE POINT LOCATION DRAWING



Graphic Packaging International Inc. February 2020 Bolier No. 9 (EUBOILER#9) Compliance Test

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12-POINT STRATIFICATION TEST

	DURATION	NITROGEN OXIDES		
	FAIL	MINIMUM SINGLE POINT TRAVERSE	Difference from Mean	Difference from Mean
Point Number	(min)	(ppm)	(ppm)	(%)
1		45.19	1.00	2.17
2		45.69	0.51	1.10
3		46.40	-0.20	-0.44
4		46.38	-0.19	-0.40
5		45.78	0.42	0.90
6		46.74	-0.54	-1.18
7		46.38	-0.18	-0.39
8		46.78	-0.58	-1.26
9		46.49	-0.30	-0.64
10		46.14	0.05	0.12
11		45.59	0.60	1.31
12		46.79	-0.59	-1.28
	Mean	46.20		

