FINAL REPORT

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FCA US LLC

WARREN, MICHIGAN

WARREN TRUCK ASSEMBLY PLANT (WTAP): FGBOILERS TESTING REPORT

RWDI # 2201514

March 10, 2022

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) was retained by FCA US LLC (FCA) to complete the emission sampling program at their Warren Truck Assembly Plant (WTAP) facility located at 21500 Mound Road, Warren, Michigan. WTAP operates an automobile assembly plant that produces the RAM 1500 Classic. This Source Testing Program outlines the performance testing required for flexible group FGBOILERS units EUBOILER3, EUBOILER4, EUBOILER5, and EUBOILER6, condition V.1. The test program was conducted to fulfill the requirements of the Michigan Department of Environment, Great Lakes and Energy (EGLE) PTI 13-19B. The testing included mass emission rates of oxides of nitrogen (NOx) from each boiler. Testing was conducted from January 18^{th}-19^{th}, 2022.

The following table represents a summary of the stack testing results.

Summary of FGBOILERS:

Parameter	NOx PPM	NOx lb/hr	NOx lbs/MMBtu
EUBOILER3	42.7	5.2	0.066
EUBOILER4	25.3	2.1	0.040
EUBOILER5	50.6	5.6	0.072
EUBOILER6	116.0	15.2	0.161

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1 INTRODUCTION

RWDI USA LLC (RWDI) was retained by FCA US LLC (FCA) to complete the emission sampling program at their Warren Truck Assembly Plant (WTAP) facility located at 21500 Mound Road, Warren, Michigan. WTAP operates an automobile assembly plant that produces the RAM 1500 Classic. This Source Testing Program outlines the performance testing required for flexible group FGBOILERS units EUBOILER3, EUBOILER4, EUBOILER5, and EUBOILER6, condition V.1. The test program was conducted to fulfill the requirements of the Michigan Department of Environment, Great Lakes and Energy (EGLE) PTI 13-19B. The testing included mass emission rates of oxides of nitrogen (NOx) from each boiler. Testing was conducted from January 18th-19th, 2022.

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2 SOURCE DESCRIPTION

2.1 Facility Description

The following sources and source group, as identified in the PTI, were included in the program:

Table 2.1.1: Summary of Source Group

Emission Unit	Capacity	Pollution Control Equipment
EUBOILER3	152 MMBtu/hr	Low NOx Burners
EUBOILER4	106 MMBtu/hr	Low NOx Burners
EUBOILER5	153 MMBtu/hr	Low NOx Burners
EUBOILER6	192 MMBtu/hr	Oxygen Trim

WTAP operates an automobile assembly plant that produces the RAM 1500 Classic for FCA US LLC. The boilers are used to produce heat for use by the plant. Each source has a single exhaust configuration that vents into the atmosphere. The testing was required to determine compliance with the air permit PTI 13-19B.

3 SAMPLING LOCATION

3.1 Sample Location Description

3.1.1 FGBOILERS

Continuous emissions monitoring (CEM) for NOx and O_2 occurred at EUBOILER3, EUBOILER4, EUBOILER5, and EUBOILER6. The outlets were located on the roof of the powerhouse. To evaluate the emissions, triplicate 60-minute tests were conducted on each source.

Figures 1 through **4** below depict the sources sampled and sampling location.

Figure 1: EUBOILER 3 Outlet

Figure 2: EUBOILER 4 Outlet

Figure 3: EUBOILER 5 Outlet

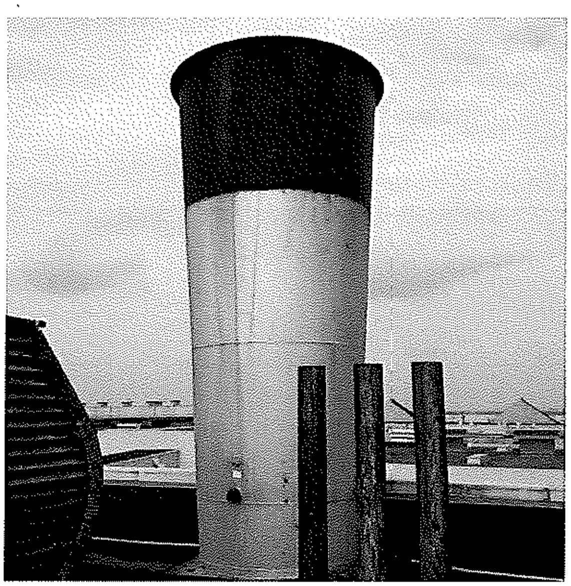
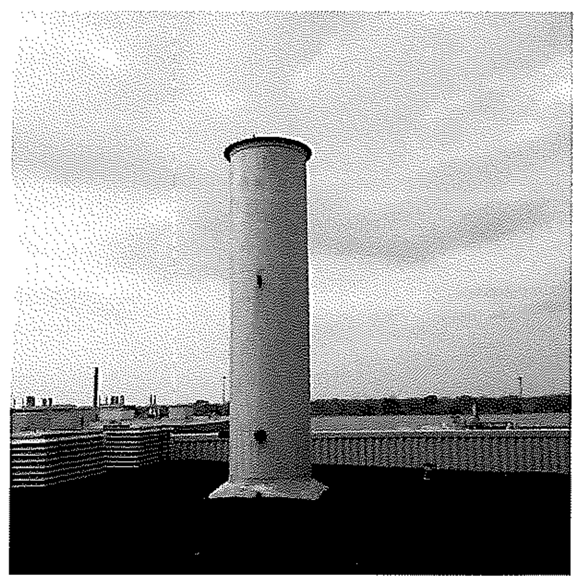


Figure 4: EUBOILER 6 Outlet



4 SAMPLING METHODOLOGY

The following section provides an overview of the sampling methodologies used in this program.

4.1 USEPA Method 3A and 7E

NOx and O_2 concentrations were determined utilizing RWDI's continuous emissions monitoring (CEM) system. Prior to testing, a 3-point analyzer calibration error check was conducted using USEPA protocol gases. The calibration error check was performed by introducing zero, mid and high-level calibration gases directly into the analyzer. The calibration error check was performed to confirm that the analyzer response was within ±2% of the certified calibration gas introduced. Prior to each test run, a system-bias test was performed where known concentrations of calibration gases were introduced at the probe tip to measure if the analyzers response was within ±5% of the introduced calibration gas concentrations. At the conclusion of each test run a system-bias check was performed to evaluate the percent drift from pre and post-test system bias checks. The system bias check was used to confirm that the analyzer did not drift greater than ±3% throughout a test run.

Zero and upscale calibration checks were conducted both before and after each test run in order to quantify measurement system calibration drift and sampling system bias. Upscale is either the mid- or high-range gas, whichever most closely approximates the flue gas level. During these checks, the calibration gases were introduced into the sampling system at the probe tip so that the calibration gases were analyzed in the same manner as the flue gas samples.

A gas sample was continuously extracted from the stack and delivered to a series of gas analyzers, which measure the pollutant or diluent concentrations in the gas. The analyzers were calibrated on-site using EPA Protocol No. 1 certified calibration mixtures. The probe tip was equipped with a sintered stainless-steel filter for particulate removal. The end of the probe was connected to a heated Teflon sample line, which delivered the sample gases from the stack to the CEM system. The heated sample line was designed to maintain the gas temperature above 250°F in order to prevent condensation of stack gas moisture within the line.

Before entering the analyzers, the gas sample was passed directly into a refrigerated condenser, which cools the gas to approximately 35°F to remove the stack gas moisture. After passing through the condenser, the dry gas entered a Teflon-head diaphragm pump and a flow control panel, which deliver the gas in series to the NO_x and O_2 analyzers. Each of these analyzers measured the respective gas concentrations on a dry volumetric basis.

4.2 USEPA Method 205

Calibration gas was mixed using an Environics 4040 Gas Dilution System. The mass flow controllers are factory calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11-point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. The calibration is done yearly, and the records are included in the Source Testing Report. A multi-point EPA Method 205 check was executed in the field prior to testing to ensure accurate gas-mixtures. The gas dilution system consisting of calibrated orifices or mass flow controllers and dilutes a high-level calibration gas to within ±2% of predicted values.

The gas divider is capable of diluting gases at set increments and was evaluated for accuracy in the field in accordance with US EPA Method 205 *"Verification of Gas Dilution Systems for Field Instrument Calibrations"*. The gas divider dilution was measured to evaluate that the responses are within ±2% of predicted values. In addition, a certified mid-level calibration gas within ±10% of one of the tested dilution gases was introduced into an analyzer to ensure the response of the gas calibration is within ±2% of gas divider dilution concentration.

4.3 USEPA Method 19

USEPA Method 19, "Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide and Nitrogen Oxide Emission Rates," was used to calculate a NOx emission factor based on Oxygen concentrations and appropriate F-factors. Equation 19-1 from the method were used.

4.4 Quality Assurance/Quality Control Activities

Applicable quality assurance measures were implemented during the sampling program to ensure the integrity of the results. These measurements included detailed documentation of field data, and equipment calibrations for all measured parameters.

Quality control procedures specific to the CEM monitoring equipment included linearity checks to determine the instrument performance and reproducibility checks prior to its use in the field. Regular performance checks on the analyzers were also carried out during the testing program by performing hourly zero checks and span calibration checks using primary gas standards. Sample system bias checks were also done. These checks were used to verify the ongoing accuracy of the monitor and sampling system over time. Pollutant-free air was introduced to perform the zero checks, followed by a known calibration (span) gas into the monitor. The response of the monitor to pollutant-free air and the corresponding sensitivity to the span gas were recorded regularly during the tests.

5 RESULTS

The emissions data for this study are presented in the '**Tables**' section of this report. Detailed information regarding each test run can be found in the corresponding appendix. Below is a summary of the applicable Table ID for each corresponding test parameter.

Table 5.1: Summary of Data

Parameter	Appendix
EUBOILER3	B-1
EUBOILER4	B-2
EUBOILER5	B-3
EUBOILER6	B-4

Reference to **Appendix B** is noted above in **Table 5.1**. Field notes are presented in **Appendix C.** All calibration information for the equipment used for the program is included in **Appendix D**. Detailed example calculations for each measured pollutant is provided in **Appendix E.** Process data is provided in **Appendix F.**

5.1 FGBOILERS Results

The following section outlines the results from the testing program for FGBOILERS

Table 5.1.1: Summary of FGBOILER Results

Parameter	NOx PPM	NOx lb/hr	NOx lbs/MMBtu
EUBOILER3	42.7	5.2	0.066
EUBOILER4	25.3	2.1	0.040
EUBOILER5	50.6	5.6	0.072
EUBOILER6	116.0	15.2	0.161

5.1.1 Sampling Variations

On EUBOILER3, Test 3 post calibration was outside of the acceptable 3% drift criteria. The test was voided. The analyzers were re-calibrated (calibration error and bias checks), and Test 4 was conducted. The average emissions for EUBOILER3 include tests 1, 2, and 4 for the average. The voided test can be found in **Appendix B-1**.

6 OPERATING CONDITIONS

Operating conditions during the sampling were monitored by FCA Operations and RWDI personnel. During the test, RWDI personnel recorded the fuel usage. All process data is provided in **Appendix F**.

A member of the RWDI sampling team contacted the operator before each test, to ensure that the process was at representative maximum operating conditions.

7 CONCLUSIONS

Testing was successfully completed from January 18th-19th, 2022. All sources were tested in accordance with referenced methodologies following the protocols provided in the Source Testing Plan

TABLES

Table 1

Boiler #3 Testing Summary

RWDI Project #2201514

Boiler #3				O_2	NOx	NOx	NOx Emission Rate	Natural Gas Usage	Natural gas Usage	Steam Production	
Test ID	Date	Start	End	%	ppm	lbs/MMBTU	lbs/hr	MMBTU/hr	ft^3/hr	lbs/hr	
1	2022-01-19	12:41	13:40	6.6	42.1	0.0642	5.05	78.74	77,195	67,980	
2	2022-01-19	14:01	15:00	6.8	42.3	0.0652	5.29	81.01	79,417	71,213	
3	2022-01-19	15:26	16:25	7.4	42.4	0.0683	5.73	83.82	82,180	73,776	**Void Sample
4	2022-01-19	17:50	18:49	7.1	43.7	0.0688	5.30	77.03	75,517	68,437	
Average (T1, T2, T4):				**6.8**	**42.7**	**0.0661**	**5.21**	**78.92**	**77,376**	**69,210**	

MMBTU = 1020 BTU/sft3 natural gas x ft3 of natural gas x 1 MMBTU/1,000,000 BTU

lb/MMBTU = NOx ppm x 0.0000001194 x 8710 x (20.9/20.9-Actual O2)

Table 2

Boiler #4 Testing Summary

RWDI Project #2201514

Boiler #4				O_2	NOx	NOx	NOx Emission Rate	Natural Gas Usage	Natural gas Usage	Steam Production
Test ID	Date	Start	End	%	ppm	lbs/mmBTU	lbs/hr	MMBTU/hr	ft^3/hr	lbs/hr
1	2022-01-18	7:38	8:37	7.0	24.8	0.0387	1.98	51.03	50,025	45,516
2	2022-01-18	8:55	9:54	7.2	24.9	0.0396	2.03	51.23	50,229	45,809
3	2022-01-18	10:12	11:11	7.4	26.2	0.0422	2.17	51.55	50,535	46,175
		Average		7.2	25.3	0.0402	2.06	51.27	50,263	45,833

MMBTU = 1020 BTU/sft3 natural gas x ft3 of natural gas x 1 MMBTU/1,000,000 BTU

lb/MMBTU = NOx ppm x 0.0000001194 x 8710 x (20.9/20.9-Actual O2)

Table 3

Boiler #5 Testing Summary

RWDI Project #2201514

Boiler #5				O_2	NOx	NOx	NOx Emission Rate	Natural Gas Usage	Natural gas Usage	Steam Production
Test ID	Date	Start	End	%	ppm	lbs/mmBTU	lbs/hr	MMBTU/hr	ft^3/hr	lbs/hr
1	2022-01-19	7:06	8:05	5.5	50.3	0.0710	5.59	78.75	77,206	67,905
2	2022-01-19	8:22	9:21	5.5	50.8	0.0718	5.47	76.18	74,688	66,657
3	2022-01-19	9:44	10:43	5.7	50.7	0.0724	5.71	78.84	77,295	67,231
		Average		5.6	50.6	0.0717	5.59	77.92	76,396	67,264

MMBTU = 1020 BTU/sft3 natural gas x ft3 of natural gas x 1 MMBTU/1,000,000 BTU
lb/MMBTU = NOx ppm x 0.0000001194 x 8710 x (20.9/20.9-Actual O2)

Table 4

Boiler #6 Testing Summary

RWDI Project #2201514

Boiler #6				O_2	NOx	NOx	NOx Emission Rate	Natural Gas Usage	Natural gas Usage	Steam Production
Test ID	Date	Start	End	%	ppm	lbs/mmBTU	lbs/hr	MMBTU/hr	ft^3/hr	lbs/hr
1	2022-01-18	13:25	14:24	5.1	115.2	0.1587	14.93	94.06	92,215	80,598
2	2022-01-18	14:38	15:37	5.3	113.9	0.1591	14.86	93.39	91,560	80,754
3	2022-01-18	15:54	16:53	5.4	118.8	0.1663	15.67	94.25	92,398	81,079
		Average		5.3	116.0	0.1614	15.15	93.90	92,058	80,810

MMBTU = 1020 BTU/sft3 natural gas x ft3 of natural gas x 1 MMBTU/1,000,000 BTU
lb/MMBTU = NOx ppm x 0.0000001194 x 8710 x (20.9/20.9-Actual O2)