EMISSIONS COMPLIANCE TEST
(40CFR63 Subpart DDDDD)

Performed At The

Pharmacia & Upjohn Company, LLC
A subsidiary of Pfizer, Inc
Building 43
Gas Stream 1 (Combined Boilers EUEBLR43-1-S1 & EUEBLR43-6-S1)
Gas Stream 2 (Boiler EUEBLR43-5-S1)
Kalamazoo, Michigan

Test Date(s)

December 10 through 13, 2019

Report No.

TRC Environmental Corporation Report 351516A

Report Submittal Date

February 5, 2020

TRC Environmental Corporation
7521 Brush Hill Road
Burr Ridge, Illinois 60527
USA

T (312) 533-2042
F (312) 533-2070

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).

Anthony Sakellariou

Mr. Anthony Sakellariou
Senior Project Manager

February 5, 2020
Date

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

Bruce Randall
TRC Emission Testing Technical Director

TABLE OF CONTENTS

APPENDIX

EMISSIONS COMPLIANCE TEST

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed an emission compliance test program to determine filterable particulate matter (PM), hydrogen chloride (HCl), carbon monoxide (CO) and mercury (Hg) from the gas streams (GS) associated with the three (3) coal-fired boilers (EUEBLR43-1-S1,EUEBLR43-5-S1 and EUEBLR43-6-S1) in Building 43 at the Pharmacia & Upjohn Company, LLC (Pfizer) facility in Kalamazoo, Michigan on December 10 through 13, 2019. The tests were authorized by and performed for Pharmacia & Upjohn Company, LLC, a subsidiary of Pfizer, Inc.

The purpose of this test program was to determine PM, Hg, CO and HCl emission rates during normal operating conditions. The results of the test program will be used in order to determine compliance with Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. MI-ROP-B3610-2014h, and United States Environmental Protection Agency (USEPA) Title 40, Code of Federal Regulations Part 63 (40CFR63), Subpart DDDDD – National Emission Standards for Hazardous Air Pollutant for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters requirements. The test program was conducted according to the TRC Test Protocol 351516A dated October 7, 2019.

1.1 Project Contact Information

Participants		
Test Facility	Pharmacia & Upjohn Company, LLC Building 43 7000 Portage Road Kalamazoo, Michigan 49001	Mr. Jeffrey Robey Manager, EHS (269) 833-3842 (phone) jeffrey.robey@pfizer.com
Air Emissions Testing Body (AETB)	TRC Environmental Corporation 7521 Brush Hill Road Burr Ridge, Illinois 60527	Mr. Anthony Sakellariou Senior Project Manager (312) 533-2035 (phone) (312) 533-2070 (fax) asakellariou@trccompanies.com
State Representatives	MDEQ, Constitution Hall 525 West Allegan Street Lansing, Michigan 48909	Mr. David Patterson Technical Programs Unit (517) 284-6782 (phone) pattersond2@michigan.gov Mr. Dennis Dunlop Mr. Matthew Karl Ms. Lindsey Wells Ms. Monica Brothers

The tests were conducted by Ryan Novosel, Rome Rothgeb, Austin Petersen and Anthony Sakellariou of TRC. Documentation of the on-site ASTM D7036-04 Qualified Individual(s) (QI) can be located in the appendix to this report.

1.2 Facility and Process Description

Pharmacia & Upjohn Company, LLC owns and operates three (3) coal-fired boilers in Building 43 (B43) at its pharmaceutical manufacturing facility in Kalamazoo, Michigan.

In regard to the three coal-fired boiler exhausts, in one instance, the exhausts from two boilers are combined into a common exhaust duct (Gas Stream 1) and share a common baghouse and common lime injection system. The table below describes how the boilers are paired together ductwork and baghouses:

Boiler	Design Capacity, lbs/hr steam	Normal Steam Output, lbs/hr	Year Placed in Service	Gas Stream (GS)
1	60,000	45,000	1948	1
5	90,000	75,000	1960	2
6	90,000	75,000	1962	1

2.0 SUMMARY OF RESULTS

The results of this test program are summarized in the tables below. Detailed individual run results are presented in Section 6.0.

GS1 (EUEBLR43-1-S1 & EUEBLR43-6-S1)			
Pollutant Tested		Measured Emissions	Boiler MACT Emission Limit
PM	lb/MMBtu	2.6×10^{-3}	4.0×10^{-2}
Hg	lb/MMBtu	2.79×10^{-6}	5.7×10^{-6}
CO	ppmvd @ 3% O2	34.2	160
HCl	lb/MMBtu	2.0×10^{-2}	2.2×10^{-2}

GS2 (EUEBLR43-5-S1)			
Pollutant Tested		Measured Emissions	Boiler MACT Emission Limit
PM	lb/MMBtu	2.2×10^{-3}	4.0×10^{-2}
Hg	lb/MMBtu	1.49×10^{-6}	5.7×10^{-6}
CO	ppmvd @ 3% O2	114.7	160
HCl	lb/MMBtu	1.9×10^{-2}	2.2×10^{-2}

The tables below summarize the test methods used, as well as the number and duration of each at each test location:

Unit ID/ Sample Location	Parameter Measured	Test Methods	No. of Runs	Run Duration (minutes)
GS-1 (EUEBLR43-1-S1, EUEBLR43-6-S1) Stack	Filterable Particulate	USEPA 1, 2, 3A, 5 and 19	3	120
	Mercury	USEPA 3A, 19 and 30B	3	90
	Carbon Monoxide	USEPA 3A and 10	3	60
	HCl	USEPA 3A, 19 and 320	3	60

Unit ID/ Sample Location	Parameter Measured	Test Methods	No. of Runs	Run Duration (minutes)
GS-2 (EUEBLR43-5-S1) Stack	Filterable Particulate	USEPA 1, 2, 3A, 5 and 19	3	120
	Mercury	USEPA 3A, 19 and 30B	3	90
	Carbon Monoxide	USEPA 3A and 10	3	60
	HCl	USEPA 3A, 19 and 320	3	60

3.0 DISCUSSION OF RESULTS

For GS-1 filterable PM testing, test train clearance issues resulted in the use of two sample probes (one for each sample port) to conduct each of the test runs. The sample train was leak checked before and after sampling at each port. The acetone probe wash included the combined washes from both probes.

For GS-2 filterable PM Run 1, two sample probes (one for each sample port) were used to conduct Run 1. The sample train was leak checked before and after sampling at each port. The acetone probe wash included the combined washes from both probes. During Run 1 it was determined that a single probe could be used at the GS-2 test location. A standard sampling approach (single probe) was used during GS-2 filterable PM Runs 2 and 3.

During GS-2 filterable PM Run 2, the TRC mobile laboratory lost power due to a short in the 220V plug. Testing was paused at 13:07 and resumed at 16:25 after the power was restored and the Method 3A analyzers for O_2 & CO_2 were re-calibrated.

No additional problems were encountered with the testing equipment during the test program. Source operation appeared normal during the entire test program. No changes or problems were encountered that required modification of any procedures presented in the test plan. No adverse test or environmental conditions were encountered during the conduct of this test program.

4.0 SAMPLING AND ANALYSIS 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.

4.1 Determination of Sample Point Locations by USEPA Method 1

This method is applicable to gas streams flowing in ducts, stacks, and flues and is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rates from stationary sources. In order to qualify as an acceptable sample location, it must be located at a position at least two stack or duct equivalent diameters downstream and a half equivalent diameter upstream from any flow disturbance.

The cross-section of the measurement site was divided into a number of equal areas, and the traverse points were then located in the center of these areas. The minimum number of points were determined from either Figure 1-1 (particulate) of USEPA Method 1.

4.2 Volumetric Flow Rate Determination by USEPA Method 2

This method is applicable for the determination of the average velocity and the volumetric flow rate of a gas stream.

The gas velocity head (ΔP) and temperature were measured at traverse points defined by USEPA Method 1. The velocity head was measured with a Type S (Stausscheibe or reverse type) pitot tube and oil-filled manometer; and the gas temperature was measured with a Type K thermocouple. The average gas velocity in the flue was calculated based on: the gas density (as determined by USEPA Methods 3A and 4); the flue gas pressure; the average of the square roots of the velocity heads at each traverse point, and the average flue gas temperature.

4.3 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 Method 7E specifications.

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 1 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.

4.3.1 CO_2 Determination by USEPA Method 3A

This method is applicable for the determination of CO_2 concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The CO_2 analyzer was equipped with a non-dispersive infrared (IR) detector.

4.3.2 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.

4.3.3 CO Determination by USEPA Method 10

This method is applicable for the determination of CO concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The non-dispersive infrared analyzer (NDIR) CO analyzer was equipped with an internal gas correlation filter wheel, which eliminates potential detector interference. As such, use of an interference removal trap was not required.

4.4 Filterable PM Determination by USEPA Method 5

This method is applicable for the determination of PM emissions from stationary sources. USEPA Methods 2-4 were performed concurrently with, and as an integral part of, these determinations.

Flue gas was withdrawn isokinetically from the source at traverse points determined per USEPA Method 1, and PM was collected in the nozzle, probe liner, and on a glass fiber filter. The probe liner and filter were maintained at a temperature of 120 ± 14°C (248 ± 25°F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. The PM mass, which included any material that condensed at or above the filtration temperature, was determined gravimetrically after the removal of uncombined water.

4.5 Trace Mercury Determination by USEPA Method 30B

Method 30B is a reference method for relative accuracy test audits (RATAs) of vapor phase Hg CEMS and sorbent trap monitoring systems installed at coal-fired boilers and is also appropriate for Hg emissions testing at such boilers. It is intended for use only under relatively low particulate conditions (i.e., sampling after all pollution control devices).

Flue gas was withdrawn at a constant rate through paired, in-stack sorbent traps. In order to be considered valid, each pair of traps met relative standard deviation specifications that varied depending upon the concentration of Hg in the flue gas. A field recovery test was performed on three sets of paired traps – one trap in each set was spiked with a known mass of Hg. In order to meet method specifications, the average recovery was required to be 85 to 115 percent.

The sorbent traps were analyzed on-site using thermal desorption and Zeeman atomic absorption using high frequency modulation of light polarization (ZAAS-HFM).

4.6 Hydrogen Chloride Determination by USEPA Method 320

The Method 320, 40CFR63, sampling and measurement system meets the requirements for stack sampling of gaseous organic and inorganic compounds set forth by the United States Environmental Protection Agency (USEPA). In particular, it meets the requirements of USEPA Reference Method 320, "Measurement Of Vapor Phase Organic And Inorganic Emissions By Extractive Fourier Transform Infrared (FTIR) Spectroscopy," 40CFR63. This method applies to the analysis of a range of volatile organic compounds (VOCs) and volatile inorganic compounds emitted from an industrial source.

The source emissions were transported to the FTIR analyzer via a heated, extractive sampling system. The various components of the matrix were identified and quantified by absorbance of infrared radiation. Data measurements and analytical results were stored on a computer. The data were copied to a flash drive and a second hard drive before departing the test site.

The FTIR spectrometer used was an MKS 2030 Analyzer outfitted with a liquid nitrogen cooled MCT (mercury cadmium telluride) detector and a heated low volume (200 mL) gas cell with a 5.11-meter pathlength. The spectral resolution was 0.5 cm^{-1} (wavenumbers). The FTIR instrument was calibrated using a spectral library of reference spectra stored on computer. Calibration was verified on site through direct and system calibration measurements using gas standards. These gases include the method-required CTS (calibration transfer standard, nominally 10 ppm Ethylene) and nitrogen zero gas. Direct and dynamic matrix spiking calibrations were conducted using a hydrogen chloride/sulfur hexafluoride gas standard.

Method 320 Testing Details:

- The total sampling system flow rate was 10 liters/minute.
- The sampling system included a heated probe maintained at 365 °F that utilized a heated filter at the probe exit to remove particulate.
- Calibration and spiking gases were injected into the probe upstream of the heated filter.
- The heated sampling umbilical was 200 feet in length and was maintained at 365 °F.
- The heated head pump, manifold, and FTIR gas cell were maintained at 365 °F.
- The percent moisture obtained by Method 320 was used to convert the HCl wet concentrations to dry.

- In order to calculate the lb/MMBtu emission rate, the CO_2 concentrations from the calibrated Method 3A CO_2 analyzer were used. CO_2 was measured on a dry basis.

The sampling system was checked for leaks after assembling the sampling equipment on-site and allowing all heated equipment to stabilize. The leak-check was performed by capping the end of the sample probe and verifying the absence of sampling system flow as measured by an inline rotameter. The FTIR analyzer was checked for leaks by pressurizing the gas cell and monitoring the pressure drop.

The CTS gas (nominally 10.0 ppm C_2H_4 in nitrogen cylinder) was flowed directly to the FTIR (direct calibration) and through the sampling system (system calibration) prior to and upon completion of testing. The repeatability (%RPD) is also reported as a calculation comparing two successive CTS measurements. Repeatability of <2% indicates the measurement had stabilized. The % Difference calculation compares measurements at the start and end of the test day; the method requirement of <5% difference was achieved in all measurements. The sampling system response time was determined at the test location using the System CTS calibration. The CTS was measured in a system calibration immediately after a system zero calibration. A response time was measured at the location based on measuring 95% of the calibration cylinder concentration.

A direct and system zero measurement was conducted at the start and end of the test day. An acceptable zero calibration is generally defined by detection of analytes (except H_2O and CO_2) below 1 ppm. Acceptable zero calibration values were obtained for all measured compounds.

The FTIR Classical Least Squares (CLS) analysis determines the concentration, in parts per million wet basis (ppmvw), for each analyzed compound as well as the residual, which is the error associated with each measured concentration. When the residual error exceeds the measured concentration, the compound is considered a non-detect, and the residual is reported as the detection limit. Therefore, if the measured concentration is 0.05 ppmvw and the residual error is 0.10 ppmvw, the concentration is reported as "<0.10".

Calibration and detailed test data can be found in the appendix to this report. The report appendix includes summaries of QA data collected during the test program. QA procedures included system leak checks, direct and system calibration and zero measurements, detector linearity checks, and verification of analysis accuracy by manual subtraction. The analysis was confirmed by manual subtraction of the measured compounds from a representative spectrum. This confirmation served to validate the computerized FTIR analysis.

As required in the EPA letter allowing the use of FTIR to measure HCl emissions using EPA Method 320 (see Appendix), a Method 301 validation study was previously conducted using the MKS FTIR analyzer and a comparable sampling system. The validation study uses data from twelve pairs of spiked and unspiked measurements to determine data consistency and accuracy. The FTIR QA appendix details how the validation study was conducted and presents the validation data and calculations.

4.7 Determination of F-Factors by USEPA Method 19

This method is applicable for the determination of the pollutant emission rate using oxygen (O_2) or carbon dioxide (CO_2) concentrations and the appropriate F factor (the ratio of combustion gas volumes to heat inputs) and the pollutant concentration. The appropriate F-Factor selected from Table 19-2 of Method 19 for bituminous coal is 1800 scf/MMBtu.

5.0 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:

- Accreditation from the Louisiana Environmental Laboratory Accreditation Program (LELAP);
- Accreditation from the Stack Testing Accreditation Council (STAC) and the American Association for Laboratory Accreditation (A2LA) that our operations conform with the requirements of ASTM D 7036 as an Air Emission Testing Body (AETB).

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.

ASTM D7036-04 specifies that: *"AETBs shall have and shall apply procedures for estimating the uncertainty of measurement. Conformance with this section may be demonstrated by the use of approved test protocols for all tests. When such protocols are used, reference shall be made to published literature, when available, where estimates of uncertainty for test methods may be found."* TRC conforms with this section by using approved test protocols for all tests.

6.0 TEST RESULTS SUMMARY

PARTICULATE TEST RESULTS SUMMARY

Page 1 of 1

Company:	Pfizer
Plant:	Kalamazoo, MI
Unit:	GS1-Boilers 1&6
Location:	Stack

Test Run Number:	1	2	3	Average
Source Condition:	High	High	High	
Date:	12/12/2019	12/12/2019	12/13/2019	
Start Time:	8:45	12:20	8:20	
End Time:	11:05	18:00	10:40	
Sample Duration (min):	120.0	120.0	120.0	120.0
Average Gas Temp, T_s, (°F):	363.6	370.6	368.3	367.5
Fractional Gas Moisture Content, B_{ws}:	0.041	0.047	0.045	0.044
Gas CO_2 Content (%vol):	8.1	8.2	8.3	8.2
Gas O_2 Content (%vol):	11.6	11.5	11.3	11.5
Gas Wet MW, M_s, (lb/lbmole-mole):	29.28	29.22	29.25	29.25
Average Gas Velocty, V_s, (ft/sec):	61.26	64.55	62.90	62.90
Measured Volumetric Flow Rate:				
Q (actual ft^3/min):	72,165	76,042	74,098	74,102
Q_{std} (std ft^3/min):	45,369	47,225	45,582	46,059
$Q_{std(dry)}$ (dry std ft^3/min):	43,498	45,023	43,537	44,019
F_c (scf/MMBtu):	1,800	1,800	1,800	1,800
Sample Volume, $V_{m(std)}$, (dry std ft^3):	85.734	87.447	85.409	86.196
Sample Volume, $V_{m(std)(metric)}$, (dry std. m^3):	2.428	2.476	2.419	2.441
PM Collected, m_n, (mg):				
Filterable	4.31	6.24	3.41	4.65
PM Concentration, C_s, (gr/dscf):				
Filterable	0.0008	0.0011	0.0006	0.0008
PM Emission Rate, ER_{M2}, (lb/hr based on measured volumetric flow rate):				
Filterable:	0.2895	0.4248	0.2298	0.3147
PM Emission Rate, ER_{Fc}, (lb/MMBtu using F_c):				
Filterable:	0.0025	0.0035	0.0019	0.0026
PM Emission Rate, ER_{Fw}, (lb/MMBtu using F_w):				
Isokinetic Variance (I)	98.6	97.1	98.1	97.9

English Units: Standard conditions of 29.92 inHg and 68° F

Metric Units: Standard conditions of 760 mmHg and 20° C

Gaseous Test Results Summary

Project Number:	351516	Start Date:	12/12/19
Customer:	Pfizer	End Date:	12/12/19
Unit Identification:	GS1 - Boilers 1 & 6	Facility:	Kalamazoo, MI
Sample Location:	Stack	Recorded by:	Anthony Sakellariou
RM Probe Type:	Extractive (Dry)	Fc Factor:	-
Load Level/Condition:	High	Fd Factor:	-

Reference Method Results, As Measured Moisture Basis

Run #	Date	Start Time	End Time	NOX ppmvd	SO2 ppmvd	CO ppmvd	CO2 % v/v dry	O2 % v/v dry
1	12/12/19	8:45	9:45	-	-	16.9	8.0	11.7
2	12/12/19	10:05	11:05	-	-	16.3	8.1	11.6
3	12/12/19	17:00	18:00	-	-	20.5	8.3	11.4
Average				-	-	17.9	8.1	11.5

Results Corrected to a Reference O_2 Concentration

Run #	NO_X ppmvd corrected to N/A	SO_2 ppmvd corrected to N/A	CO ppmvd corrected to 3% Oxygen
1	-	-	32.7
2	-	-	31.3
3	-	-	38.5
Average	-	-	34.2

TRC

Mercury Test Results Summary

Pfizer

Kalamazoo, MI

GS1 - Boiler 1 & 6 Stack

Mercury Emissions Summary

F_c-Factor	1800

Run No.	Date	Start Time	Finish Time	Trap A Hg Conc. C_a µg/dscm	Trap B Hg Conc. C_b µg/dscm	Average Hg Conc. C_d µg/dscm	Average Hg Conc. E lb/dscf	Unit CO_2 Concentration dry, %	Fuel Factor (F_c) scf/MMBtu	Hg Emission Rate lb/mmBtu
1	12/13/19	11:10	12:40	1.98	2.23	2.10	1.313E-10	8.30	1,800	2.85E-06
2	12/13/19	13:00	14:30	2.00	2.08	2.04	1.273E-10	8.50	1,800	2.69E-06
3	12/13/19	14:50	16:20	2.10	2.14	2.12	1.325E-10	8.40	1,800	2.84E-06
Average				2.03	2.15	2.09	1.303E-10	8.40	1,800	2.79E-06

TRC

EMISSIONS TEST RESULTS SUMMARY - EPA METHOD 320						
Company:	**Pfizer**		**Date:**	**12/13/2019**		
Plant:	**Kalamazoo, MI**		**Project #:**	**351516**		
Unit:	**GS1 - Boilers 1 & 6**		**Op. Condition:**	**High**		
Sample Loc:	**Stack**		**TRC ENVIRONMENTAL**			
	Date		12/13/19	12/13/19	12/13/19	
	Start Time		9:40	11:10	13:30	
	End Time		10:40	12:10	14:30	
	Test Run		1	2	3	Average
Moisture	Moisture Method 320	Fraction	0.043	0.042	0.044	0.043
F Factor	F Factor Fc	dscf/MMBtu	1800	1800	1800	1800
	CO_2 Method 3A	%, Dry	8.3	8.3	8.5	8.4
	Hydrogen Chloride HCl	ppmvw	9.67	9.41	9.30	9.46
MW=	36.4606	ppmvd	10.10	9.83	9.73	9.88
		lb/MMBtu	2.1E-02	2.0E-02	1.9E-02	2.0E-02

PARTICULATE TEST RESULTS SUMMARY

Page 1 of 1

Company: Pfizer
Plant: Kalamazoo, MI
Unit: GS2-Boiler 5
Location: Stack

Test Run Number:	1	2	3	Average
Source Condition:	High	High	High	
Date:	12/10/2019	12/10/2019	12/10/2019	
Start Time:	9:50	13:20	16:05	
End Time:	12:52	15:40	18:15	
Sample Duration (min):	120.0	120.0	120.0	120.0
Average Gas Temp, T_s, (^oF):	311.3	315.6	317.1	314.6
Fractional Gas Moisture Content, B_{ws}:	0.045	0.046	0.047	0.046
Gas CO_2 Content (%vol):	8.8	8.4	8.3	8.5
Gas O_2 Content (%vol):	10.7	11.2	11.3	11.1
Gas Wet MW, M_s, (lb/lbmole-mole):	29.30	29.25	29.23	29.26
Average Gas Velocty, V_s, (ft/sec):	41.01	42.34	41.91	41.75
Measured Volumetric Flow Rate:				
Q (actual ft^3/min):	48,311	49,876	49,374	49,187
Q_{std} (std ft^3/min):	31,884	32,904	32,544	32,444
$Q_{std(dry)}$ (dry std ft^3/min):	30,441	31,403	31,029	30,958
F_c (scf/MMBtu):	1,800	1,800	1,800	1,800
Sample Volume, $V_{m(std)}$, (dry std ft^3):	89.108	93.611	92.647	91.789
Sample Volume, $V_{m(std)(metric)}$, (dry std. m^3):	2.523	2.651	2.624	2.599
PM Collected, m_n, (mg):				
Filterable	5.49	4.03	3.39	4.30
PM Concentration, C_s, (gr/dscf):				
Filterable	0.0010	0.0007	0.0006	0.0007
PM Emission Rate, ER_{M2}, (lb/hr based on measured volumetric flow rate):				
Filterable:	0.2479	0.1790	0.1502	0.1924
PM Emission Rate, ER_{Fc}, (lb/MMBtu using F_c):				
Filterable:	0.0028	0.0020	0.0017	0.0022
Isokinetic Variance (I)	93.8	95.6	95.7	95.0

English Units: Standard conditions of 29.92 inHg and 68° F

Metric Units: Standard conditions of 760 mmHg and 20° C

Gaseous Test Results Summary

Project Number:	351516	Start Date:	12/10/19
Customer:	Pfizer	End Date:	12/10/19
Unit Identification:	GS2 - Boiler 5	Facility:	Kalamazoo, MI
Sample Location:	Stack	Recorded by:	Anthony Sakellariou
RM Probe Type:	Extractive (Dry)	Fc Factor:	-
Load Level/Condition:	High	Fd Factor:	-

Reference Method Results, As Measured Moisture Basis

Run #	Date	Start Time	End Time	NOX ppmvd	SO2 ppmvd	CO ppmvd	CO2 % v/v dry	O2 % v/v dry
1	12/10/19	11:52	12:52	-	-	62.9	8.5	11.0
2	12/10/19	13:20	14:20	-	-	79.6	8.4	11.2
3	12/10/19	17:15	18:15	-	-	45.3	8.3	11.3
Average				-	-	62.6	8.4	11.1

Results Corrected to a Reference O_2 Concentration

Run #	NO_X ppmvd corrected to N/A	SO_2 ppmvd corrected to N/A	CO ppmvd corrected to 3% Oxygen
1	-	-	113.8
2	-	-	146.2
3	-	-	84.1
Average	-	-	114.7

Mercury Test Results Summary

Pfizer

Kalamazoo, MI

GS2 - Boiler 5 Stack

Mercury Emissions Summary

F_c-Factor	1800

Run No.	Date	Start Time	Finish Time	Trap A Hg Conc. C_a µg/dscm	Trap B Hg Conc. C_b µg/dscm	Average Hg Conc. C_d µg/dscm	Average Hg Conc. E lb/dscf	Unit CO_2 Concentration dry, %	Fuel Factor (F_c) scf/MMBtu	Hg Emission Rate lb/mmBtu
1	12/11/19	9:15	10:45	0.79	0.81	0.80	4.981E-11	8.30	1800	1.08E-06
2	12/11/19	11:15	12:45	1.06	1.08	1.07	6.672E-11	8.30	1800	1.45E-06
3	12/11/19	13:05	14:35	1.41	1.44	1.43	8.904E-11	8.30	1800	1.93E-06
Average				1.09	1.11	1.10	6.852E-11	8.30	1800	1.49E-06

TRC

EMISSIONS TEST RESULTS SUMMARY - EPA METHOD 320

Company:	**Pfizer**	**Date:**	**12/11/2019**
Plant:	**Kalamazoo, MI**	**Project #:**	**351516**
Unit:	**GS2 - Boiler 5**	**Op. Condition:**	**High**
Sample Loc:	**Stack**	**TRC ENVIRONMENTAL**	

	Date		12/11/19	12/11/19	12/11/19	
	Start Time		13:05	15:04	16:20	
	End Time		14:05	16:04	17:20	
	Test Run		1	2	3	Average
Moisture	Moisture Method 320	Fraction	0.041	0.041	0.041	0.041
F Factor	F Factor Fc	dscf/MMBtu	1800	1800	1800	1800
	CO_2 Method 3A	%, Dry	8.3	8.3	8.2	8.3
	Hydrogen Chloride HCl	ppmvw	9.01	9.14	8.22	8.79
MW=	36.4606	ppmvd	9.39	9.54	8.57	9.17
		lb/MMBtu	1.9E-02	2.0E-02	1.8E-02	1.9E-02