



Oxides of Nitrogen Relative Accuracy Test Audit Emissions Test Report Boilers 2 & 4A

Prepared for:

Packaging Corporation of America

Packaging Corporation of America
2246 Udell Street
Filer City, Michigan 49634

Project No. 049AS-574842
July 12, 2019

Montrose Air Quality Services
4949 Fernlee Avenue
Royal Oak, Michigan 48073
(248) 548-8070

EXECUTIVE SUMMARY

Montrose Air Quality Services (MAQS) was retained by Packaging Corporation of America (PCA) to conduct a relative accuracy test audit (RATA) of the continuous emission monitoring systems serving Boilers 2 and 4A located at the PCA facility in Filer City, Michigan. This emissions testing program included evaluation of oxides of nitrogen (NOx) and oxygen (O₂) concentrations and corresponding NOx emission rates (lb/MMBtu) for EUBOILER2 at a single load while firing natural gas and EUBOILER4A at a single load while firing natural gas and biogas

Pursuant to Title 40, Part 60, Appendix B, Performance Specification 2, the relative accuracy of the Boilers 2 and 4A CEMS must remain less than 20%. Table I summarizes the results of the test program.

Table I

Test Results Summary

Test Date	Unit	Parameter	Result
5/14/2018	Boiler 2	NOx (lb/MMBtu)	1.6% RA
5/15/2018	Boiler 4A	NOx (lb/MMBtu)	1.7% RA

TABLE OF CONTENTS

1. INTRODUCTION	5
1.A IDENTIFICATION, LOCATION, AND DATES OF TEST	5
1.B PURPOSE OF TESTING	5
1.C SOURCE DESCRIPTION	5
1.D TEST PROGRAM CONTACT	6
1.E TESTING PERSONNEL	6
2. SUMMARY OF RESULTS	6
2.A OPERATING DATA	6
2.B APPLICABLE PERMIT	6
2.C RESULTS	7
2.D EMISSION REGULATION COMPARISON	7
3. SOURCE DESCRIPTION	7
3.A PROCESS DESCRIPTION	7
3.B PROCESS FLOW DIAGRAM	7
3.C RAW AND FINISHED MATERIALS	7
3.D PROCESS CAPACITY	8
3.E PROCESS INSTRUMENTATION	8
4. SAMPLING AND ANALYTICAL PROCEDURES	8
4.A SAMPLING TRAIN AND FIELD PROCEDURES	8
4.B RECOVERY AND ANALYTICAL PROCEDURES	8
4.C SAMPLING PORTS	8
4.D TRAVERSE POINTS	8
5. TEST RESULTS AND DISCUSSION	9
5.A RESULTS TABULATION	9
5.B DISCUSSION OF RESULTS	9
5.C SAMPLING PROCEDURE VARIATIONS	9
5.D PROCESS OR CONTROL DEVICE UPSETS	9
5.E CONTROL DEVICE MAINTENANCE	9
5.F RE-TEST CHANGES	9
5.G AUDIT SAMPLE ANALYSES	9
5.H CALIBRATION SHEETS	10
5.I SAMPLE CALCULATIONS	10
5.J FIELD DATA SHEETS	10
5.K LABORATORY DATA	10

TABLE OF CONTENTS (continued)

TABLES

- 1 Testing Personnel

Figures

- 1 USEPA Method 7E and 3A
- 2 Boiler No. 2 Exhaust Stack Figure
- 3 Boiler No. 4A Exhaust Stack Figure

APPENDICES

- A AQD Test Plan/Report Format Guideline
- B Boiler No. 2 RATA Results Summary
- C Boiler No. 4A RATA Results Summary
- D Compact Disk with all MAQS CEMS Data Files
- E Equipment Calibration and Span Gas Documents
- F Example Calculations
- G Process Operating Data

1. Introduction

Montrose Air Quality Services (MAQS) has been retained by Packaging Corporation of America (PCA) to conduct a relative accuracy test audit (RATA) of the continuous emission monitoring systems serving Boiler's 2 and 4A located at the PCA facility in Filer City, Michigan. This emissions testing program included evaluation of oxides of nitrogen (NO_x) and oxygen (O₂) concentrations and corresponding NO_x emission rates (lb/MMBtu) EUBOILER2 and EUBOILER4A at a single load while firing natural gas in EUBOILER2 and natural gas plus biogas in EUBOILER4A. All testing was performed in accordance with MAQS test plan 049AS-574842.

AQD has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (March 2018). This document is provided as Appendix A. The following is a summary of the emissions test program and results in the format suggested by the aforementioned document.

1.a Identification, Location, and Dates of Test

The relative accuracy of the CEM systems serving PCA Boiler Nos. 2 and 4A was evaluated. Each CEM system monitors and records the concentration of oxides of nitrogen (NO_x) and oxygen (O₂) in the boiler exhaust gas and then calculates the resultant NO_x emission rate (in terms of pounds per million Btu heat input, lbs/MMBtu). The relative accuracy of each CEM system was verified in terms of NO_x emission rate (lbs/MMBtu).

Each CEM system is located at PCA (2246 Udell Street, Filer City, Michigan). Testing of the Boiler Nos. 2 and 4A CEM systems was conducted on May 14 and 15, 2019.

1.b Purpose of Testing

The purpose of the testing was to verify the relative accuracy of the CEM systems. Boiler Nos. 2 and 4A are affected by the requirements of Title 40, Part 60, Appendix B, Performance Specification 2, the relative accuracy of the Boilers 2 and 4A CEMS must remain less than 20%.

1.c Source Description

Boiler 2:

Boiler No. 2 has a maximum heat input rating of 186 MMBtu/hr. The boiler has the capability to burn coal, natural gas, biogas, and No. 6 fuel oil. The exhaust is controlled by a baghouse when burning coal and can bypass the baghouse when both EUBOILER1 and EUBOILER2 have ceased firing coal.

Boiler 4:

PCA operates a Babcock & Wilcox boiler unit, designated as EUBOILER4A, to provide steam for various mill processes and for use in electrical generation while burning natural gas or biogas. EUBOILER4A is rated at 227 MMBtu/hr and is equipped with low-NO_x burners. The maximum steam load for the boiler is 150,000 pounds of steam.

1.d Test Program Contact

The contact for information regarding the test program as well as the test report is as follows:

Dyllan Walker
Packaging Corporation of America
2246 Udell Street
Filer City, MI 49634
(231) 723-9951 ext. 434

1.e Testing Personnel

Names and affiliations for personnel who were present during the testing program are summarized by Table 1.

Table 1
Testing Personnel

Name	Affiliation
Dyllan Walker	PCA
Matthew Young	MAQS
Joshua Boulianne	MAQS

2. Summary of Results

Sections 2.a through 2.d summarize the results of the emissions test program.

2.a Operating Data

Natural gas and biogas flowrate (scf/hr), boiler steam load (klbs/hr), NO_x concentration, and O₂ concentration were monitored throughout the RATA emissions test program. The data is presented in Appendices B, C, and G.

2.b Applicable Permit

Boiler Nos. 2 and 4A are covered by AQD Renewable Operating Permit No. MI-ROP-B3692-2015b.

2.c Results

The results of the RATA emissions test program for Boiler Nos. 2 and 4A are summarized in Appendices B and C, respectively.

2.d Emission Regulation Comparison

The boilers are affected by the requirements of Title 40, Part 60, Subpart Db of the Code of Federal Regulations (40 CFR 60, Subpart Db) which require that NO_x emissions be continuously monitored by installing, maintaining, and operating a continuous emission monitoring (CEM) system and that the relative accuracy of each CEM system be verified on, at a minimum, an annual basis. The RA limit is 20%. The RA of each boiler CEM system was less than 20%.

3. Source Description

Sections 3.a through 3.e provide a detailed description of the process.

3.a Process Description

Boiler 2:

Boiler No. 2 has a maximum heat input rating of 186 MMBtu/hr. The boiler has the capability to burn coal, natural gas, biogas, and No. 6 fuel oil. The exhaust is controlled by a baghouse when burning coal and can bypass the baghouse when both EUBOILER1 and EUBOILER2 have ceased firing coal.

Boiler 4A:

PCA operates a Babcock & Wilcox boiler unit, designated as EUBOILER4A, to provide steam for various mill processes and for use in electrical generation while burning natural gas or biogas. EUBOILER4A is rated at 227 MMBtu/hr and is equipped with low-NO_x burners. The maximum steam load for the boiler is 150,000 pounds of steam. The addition of biogas changes the F factor used to calculate the lbs/mmbtu. MAQS used the new F factor presented on the Boiler print outs to calculate the lbs/mmbtu.

3.b Process Flow Diagram

Due to the simplicity of the boiler process, a process flow diagram is not necessary.

3.c Raw and Finished Materials

The raw materials used by the boilers include natural gas, biogas, and water. The product is steam.

3.d Process Capacity

Boiler No. 2 has a maximum heat input rating of 186 MMBtu/hr.

EUBOILER4A is rated at 227 MMBtu/hr and is equipped with low-NO_x burners. The maximum steam load for the boiler is 150,000 pounds of steam.

3.e Process Instrumentation

Natural gas flowrate (scf/hr), biogas flowrate (scf/hr), boiler steam load (klbs/hr), NO_x concentration, and O₂ concentration were monitored throughout the RATA emissions test program. The data is presented in Appendices B, C, and G.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used to verify the relative accuracy of the Boiler Nos. 2 and 4A CEM systems.

4.a Sampling Train and Field Procedures

The NO_x concentration of the exhaust gas was measured using a TECO 42i NO_x gas analyzer (Serial No. 42CHL-55531-303) and the O₂ content was measured using a Servomex 1400 O₂ gas analyzer (Serial No. 04100C1-396044). A sample of the gas stream was drawn through an insulated stainless-steel probe with an in-line glass fiber filter to remove any particulate, a heated Teflon[®] sample line, and through a refrigerated Teflon[®] impinger train with a peristaltic pump to remove the moisture from the sample before it enters the analyzer. Data was recorded at 10-second intervals on an IBM PC equipped with data acquisition software.

Sampling and analysis procedures followed the requirements of 40 CFR 60, Appendix B, PS2.

4.b Recovery and Analytical Procedures

Because all measurements were conducted using on-line analyzers, no samples were recovered during the test program.

4.c Sampling Ports

For each of the Boilers, the reference method sampling probe was moved to three points across the stack during each emissions test run.

4.d Traverse Points

For each of the Boilers, the reference method sampling probe was moved to three points across the stack during each emissions test run.

5. Test Results and Discussion

Sections 5.a through 5.k provide a summary of the test results.

5.a Results Tabulation

The results of the RATA emissions test program for Boiler Nos. 2 and 4A are summarized by Appendices B and C, respectively. Relevant raw test data for emissions test runs and for analyzer calibrations are provided electronically in Appendix D.

5.b Discussion of Results

The boilers are affected by the requirements of Title 40, Part 60, Subpart Db of the Code of Federal Regulations (40 CFR 60, Subpart Db) which require that NO_x emissions be continuously monitored by installing, maintaining, and operating a continuous emission monitoring (CEM) system and that the relative accuracy of each CEM system be verified on, at a minimum, an annual basis. The RA limit is 20%. The RA of each boiler CEM system was less than 20%.

5.c Sampling Procedure Variations

During testing of Boiler 2, the average NO_x concentration began to rise above the span value of the reference NO_x analyzer. The analyzer was recalibrated using a 148 ppm NO_x cylinder provided by PCA. Runs 2-4 were not used as a result.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

Only routine maintenance was performed on Boilers 2 and 4A prior to the emissions test program.

5.f Re-Test Changes

The emissions test program was not a re-test.

5.g Audit Sample Analyses

No audit samples were requested by AQD.

5.h Calibration Sheets

Certificates of analysis for the calibration gases used during testing are provided as Appendix E.

5.i Sample Calculations

Sample calculations are provided as Appendix F.

5.j Field Data Sheets

Copies of field data sheets and relevant field notes are provided as Appendix E.

5.k Laboratory Data

No laboratory analysis was included in this test program.

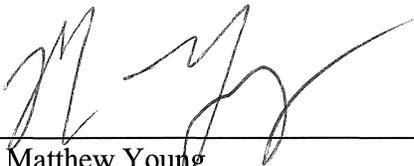
MEASUREMENT UNCERTAINTY STATEMENT

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, Montrose Air Quality Services, LLC, (MAQS) personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, MAQS personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of our Quality Manual and ASTM D 7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

Limitations

All testing performed was done in conformance to the ASTM D7036-04 standard. The information and opinions rendered in this report are exclusively for use by PCA. MAQS will not distribute or publish this report without PCA's consent except as required by law or court order. MAQS 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
Client Project Manager

This report was reviewed by:



Steve Smith
Client Project Manager

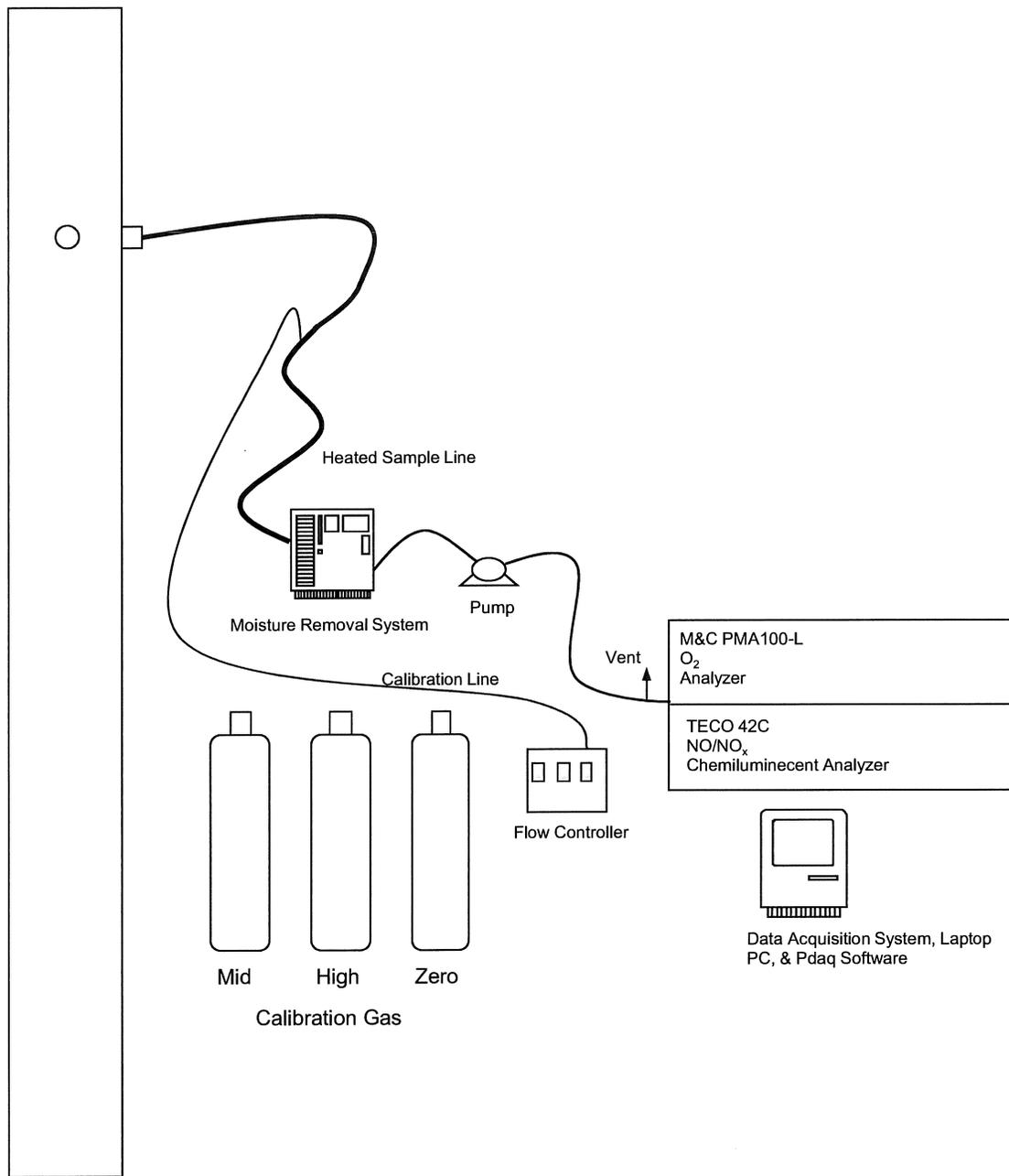


Figure No. 1

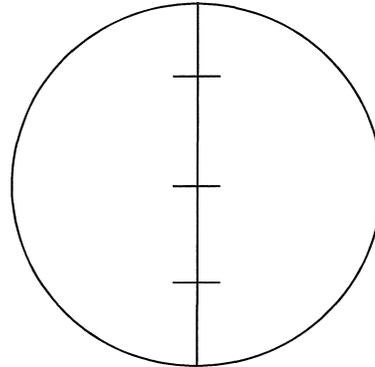
Site:
USEPA Method 3A and 7E
PCA
Filer City, Michigan

Sampling Date:
May 14-15, 2019

Montrose Air Quality Services
4949 Fernlee Avenue
Royal Oak, MI 48073

diameter = 48 inches

Points	Distance "
1	8.0
2	24.0
3	40.0



Not to Scale

Note: NO_x/O₂ sampling was extracted at three points through a stainless steel probe positioned at approximately 16.7%, 50% and 83.3% of the sample stream diameter (7 minutes at each point).

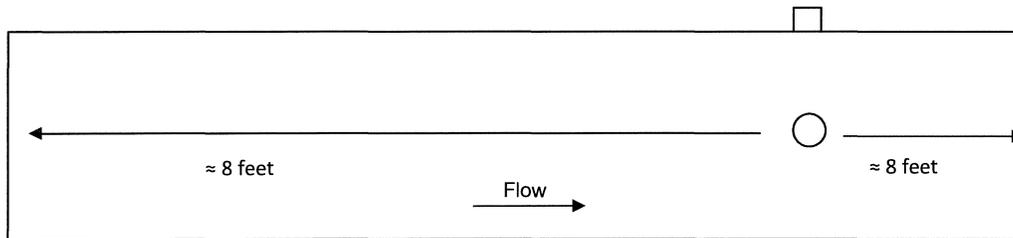


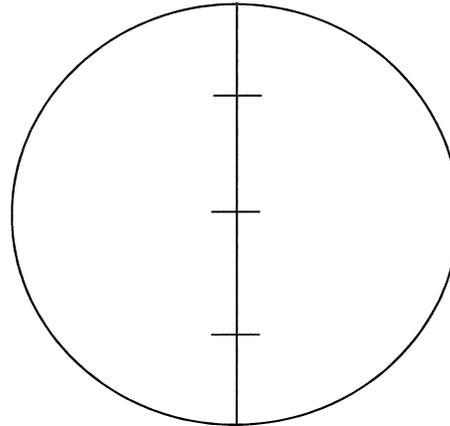
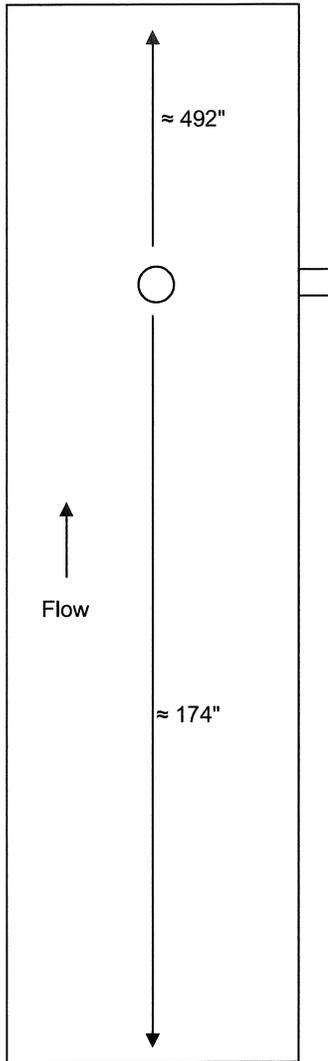
Figure No. 2

Site:
EUBOILER2 Exhaust
Packaging Corporation of America
Filer City, Michigan

Sampling Date:
May 14, 2019

Montrose Air Quality Services
4949 Fernlee Avenue
Royal Oak, Michigan 48073

diameter = 67.5 inches



Not to Scale

Points	CEM Distance "
1	11.3
2	33.8
3	56.2

Note: NOx/O2 sampling was extracted at three points through a stainless steel probe positioned at approximately 16.7%, 50% and 83.3% of the sample stream diameter (7 minutes at each point).

Figure No. 3

Site: EUBOILER4A Exhaust
Packaging Corporation of America
Filer City, Michigan

Sampling Date: May 15, 2019

Montrose Air Quality Services
4949 Fernlee Avenue
Royal Oak, Michigan 48073