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**REPORT OF A RELATIVE ACCURACY TEST AUDIT ON THE CEMS ASSOCIATED WITH THE
BOILER #9 EXHAUST STACK AT THE PHARMACIA & UPJOHN COMPANY, LLC FACILITY
LOCATED IN KALAMAZOO, MICHIGAN**

Prepared for:

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AIR QUALITY DIVISION

Prepared by:

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FEBRUARY 6, 2018

STACK TEST GROUP, INC. PROJECT NO. 18-3005

Report Prepared By:



Bill J. Byczynski
Principal

1.0 EXECUTIVE SUMMARY

On March 7, 2017, The Stack Test Group, Inc. performed a relative accuracy test audit (RATA) on the boiler #9 exhaust stack continuous emissions monitoring system (CEMS) at the Pharmacia & Upjohn Company, LLC facility located in Kalamazoo, Michigan. Presented below is the relative accuracy of this system.

NOx Relative Accuracy:	5.18 Percent
Allowable Limit:	20.0 Percent

2.0 INTRODUCTION

The Stack Test Group, Inc. conducted a relative accuracy test audit (RATA) on the CEMS system associated with the #9 boiler exhaust stack. Testing was performed at the Pharmacia & Upjohn Company, LLC facility located in Kalamazoo, Michigan on February 6, 2018. Ten RA test runs lasting 21 minutes in duration were conducted on CEMS system. The purpose of this testing was to determine the RA of the existing CEMS systems associated with the boiler #9 exhaust and to prove compliance with the existing permit.

Testing was conducted while Pharmacia & Upjohn Company personnel operated the boiler at greater than 50% capacity and normal conditions. The boiler averaged 95,949 LBS/HR of steam and 108,634 MMBTU/HR which is greater than 50% of maximum capacity. The boiler is rated at 120,000 lbs/hr of steam or a heat input of 144.5 MMBTU/HR. A copy of the boiler operating data is included in Appendix C.

The serial number of the Pharmacia & Upjohn Company TAPI T200M dual bench NOx/O2 certified during this test series is 470.

Testing was supervised by Mr. Gary Kohnke of the Stack Test Group, Inc. and coordinated by Mr. Jeff Robey, EH&S of Pharmacia & Upjohn Company. The testing was witnessed by representatives of the Michigan Department of Environmental Quality (MDEQ).

All testing was in accordance with U.S. EPA Reference Methods 3A, 7E and 19 and Appendix B Performance Specifications 2, 3 & 4A. This report contains a summary of results for the above mentioned tests and all the supporting field, process, and computer generated data.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 Nitrogen Oxides (NOx) & Oxygen (O₂)

3.1.1 Sample Collection

Oxygen and nitrogen oxides emissions and the RA of the CEMS system were determined in accordance with USEPA Reference Methods 3A, 7E and 19 and Appendix B Performance Specifications 2 and 3. These Methods are titled:

Method 3 A	Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)
Method 7E	Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)
Method 19	Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides Emission Rates
Perf. Spec. 2	Specifications and Test Procedures for SO ₂ and NOx Continuous Emission Monitoring Systems in Stationary Sources
Perf. Spec. 3	Specifications and Test Procedures for O ₂ and CO ₂ Continuous Emission Monitoring Systems in Stationary Sources

These methods appear in detail in Title 40 of the Code of Federal Regulations (CFR), Part 60, Appendix A & B.

Oxygen and nitrogen oxides emissions were determined using U.S. EPA Methods 3A and 7E, respectively. A gas sample was drawn from the exhaust stack through a sintered filter, heated stainless steel probe, and transported to a Universal gas conditioner through a heated Teflon line set to 260°F. The gas conditioner removed moisture from the gas stream and pumped a dry gas sample through a Teflon line and manifold flow system to a TECO Model 42C NO_x analyzer and a Servomex Model 1440C O₂ analyzer.

3.1.2 Sample Duration and Frequency

Ten continuous samples were collected with each test lasting twenty-one minutes in duration. A sample was drawn for at least twice the analyzer response time before beginning the test run. The response time of the NO_x analyzer was approximately 55 seconds and the response time of the O₂ analyzer was approximately 40 seconds.

3.1.3 Calibration

At the beginning of the test series, the analyzers were calibrated and then checked for calibration error by introducing zero, mid-range and high-range calibration gases to the back of the analyzers. Before and after every other test run, a system bias was performed by introducing a zero and mid-range NO_x and O₂ calibration gas to the outlet of the probe. Calibration gases used were U.S. EPA Protocol 1 certified. A copy of the calibrations are included in Appendix D and the gas certification sheets are included in Appendix E. The raw ppm readings were corrected for calibration drift and bias per the requirements of Method 7E. The corrected and uncorrected reading are also included in Appendix D.

3.1.4 Data Reduction

The analyzer outputs were recorded on a data logger and down-loaded on to a laptop computer. An average output was recorded every ten seconds and every minute, however only the minute averages were used in the calculations. All data reduction was performed using Microsoft Excel software.

4.0 TEST RESULTS

Presented in this section are the results of this test series. Test results are reported in Tables 4.1 through 4.3. Table 4.1 presents the relative accuracy results for the CEMS system. The ten individual test runs are reported for both the CEMS and the Reference Method. Table 4.1 also presents the standard deviation, confidence coefficient and the relative accuracy.

Table 4.1 also presents the relative accuracy results (RA). The results are presented in terms of pounds per million BTU (lb/MMBTU) for each analyzer and the absolute difference in lb/MMBTU. The relative accuracy is presented in terms of percent.

Copies of the calculations used to determine these emission rates may be found in Appendix A. Copies of the field parameter sheets are presented in Appendix B. Copies of the raw CEMS data is presented in Appendix C. Copies of analyzer calibrations are presented in Appendix D.

4.1
RELATIVE ACCURACY TEST AUDIT
 For
Nitrogen Oxides

PLANT: Pharmacia & Upjohn Company
 PROJECT #: 18-3005
 SOURCE: Boiler #9
 R.M. ANALYZER: TECO 42C
 LOCATION: Exhaust Stack

Date	Time	Run	Reference Method	CEM Monitor	Diff. (X1)		DI^2	
					NOX (lb/MMBTU)	NOX (lb/MMBTU)		
02/08/18	08:10 AM	08:31 AM	1	0.040	0.040	0.000	0.000000	
02/08/18	08:37 AM	08:58 AM	2	0.038	0.040	-0.002	0.000004	
02/08/18	09:03 AM	09:24 AM	3	0.039	0.040	-0.001	0.000001	
02/08/18	09:30 AM	09:51 AM	4	0.039	0.040	-0.001	0.000001	
02/08/18	09:55 AM	10:16 AM	5	0.038	0.040	-0.002	0.000004	
02/08/18	10:22 AM	10:43 AM	6	0.038	0.039	-0.001	0.000001	
02/08/18	10:49 AM	11:10 AM	7	0.038	0.040	-0.002	0.000004	
02/08/18	11:15 AM	11:36 AM	8	0.038	0.040	-0.002	0.000004	
02/08/18	11:41 AM	12:02 PM	9	0.038	0.040	-0.002	0.000004	
* 02/08/18	12:06 PM	12:27 PM	10	0.038	0.040	-0.002	0.000004	
SUM							-0.0130	0.0000230
MEAN					0.0384	0.0399	-0.0014	
STANDARD DEVIATION							0.0007265	
CONFIDENCE COEFFICIENT							0.0005478	
RELATIVE ACCURACY							5.18	

CALCULATION USED: $RA = [|d| + |cc|] / RM\ MEAN * 100$

* Note: This test run was not used in calculating the relative accuracy.