



40CFR75 APPENDIX E NITROGEN OXIDES EMISSIONS ESTIMATION PROCEDURE

Performed At

**Michigan Public Power Agency
Kalkaska Energy Center
EU-TURBINE 1A
EU-TURBINE 1B
Kalkaska, Michigan**

Test Dates

May 3 and 4, 2023

Report No.

TRC Environmental Corporation Report 536881

Report Submittal Date

June 8, 2023

TRC Environmental Corporation
207C Eisenhower Lane South
Lombard, Illinois 60148
USA

T 312-533-2042



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).

A handwritten signature in cursive script that reads "Anthony Sakellariou".

Anthony Sakellariou
Senior Project Manager

June 8, 2023
Date

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

A handwritten signature in cursive script that reads "Bruce Randall".

Bruce Randall
TRC Emission Testing Technical Director



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40CFR75 NITROGEN OXIDES EMISSIONS ESTIMATION PROCEDURE

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed a Title 40, Code of Federal Regulations, Part 75, Appendix E (40CFR75) nitrogen oxides (NO_x) emissions estimation procedure on May 3 and 4, 2023 at the Kalkaska Energy Center of Michigan Public Power Agency (MPPA) in Kalkaska, Michigan. The tests were authorized by and performed for MPPA.

The purpose of this test program was to generate a curve relating the NO_x emissions rate to the heat input for four (4) load conditions while firing natural gas. This testing was performed in order to satisfy the requirements of the 40CFR75 Part 75, Appendix E. The test program was conducted according to the TRC Test Protocol dated March 6, 2023.

1.1 Project Contact and Qualified Individual (QI) Information

Participants		
Test Facility	Michigan Public Power Agency 1750 Prough Road SW Kalkaska, Michigan 49646 Permit No. MI-ROP-N7113-2022 Facility No. N7113	Mr. Matt Burk Power Generation Services Lead 517-323-8919 ext. 135 (phone) mburk@mpower.org
Test Coordinator	Michigan Public Power Agency 809 Centennial Way Lansing, Michigan 48971	
Air Emissions Testing Body (AETB)	TRC Environmental Corporation 207C Eisenhower Lane South Lombard, Illinois 60148	Mr. Gavin Lewis Project Manager 219-613-0163 (phone) glewis@trccompanies.com

Rome Rothgeb and Gavin Lewis of TRC conducted the testing. Documentation of the on-site ASTM D7036-04 Qualified Individual(s) (QI) can be located in the appendix to this report.

Jeremy Howe and Sharon LeBlanc from The Michigan Department of Environment, Great Lakes, and Energy (EGLE) observed the testing.



2.0 SUMMARY OF RESULTS

During this test program, three (3) Reference Method 7E NO_x and oxygen (O₂) test runs were conducted at each of four approximately equally spaced load conditions, ranging from the maximum operating load to the minimum operating load allowing for a 15-minute unit stabilization at each condition.

Unit operating data, recorded by plant personnel, are appended to the report. A standard fuel factor of 8710 dry standard cubic feet per million Btu (dscf/MMBtu) for natural gas was used to calculate the NO_x emissions on a pounds per million Btu (lb/MMBtu) basis. Heat input (calculated from operating data and fuel analysis) and lb/MMBtu were used to calculate the lb/hr emission rates. The results for the tests conducted are summarized in the following tables:

Table 1 – EU-TURBINE 1A

Fuel	Load MW	Heat Input MMBtu/hr	O ₂ % dry	NO _x ppmvd	NO _x ppmvd at 15% O ₂	NO _x lb/MMBtu	NO _x lb/hr
Natural gas	55.0	274.4	15.03	21.17	21.28	0.078	21.50
	45.0	230.9	15.59	21.78	24.20	0.089	20.55
	50.0	253.5	15.34	21.90	23.24	0.086	21.71
	40.0	217.9	15.69	20.43	23.11	0.085	18.59

Table 2 – EU-TURBINE 1B

Fuel	Load MW	Heat Input MMBtu/hr	O ₂ % dry	NO _x ppmvd	NO _x ppmvd at 15% O ₂	NO _x lb/MMBtu	NO _x lb/hr
Natural gas	55.0	294.9	14.77	23.29	22.42	0.083	24.38
	45.0	249.3	15.33	21.68	22.98	0.085	21.11
	50.0	271.4	15.09	22.18	22.51	0.083	22.52
	40.0	230.1	15.44	21.43	23.15	0.085	19.64

Complete test results from this program are presented in Section 6.0



3.0 DISCUSSION OF RESULTS

No problems were encountered with the testing equipment during the test program. Source operations 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 TEST 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 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. Sample was collected at 12 points during each test run.

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 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.

4.1.1 O₂ Determination by USEPA Method 3A

This method is applicable for the determination of O₂ concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The O₂ analyzer was equipped with a paramagnetic-based detector.



4.1.2 NO_x Determination by USEPA Method 7E

This method is applicable for the determination of NO_x concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The NO_x analyzer used a photomultiplier tube to measure the light emitted from the chemiluminescent decomposition of NO₂.

4.2 Determination of F-Factors by 40CFR75 Appendix F

This procedure is applicable for the determination of the pollutant emission rate using oxygen (O₂) or carbon dioxide (CO₂) concentrations and the appropriate F factor (the ratio of combustion gas volumes to heat inputs) and the pollutant concentration. The appropriate F-Factor was selected from Table 1 of 40CFR75 Appendix F.

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 SUMMARIES

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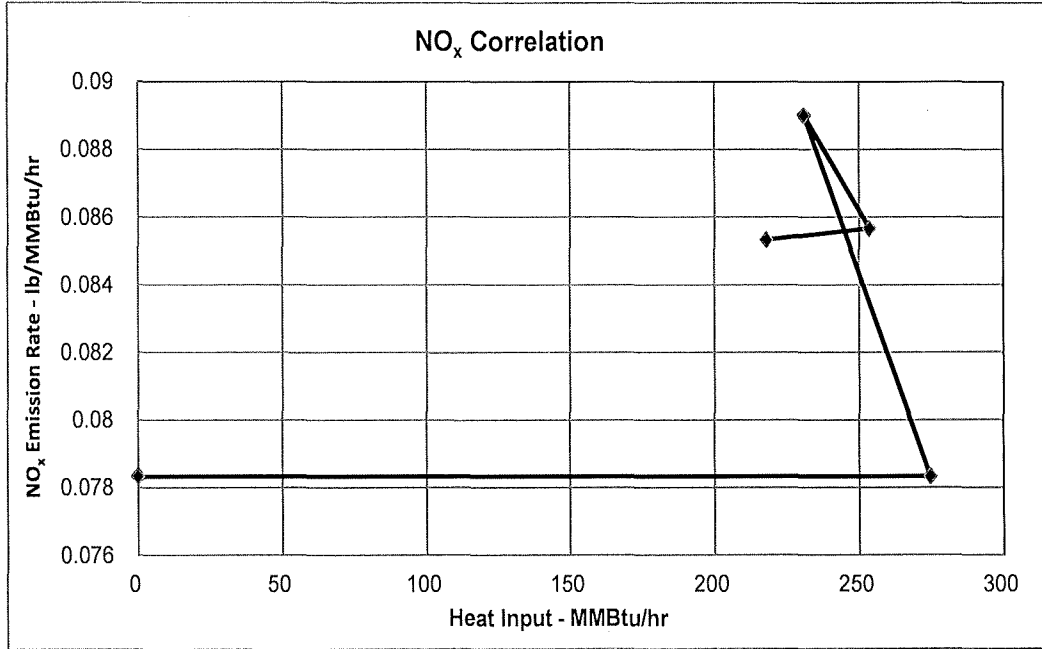
NITROGEN OXIDES EMISSIONS ESTIMATION SUMMARY

Project No: 536881
Company: MPPA
Date: May 3 and 4, 2023
Plant: Kalkaska Energy Center
Unit: EU-TURBINE 1A
Fuel: Natural Gas

Date	Run #	Start Time	Stop Time	Average Btu/scf	Fuel Factor dscf/10 ⁶ Btu	Oper. Load MW	Gas Usage x100 scfh	Heat Input 10 ⁶ Btu/hr	O ₂ % dry	NO _x				
										ppmvd	@15%O ₂	lbs/10 ⁶ Btu	lbs/hr	
05/03/23	High	1-1	6:07	6:42	1063	8710	55.0	2587.8	275.1	15.03	21.20	21.30	0.078	21.46
05/03/23	High	1-2	6:59	7:35	1063	8710	55.0	2579.2	274.2	15.04	21.09	21.21	0.078	21.39
05/03/23	High	1-3	7:46	8:23	1063	8710	55.0	2578.4	274.1	15.03	21.21	21.33	0.079	21.65
Average							55.0	2581.8	274.4	15.03	21.17	21.28	0.078	21.50
05/03/23	MidLow	2-1	8:46	9:24	1063	8710	45.0	2165.9	230.2	15.59	21.84	24.26	0.089	20.49
05/03/23	MidLow	2-2	9:36	10:13	1063	8710	45.0	2172.4	230.9	15.59	21.83	24.25	0.089	20.55
05/03/23	MidLow	2-3	10:28	11:05	1063	8710	45.0	2179.2	231.6	15.59	21.67	24.07	0.089	20.62
Average							45.0	2172.5	230.9	15.59	21.78	24.20	0.089	20.55
05/04/23	MidHigh	3-1	6:02	6:38	1063	8710	50.0	2381.4	253.1	15.39	21.88	23.44	0.086	21.77
05/04/23	MidHigh	3-2	6:50	7:26	1063	8710	50.0	2383.0	253.3	15.34	21.97	23.31	0.086	21.78
05/04/23	MidHigh	3-3	7:38	8:14	1063	8710	50.0	2388.9	253.9	15.29	21.84	22.96	0.085	21.58
Average							50.0	2384.4	253.5	15.34	21.90	23.24	0.086	21.71
05/04/23	Low	4-1	8:47	10:24	1063	8710	40.0	2074.5	220.5	15.72	20.62	23.49	0.087	19.19
05/04/23	Low	4-1	10:36	11:12	1063	8710	40.0	2033.0	216.1	15.68	20.23	22.84	0.084	18.15
05/04/23	Low	4-3	11:23	11:59	1063	8710	40.0	2040.8	216.9	15.66	20.43	23.00	0.085	18.44
Average							40.0	2049.4	217.9	15.69	20.43	23.11	0.085	18.59



EU-TURBINE 1A CORRELATION CHART





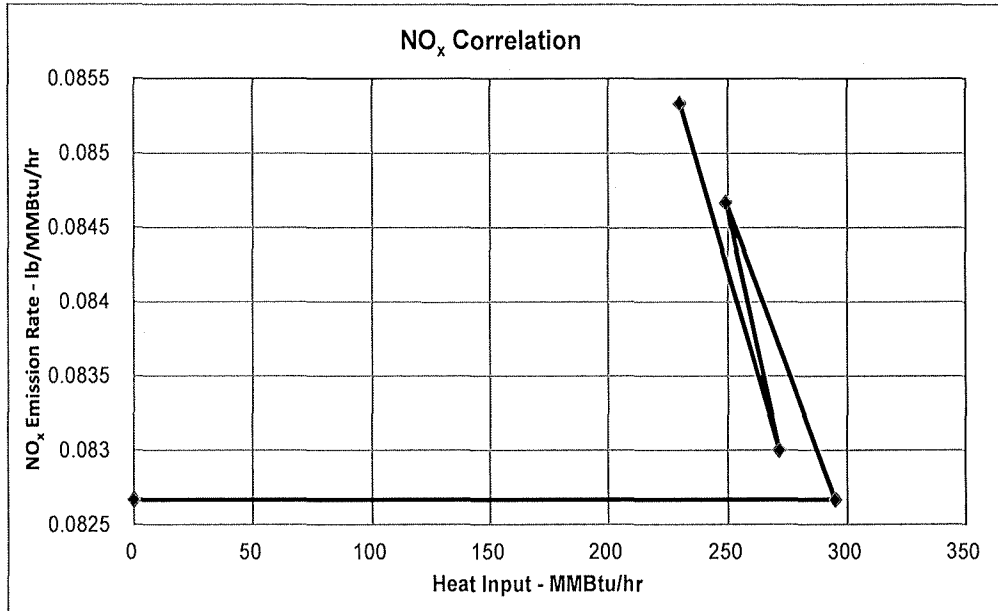
NITROGEN OXIDES EMISSIONS ESTIMATION SUMMARY

Project No: 536881
Company: MPPA
Date: May 3 and 4, 2023
Plant: Kaskaska Energy Center
Unit: EU-TURBINE 1B
Fuel: Natural Gas

Date	Run #	Start Time	Stop Time	Average Btu/scf	Fuel Factor dscf/10 ⁶ Btu	Oper. Load MW	Gas Usage x100 scfh	Heat Input 10 ⁶ Btu/hr	O ₂ % dry	NO _x				
										ppmvd	@15%O ₂	lbs/10 ⁶ Btu	lbs/hr	
05/03/23	High	1-1	6:07	6:42	1063	8710	55.0	2770.0	294.5	14.80	23.32	22.55	0.083	24.44
05/03/23	High	1-2	6:59	7:35	1063	8710	55.0	2780.0	295.5	14.76	23.37	22.46	0.083	24.53
05/03/23	High	1-3	7:46	8:23	1063	8710	55.0	2771.6	294.6	14.75	23.16	22.23	0.082	24.16
Average							55.0	2773.9	294.9	14.77	23.29	22.42	0.083	24.38
05/03/23	MidLow	2-1	8:46	9:24	1063	8710	45.0	2336.2	248.3	15.33	22.01	23.33	0.086	21.36
05/03/23	MidLow	2-2	9:36	10:13	1063	8710	45.0	2345.3	249.3	15.34	21.49	22.79	0.084	20.94
05/03/23	MidLow	2-3	10:28	11:05	1063	8710	45.0	2354.5	250.3	15.33	21.54	22.81	0.084	21.02
Average							45.0	2345.3	249.3	15.33	21.68	22.98	0.085	21.11
05/04/23	MidHigh	3-1	6:02	6:38	1063	8710	50.0	2551.1	271.2	15.15	21.92	22.48	0.083	22.51
05/04/23	MidHigh	3-2	6:50	7:26	1063	8710	50.0	2553.0	271.4	15.09	22.16	22.50	0.083	22.52
05/04/23	MidHigh	3-3	7:38	8:14	1063	8710	50.0	2554.6	271.6	15.03	22.45	22.55	0.083	22.54
Average							50.0	2552.9	271.4	15.09	22.18	22.51	0.083	22.52
05/04/23	Low	4-1	8:47	10:24	1063	8710	40.0	2140.0	227.5	15.49	20.61	22.47	0.083	18.88
05/04/23	Low	4-1	10:36	11:12	1063	8710	40.0	2178.1	231.5	15.42	21.68	23.36	0.086	19.91
05/04/23	Low	4-3	11:23	11:59	1063	8710	40.0	2177.0	231.4	15.41	22.02	23.64	0.087	20.13
Average							40.0	2165.0	230.1	15.44	21.43	23.15	0.085	19.64



EU-TURBINE 1B CORRELATION CHART



APPENDIX



Part 75 ECMPs Reporting Information - PGVP

Facility Name:	MPPA - Kalkaska Energy Center
Unit	EU-TURBINE 1A
Test Date:	May 3 and 4, 2023

Test During Natural Gas Combustion

<i>Testing Parameter</i>	<i>Gas Level Code</i>	<i>Gas Type Code</i>	<i>Cylinder Identifier</i>	<i>Vendor Identifier</i>	<i>Expiration Date</i>
NO _x	LOW	O2, BALN	ALM-019440	B12022	12/19/2030
	MID	CO,CO2,NO,NOX,SO2,BALN	CC415796	B12022	6/28/2025
	HIGH	CO,CO2,NO,NOX,SO2,BALN	CC255613	B12022	3/24/2025
O ₂	LOW	CO,CO2,NO,NOX,SO2,BALN	CC415796	B12022	6/28/2025
	MID	O2, BALN	ALM-019440	B12022	12/19/2030
	HIGH	CO2, O2, BALN	CC140153	B12021	9/15/2029



Part 75 ECMPs Reporting Information - PGVP

Facility Name:	MPPA - Kalkaska Energy Center
Unit	EU-TURBINE 1B
Test Date:	May 3 and 4, 2023

Test During Natural Gas Combustion

<i>Testing Parameter</i>	<i>Gas Level Code</i>	<i>Gas Type Code</i>	<i>Cylinder Identifier</i>	<i>Vendor Identifier</i>	<i>Expiration Date</i>
NO _x	LOW	O ₂ , BALN	ALM-019440	B12022	12/19/2030
	MID	CO,CO ₂ ,NO,NOX,SO ₂ ,BALN	CC357352	B12021	10/18/2024
	HIGH	CO,CO ₂ ,NO,NOX,SO ₂ ,BALN	CC255613	B12022	3/24/2025
O ₂	LOW	CO,CO ₂ ,NO,NOX,SO ₂ ,BALN	CC357352	B12021	10/18/2024
	MID	O ₂ , BALN	ALM-019440	B12022	12/19/2030
	HIGH	CO ₂ , O ₂ , BALN	CC140153	B12021	9/15/2029



Part 75 ECMPS Reporting Information

Facility Name:	Michigan Public Power Agency – Kalkaska Energy Center
Location:	EU-TURBINE 1A EU-TURBINE 1B
Test Date:	May 3 and 4, 2023

Test Parameters:	1, 3A, 7E, 19
QI Last Name:	Lewis
QI First Name:	Gavin
QI Middle Initial:	----
AETB Name:	TRC Environmental Corporation
AETB Phone No:	219-613-0163
AETB Email:	glewis@trccompanies.com
Group 1 Exam Date:	01-05-2023
Provider Name:	Source Evaluation Society
Provider Email:	gstiprogram@gmail.com
Group 3 Exam Date:	01-05-2023
Provider Name:	Source Evaluation Society
Provider Email:	gstiprogram@gmail.com