EMISSIONS TEST REPORT

for

OXIDES OF NITROGEN (NOX) AND CARBON MONOXIDE (CO) EMISSIONS

Permit to Install (PTI) 227-15A
FG-AUXBOILERS-S1

DTE Electric, Trenton Channel Power Plant
Trenton, Michigan

August 21-23, 2019

Prepared By
Environmental Management & Resources
Environmental Field Services Group
DTE Corporate Services, LLC
7940 Livernois H-136
Detroit, MI 48210

DTE

DTE

CONTENTS

DTE

EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group performed emissions testing at the DTE Electric, Trenton Channel Power Plant, located in Trenton, Michigan. The fieldwork, performed on August 21-23, 2019 was conducted to satisfy requirements of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit to Install (PTI) 227-15A. Emissions tests were performed on the FG-AUXBOILERS-S1. Testing was performed for Oxides of Nitrogen (NO_x) while operating the auxiliary boilers at the highest achievable operating load.

The results of the emissions testing are highlighted below:

NO_x Emissions Test Results
Trenton Channel Power Plant
Auxiliary Boilers (FG-AUXBOILERS-S1)
August 21-23, 2019

Auxillary Boilers Load (HP)	Heat Input (MMBtu/hr)	NO_x Concentration (ppm)	NO_x Emissions (lb/hr)
EU-TCHAUX1-S1 (Boiler 21)	77.7 (82.35)[2]	23.8	2.38
EU-TCHAUX2-S1 (Boiler 22)	93.2 (99.9)[2]	19.5	2.40
EU-TCHAUX3-S1 (Boiler 23)	83.5 (99.9)[2]	18.8	2.13
Permit Limit			**6.99**

(1) Average Oxides of Nitrogen Emissions Concentration (ppm) dry, corrected
(2) Maximum Heat Input (MMBtu/hr)

DTE

1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group performed emissions testing at the DTE Electric, Trenton Channel Power Plant, located in Trenton, Michigan. The fieldwork, performed on August 21-23, 2019, was conducted to satisfy requirements of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit to Install (PTI) 227-15A. Emissions tests were performed on the FG-AUXBOILERS-S1. Testing was performed for Oxides of Nitrogen (NO_x) while operating the auxiliary boilers at the highest achievable operating load.

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 3A, 7E & 10. The fieldwork was performed in accordance with EPA Reference Methods and EM&R's Intent to Test[1], Test Plan Submittal. The following DTE personnel participated in the testing program: Mark Grigereit, Principal Engineer and Fred Meinecke, Senior Environmental Technician. Mr. Grigereit was the project leader. Ms. Regina Angellotti (EGLE) approved the test plan.

2.0 SOURCE DESCRIPTION

The DTE Electric Trenton Power Plant located at 4695 West Jefferson Avenue, Trenton, Michigan, employs the use of three (3) natural gas-fired auxiliary boilers. The boilers are identified as emission units EU-TCHAUX1-S1 through EU-TCHAUX3-S1 (flexible group FG-AUXBOILERS-S1) in EGLE PTI No. 227-15A. The facility is permitted for five (5) boilers, but only three were constructed and are operated. Each boiler is equipped with a low NO_x combustor for NO_x control, flue gas recirculation, and a continuous oxygen trim system. The boilers fire natural gas to generate steam which provides auxiliary heating throughout the plant when needed.

The auxiliary boilers exhausts directly to the atmosphere through a common circular stack.

A schematic representation of the auxiliary boilers exhaust and sampling location is presented in Figure 1.

[1] EGLE, Test Plan, Submitted June 28, 2019. (Attached-Appendix A)
[2] EGLE, Approval Letter, Received July 15, 2019. (Attached-Appendix A)

DTE

3.0 SAMPLING AND ANALYTICAL PROCEDURES

DTE Energy obtained emissions measurements in accordance with procedures specified in the USEPA *Standards of Performance for New Stationary Sources*. The sampling and analytical methods used in the testing program are indicated in the table below

Sampling Method	Parameter	Analysis
USEPA Method 3A	Oxygen	Instrumental Analyzer Method
USEPA Method 7E	Oxides of Nitrogen	Chemilumenecent Instrumental Analyzer Method

3.1 OXYGEN (USEPA METHOD 3A)

3.1.1 Sampling Method

Oxygen (O_2) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The analyzer utilizes a paramagnetic sensor. Testing was performed simultaneously with the gaseous emissions testing.

The EPA Method 3A sampling system (Figure 2) consisted of the following:

(1) Single-point sampling probe (traversed across the duct per procedures in Method 7E)
(2) Heated Teflon™ sampling line
(3) Gas conditioner with particulate filter
(4) Flexible unheated Teflon™ sampling line
(5) Servomax 1400 O_2/CO_2 gas analyzer
(6) Appropriate USEPA Protocol 1 calibration gases
(7) Data Acquisition System

3.1.2 Sampling Train Calibration

The O_2 analyzer was calibrated per procedures outlined in USEPA Methods 3A and 7E. Zero, span, and mid-range calibration gases were introduced directly into the analyzer to verify the instruments linearity. A zero and mid-range span gas was then introduced through the entire sampling system to determine sampling system bias at the completion of each test. Calibration gases were EPA Protocol 1 gases and the

concentrations were within the acceptable ranges (40-60% mid-range and span) specified in Method 7E. Calibration gas certification sheets are in Appendix C.

3.1.3 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The O_2 emissions were recorded in percent (%). The 1-minute readings collected during the testing can be found in Appendix B.

3.2 OXIDES OF NITROGEN (USEPA METHODS 7E)

3.2.1 Sampling Method

Oxides of nitrogen (NO_x) emissions were evaluated using USEPA Method 7E, "Determination of Oxides of Nitrogen Emissions from Stationary Sources". The NO_x analyzer utilizes a Chemiluminecent detector. Triplicate 60-minute tests were performed on each boiler exhaust.

The EPA Method 7E sampling system (Figure 2) consisted of the following:

(1) Stainless-steel sample probe (traversed across the duct per procedures in Method 7E)
(2) Heated Teflon™ sampling line
(3) Gas conditioner with particulate filter
(4) Flexible unheated Teflon™ sampling line
(5) TECO 42i Chemilumenecent NO/NO_x gas analyzer,
(6) Appropriate USEPA Protocol 1 calibration gases
(7) Data Acquisition System.

3.2.2 Sampling Train Calibration

The sampling train was calibrated per procedures outlined in USEPA Method 7E. Zero, span, and mid-range calibration gases were introduced directly into the analyzer to verify the instruments linearity. A zero and mid-range span gas was then introduced through the entire sampling system to determine sampling system bias at the completion of each test.

3.2.3 Quality Control and Assurance

All sampling and analytical equipment was calibrated per the guidelines referenced in Methods 7E. Calibration gases were EPA Protocol 1 gases and the concentrations were within the acceptable ranges (40-60% mid-range and span) specified in Method 7E. Calibration gas certification sheets are in Appendix C.

DTE performed a NO_x converter efficiency test by directly challenging the NO_x analyzer with a nitrogen dioxide (NO_2) calibration gas of 15.6 ppm. Results from the converter efficiency test demonstrated that the analyzer met the requirements of Method 7E (Eq-1). Equation-1 shows the converter efficiency test performed.

Eq. 1 $$Eff_{NO2} = \frac{C_{Dir}}{C_v} = \frac{14.2}{15.6} = 91\%$$

3.2.4 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The NO_x emissions were recorded in parts per million (ppm). The 1-minute readings collected can be found in Appendix B.

Emissions calculations are based on calculations located in USEPA Methods 7E and 19 and can be found in Appendix D. The NO_x emissions data collected during the testing was calculated as parts per million, dry, corrected to 15% O_2.

The emissions data collected can be found in Appendix B.

4.0 OPERATING PARAMETERS

The PTI identifies natural gas material use limits of 97,941 scf/hr per boiler and 2,573.8 MMscf per 12-month rolling period for all three boilers. This equates to a permitted heat input capacity of 99.9 MMbtu/hr per boiler at a standard natural gas heating value of 1,020 BTU/scf. Fuel consumption varies with operating parameters and was measured throughout the emissions testing. For purposes of this testing, "full load" was defined as a heat input of 99.9MMbtu/hr for boilers EU-TCHAUX2 and EU-TCHAUX3. The heat input capacity for boiler EU-TCHAUX1 is defined as 82.35 MMbtu/hr.

EU-TCHAUX1 & 2 operated within 90% of the maximum heat input for each boiler. EU-TCHAUX3 was operationally limited to 83.5% of the rate heat input at the time of testing.

The test program included the collection of auxiliary boilers operating data during each test run. Parameters recorded included heat input and fuel feed rate.

Operational data and results of the fuel analysis can be found in Appendix E.

DTE

5.0 RESULTS

The results of the NO_x emission testing conducted on FG-AUXBOILERS-S1 are presented in Table No 1. The NO_x emissions are presented in parts per million (ppm) and pounds per hour (lb/hr).

Testing of FG-AUXBOILERS-S1 demonstrated compliance with EGLE PTI emission rates. Testing was performed while the auxiliary boilers were operated at the maximum achievable load on each day of testing.

DTE

6.0 CERTIFICATION STATEMENT

"I certify that I believe the information provided in this document is true, accurate, and complete. Results of testing are based on the good faith application of sound professional judgment, using techniques, factors, or standards approved by the Local, State, or Federal Governing body, or generally accepted in the trade."

Mark Grigereit, QSTI

This report prepared by:

Mr. Mark Grigereit, QSTI
Principal Engineer, Field Services Group
Environmental Management and Resources
DTE Energy Corporate Services, LLC

This report reviewed by:

for Mr. Jason Logan, QSTI
Environmental Specialist, Field Services Group
Environmental Management and Resources
DTE Energy Corporate Services, LLC

DTE

RESULTS TABLE

DTE

TABLE NO. 1
NITROGEN OXIDE (NO_x) EMISSION TESTING RESULTS
EU-TCHAUX1-S1 (Boiler 21) - Trenton Channel Power Plant
August 22, 2019

Test	Time	Fuel Flow (kscf/hr)	Heat Input (MMBtu/hr)	Oxygen [1] (%)	NO_x Emissions (ppm)[1]	NO_x Emissions (lb/hr)[2]
Run - 1	11:36-12:36	72.8	77.7	4.1	23.8	2.38
Run - 2	12:49-13:49	72.8	77.7	4.2	23.8	2.39
Run - 3	14:03-15:03	72.8	77.6	4.2	23.8	2.38
		72.8	***77.7***	***4.2***	***23.8***	***2.38***

(1) Corrected for analyzer drift per USEPA method 7E

(2) pounds per hour

NOx Permit Limits:

6.99 lb/hr

DTE

TABLE NO. 2
NITROGEN OXIDE (NO_x) EMISSION TESTING RESULTS
EU-TCHAUX2-S1 (Boiler 22) - Trenton Channel Power Plant
August 21, 2019

Test	Time	Fuel Flow (kscf/hr)	Heat Input (MMBtu/hr)	Oxygen [1] (%)	NO_x Emissions (ppm)[1]	NO_x Emissions (lb/hr)[2]
Run - 1	15:25-16:25	87.3	93.1	4.5	19.2	2.35
Run - 2	16:41-17:41	87.3	93.2	4.6	19.7	2.42
Run - 3	18:00-19:00	87.3	93.2	4.5	19.7	2.42
		87.3	***93.2***	***4.5***	***19.5***	***2.40***

(1) Corrected for analyzer drift per USEPA method 7E

(2) pounds per hour

NOx Permit Limits:

6.99 lb/hr

DTE

TABLE NO. 3
NITROGEN OXIDE (NO_x) EMISSION TESTING RESULTS
EU-TCHAUX3-S1 (Boiler 23) - Trenton Channel Power Plant
August 23, 2019

Test	Time	Fuel Flow (kscf/hr)	Heat Input (MMBtu/hr)	Oxygen [1] (%)	NO_x Emissions (ppm)[1]	NO_x Emissions (lb/hr)[2]
Run - 1	11:35-12:35	78.3	83.6	5.0	18.7	2.12
Run - 2	12:47-13:47	78.3	83.6	5.0	18.8	2.13
Run - 3	14:03-15:03	78.3	83.5	5.0	18.9	2.15
		78.3	***83.6***	***5.0***	***18.8***	***2.13***

(1) Corrected for analyzer drift per USEPA method 7E

(2) pounds per hour

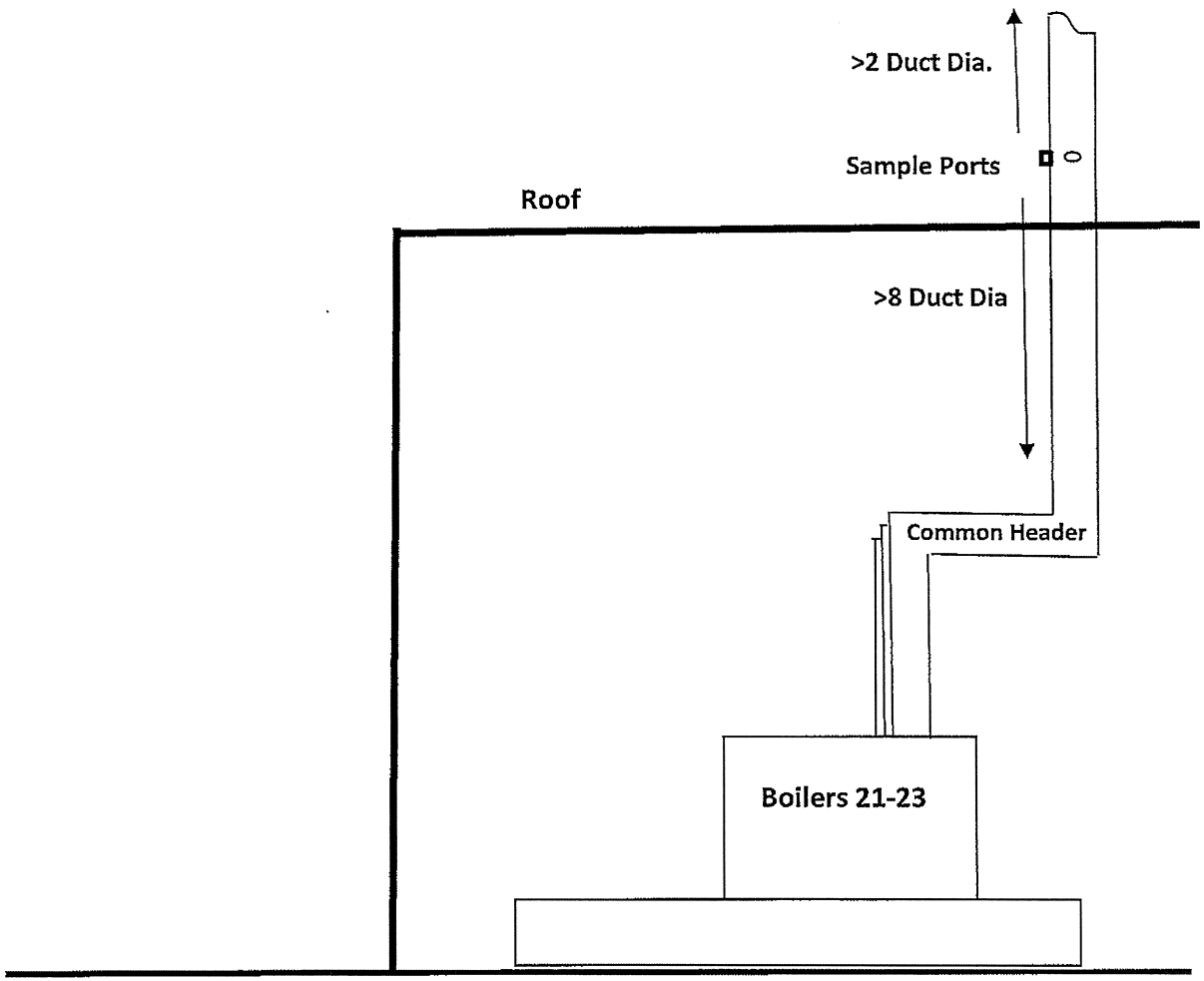
NOx Permit Limits:

6.99 lb/hr

DTE

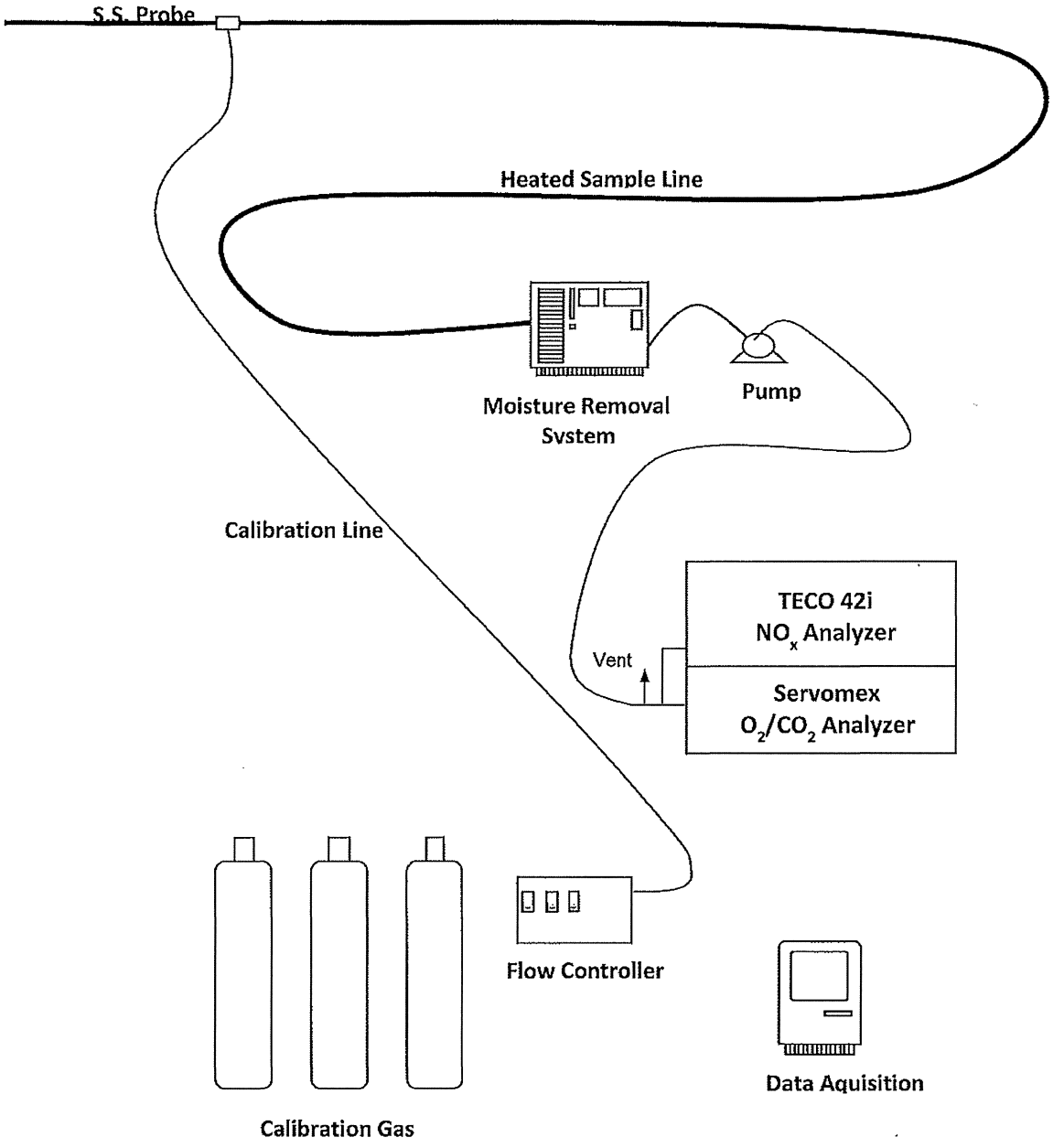
FIGURES

Figure 1 – Sampling Location
Trenton Channel Power Plant – EU-AUXBOILERS-S1
August 21-23, 2019



DTE

Figure 2 – EPA Methods 3A & 7E
Trenton Channel Power Plant – EU-AUXBOILERS-S1
August 21-23, 2019



DTE