

MATS COMPLIANCE
TEST REPORT
FOR
GRAND HAVEN BOARD OF LIGHT & POWER
UNIT 3
August 1 & 2, 2017

Grand Haven Board of Light & Power
1700 Eaton Drive
Grand Haven, MI 49417

Job # 17-135

Test Report Date: 08-24-17

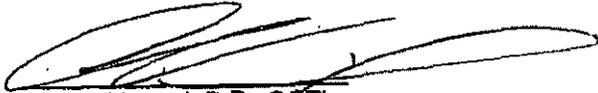


August 24, 2017

I, Tim Moody, hereby certify that the data obtained for Grand Haven Board of Light & Power on Unit 3 is in accordance with procedures set forth by the USEPA. This report accurately represents the data obtained from the testing procedures and analysis of this data.


Tim Moody, QSTI
Crew Chief

I, Carl Vineyard, hereby certify that I have reviewed this report and to the best of my knowledge, the data presented herein is complete and accurate.


Carl Vineyard, P.E., QSTI
Test Engineer

Grace Consulting, Inc.
P.O. Box 58
510 Dickson St.
Wellington, OH 44090

Toll Free: 1-877-GCI-TEST
Phone: 440-647-6672
Fax: 440-647-6673
gcitest.com

RECEIVED

SEP 06 2017

AIR QUALITY DIVISION

INTRODUCTION	1-2
SUMMARY OF TEST RESULTS	3-10
METHODS AND DISCUSSION	11-13
APPENDIX	14
Sample Calculations	15-22
Test Data Sheets	23-46
GCI Calibration Data	47-51
Calibration Sheets/Gas Certification Sheets	52-58
Laboratory Reports	59-118
Plant Data	119-137
Accreditation	138-143

INTRODUCTION

INTRODUCTION

This report presents the results of the emissions test performed for Grand Haven Board of Light & Power on Unit 3.

The purpose of the tests was to determine the emissions of the unit for compliance. The results can be found in the Summary of Test Results section of this report.

The testing was performed by Grace Consulting, Inc., located at 510 Dickson Street, Wellington, OH, 44090. Present during the testing from Grace Consulting, Inc. were Tim Moody, Tyler Seese, and Tyree Wilson. Also present during the testing were Chris Morse and Paul Cederquist from Grand Haven Board of Light & Power.

The tests were performed on August 1 & 2, 2017. The testing was completed in accordance with USEPA test methods as published in the July 1, 2017 Federal Register, - "Standards of Performance for New Stationary Sources" and subsequent revisions.

The sampling and analytical procedures can be found in the Methods and Discussion section of this report. The raw field data and the equations used to determine the final results are presented in the Appendix section.

SUMMARY OF TEST RESULTS

SUMMARY OF TEST RESULTS

The following presents the results of the emissions tests performed for Grand Haven Board of Light & Power on Unit 3.

**PARTICULATE EMISSIONS
Method 5 MATS**

Run #	Date	lb/dscf	lbs/hr	lb/mmBtu	lb/MWH
1	08-01-17	3.50E-07	3.98	0.005	0.056
2	08-01-17	1.27E-07	1.45	0.002	0.020
3	08-01-17	1.54E-07	1.76	0.002	0.025
AVG.		2.10E-07	2.40	0.003	0.034

**HCl EMISSIONS
Method 26A**

Run #	Date	ppmvd	ppmvd @ 3% O₂	lb/hr	lb/mmBtu	lb/MWH
1	08-02-17	0.99	1.32	1.05	0.00139	0.01491
2	08-02-17	1.38	1.86	1.47	0.00199	0.02071
3	08-02-17	1.42	1.75	1.55	0.00186	0.02183
AVG.		1.26	1.64	1.36	0.00174	0.01915

HCl AUDIT SAMPLE SUMMARY

Reported Value	Assigned Value	Acceptable Limits	Status
6.257	6.06	5.45 - 6.67	Acceptable

The complete results can be found on the computer printouts following.

GRACE CONSULTING, INC.
Particulate Analysis

Grand Haven Board of Light & Power
Grand Haven, MI
Unit 3
17-135

Run Number			1	2	3
Date			8/1/2017	8/1/2017	8/1/2017
Location			Unit 3	Unit 3	Unit 3
Comment			Method 5 MATS	Method 5 MATS	Method 5 MATS
Start Time			7:20	9:40	11:40
End Time			9:10	11:25	13:27
Barometric Pressure	In. Hg.	Pb	29.46	29.46	29.46
Static Pressure	In. H2O	Pf	0.44	0.45	0.46
Condensate Collected	grams	Vic	274.4	295.2	292.5
Volume Sampled	dcf	Vm	85.326	88.553	86.342
Meter Correction Factor		Y	0.989	0.989	0.989
Pitot Tube Correction Factor		Pc	0.832	0.832	0.832
Square Root of Delta P			0.504	0.509	0.510
Orifice Pressure	In. H2O		2.388	2.478	2.470
Meter Temperature	Degree F		83	88	89
Flue Temperature	Degree F		171	166	173
Percent CO2	%		11.60	11.70	11.70
Percent O2	%		7.80	7.80	7.50
Diameter of Nozzle	In.		0.344	0.344	0.344
Area of Flue	Sq. ft.		143.1	143.1	143.1
Sample Time	min.		96	96	96
Weight Gain	grams		0.0129	0.0047	0.0057
F-Factor			1,800	1,800	1,800
MW			70.6	71.0	71.1
Absolute Flue Pressure	In. Hg	Ps	29.49	29.49	29.49
Corrected Sample Volume	dscf	Vms	81.27	81.71	81.36
Measured Moisture of Flue Gas	%	Bws	13.73%	14.55%	14.49%
Calculated Saturated Moisture	%	Bwsat	N/A	N/A	N/A
Moisture used for Calculations	%	Bwsu	13.73%	14.55%	14.49%
Molecular Weight	lb/lb-mole	Ms	28.50	28.41	28.41
Velocity of Flue Gas	fps	Vs	31.06	31.29	31.53
Volume of Flue Gas	ACFM	Vo	268,699	268,679	270,718
Volume of Flue Gas	DSCFM	Qsd	189,766	190,871	190,333
Dust Concentration	lb/dscf	Wd	3.50E-07	1.27E-07	1.54E-07
Dust Concentration	lb/hr	Wh	3.98	1.45	1.76
Dust Concentration	gr/acf	Wa	1.74E-03	6.31E-04	7.60E-04
Dust Concentration	gr/dscf	Ws	2.45E-03	8.88E-04	1.08E-03
Isokinetic Rate	%	%I	98.9	98.9	98.7
Dust Concentration	mg/ACM @ 160 C		3.227	1.158	1.412
Sample Volume @ Stack Conditions	dacm	Vstack	2.7902	2.7830	2.8020
Sample Volume @ Standard Cond	dscm	Vms (metric)	2.3014	2.3138	2.3039
Particulate Concentration	mg/acm (wet)	Cpm(stack)	3.988	1.443	1.739
Particulate Concentration	mg/wscm		4.836	1.736	2.115
Particulate Concentration	mg/DSCM		5.805	2.031	2.474
Particulate Concentration	mg/Ncm		4.836	1.736	2.115
Particulate Emissions	lb/mmBtu	DI	0.005	0.002	0.002
Particulate Emissions	lb/MWH		0.056	0.020	0.025

Averages: Flue Temp.:	170.0	Part. Emis:	lb/dscf	2.10E-07
ACFM:	268,699		lb/hr	2.40
DSCFM:	190,323		gr/acf	1.04E-03
Percent O2:	7.70%		gr/dscf	1.47E-03
			lb/mmBtu	0.003
			lb/MWH	0.034

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

Grand Haven Board of Light & Power
Grand Haven, MI - Unit 3

Date: 8/1/2017
Pollutant: CO2
Monitor Span: 19.47

Run Number	Average Measured Value	Initial Zero Gas Bias	Final Zero Gas Bias	Zero Gas Drift	Initial Upscale Gas Bias	Final Upscale Gas Bias	Upscale Gas Drift	Calibration Gas	Corrected Value, Dry Basis
1	11.58	0.15	0.17	0.10	11.23	11.18	-0.26	11.20	11.60
2	11.68	0.17	0.20	0.15	11.18	11.24	0.31	11.20	11.70
3	11.70	0.20	0.04	-0.82	11.24	11.21	-0.15	11.20	11.70

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o) \quad \text{Eq. 6C-1}$$

where:

- C_{gas} = Effluent gas concentration, dry basis, percent
- C_{avg} = Average gas concentration indicated by gas analyzer, dry basis, percent
- C_o = Average of initial and final system calibration bias check responses for the zero gas, percent
- C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, percent
- C_{ma} = Actual concentration of the upscale calibration gas, percent

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

Grand Haven Board of Light & Power
Grand Haven, MI - Unit 3

Date: 8/1/2017
Pollutant: O2
Monitor Span: 21.80

Run Number	Average Measured Value	Initial Zero Gas Bias	Final Zero Gas Bias	Zero Gas Drift	Initial Upscale Gas Bias	Final Upscale Gas Bias	Upscale Gas Drift	Calibration Gas	Corrected Value, Dry Basis
1	7.87	0.05	0.09	0.18	10.94	10.98	0.18	10.94	7.80
2	7.87	0.09	0.11	0.09	10.98	11.04	0.28	10.94	7.80
3	7.67	0.11	0.22	0.50	11.04	11.08	0.18	10.94	7.50

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o) \quad \text{Eq. 6C-1}$$

where:

- C_{gas} = Effluent gas concentration, dry basis, percent
- C_{avg} = Average gas concentration indicated by gas analyzer, dry basis, percent
- C_o = Average of initial and final system calibration bias check responses for the zero gas, percent
- C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, percent
- C_{ma} = Actual concentration of the upscale calibration gas, percent

GRACE CONSULTING, INC.
HCl Analysis

Grand Haven Board of Light & Power
Grand Haven, MI
Unit 3
17-135

Run Number			1	2	3
Date			8/2/2017	8/2/2017	8/2/2017
Location			Unit 3	Unit 3	Unit 3
Comment			Method 26A	Method 26A	Method 26A
Start Time			6:55	8:35	10:20
End Time			8:25	10:03	11:50
Barometric Pressure	In. Hg.	Pb	29.3	29.3	29.3
Static Pressure	In. H2O	Pf	0.55	0.57	0.57
Condensate Collected	grams	Vlc	233.8	231.5	203
Volume Sampled	dcf	Vm	67.919	69.034	69.582
Meter Correction Factor		Y	0.989	0.989	0.989
Pitot Tube Correction Factor		Pc	0.832	0.832	0.832
Square Root of Delta P			0.503	0.506	0.511
Orifice Pressure	In. H2O		2.306	2.417	2.464
Meter Temperature	Degree F		75	86	86
Flue Temperature	Degree F		171	173	174
Percent CO2	%		12.10	11.80	13.00
Percent O2	%		7.50	7.60	6.40
Diameter of Nozzle	In.		0.344	0.344	0.344
Area of Flue	Sq. ft.		143.1	143.1	143.1
Sample Time	min.		72	72	72
HCl Collected	grams		0.00276	0.00384	0.00399
F-Factor			1,800	1,800	1,800
MW			70.3	71.1	71.1
Absolute Flue Pressure	in. Hg	Ps	29.34	29.34	29.34
Corrected Sample Volume	dscf	Vms	65.29	65.05	65.57
Measured Moisture of Flue Gas	%	Bws	14.44%	14.37%	12.74%
Calculated Saturated Moisture	%	Bwsat	N/A	N/A	N/A
Moisture used for Calculations	%	Bwsu	14.44%	14.37%	12.74%
Molecular Weight	lb/lb-mole	Ms	28.47	28.44	28.76
Velocity of Flue Gas	fps	Vs	31.10	31.35	31.50
Volume of Flue Gas	ACFM	Vo	266,991	269,136	270,471
Volume of Flue Gas	DSCFM	Qsd	187,437	188,621	192,761
HCl Concentration	lb/dscf	Wd	9.32E-08	1.30E-07	1.34E-07
HCl Concentration	ppmvd		0.99	1.38	1.42
HCl Concentration	ppmvd @ 3% O2		1.32	1.86	1.75
HCl Concentration	lb/hr	Wh	1.05	1.47	1.55
HCl Concentration	gr/acf	Wa	4.58E-04	6.38E-04	6.69E-04
HCl Concentration	gr/dscf	Ws	6.52E-04	9.11E-04	9.39E-04
Isokinetic Rate	%	%I	107.3	106.3	104.8
HCl Emissions	lb/mmBtu	DI	0.00139	0.00199	0.00186
HCl Emissions	lb/MWH		0.01491	0.02071	0.02183

Averages: Flue Temp.:	173	HCl Emis: lb/dscf	1.19E-07
ACFM:	268,866	ppmvd	1.26
DSCFM:	189,573	ppmvd @ 3% O2	1.64
Percent O2:	7.17%	lb/hr	1.36
		gr/acf	5.89E-04
		gr/dscf	8.34E-04
		lb/mmBtu	0.00174
		lb/MWH	0.01915

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

Grand Haven Board of Light & Power
Grand Haven, MI - Unit 3

Date: 8/2/2017
Pollutant: CO2
Monitor Span: 19.47

Run Number	Average Measured Value	Initial Zero Gas Bias	Final Zero Gas Bias	Zero Gas Drift	Initial Upscale Gas Bias	Final Upscale Gas Bias	Upscale Gas Drift	Calibration Gas	Corrected Value, Dry Basis
1	11.81	0.10	0.13	0.15	10.95	10.99	0.21	11.20	12.10
2	11.58	0.13	0.16	0.15	10.99	10.96	-0.15	11.20	11.80
3	12.70	0.16	0.16	0.00	10.96	10.91	-0.26	11.20	13.00

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o) \quad \text{Eq. 6C-1}$$

where:

- C_{gas} = Effluent gas concentration, dry basis, percent
- C_{avg} = Average gas concentration indicated by gas analyzer, dry basis, percent
- C_o = Average of initial and final system calibration bias check responses for the zero gas, percent
- C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, percent
- C_{ma} = Actual concentration of the upscale calibration gas, percent

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

Grand Haven Board of Light & Power
Grand Haven, MI - Unit 3

Date: 8/2/2017
Pollutant: O2
Monitor Span: 21.80

Run Number	Average Measured Value	Initial Zero Gas Bias	Final Zero Gas Bias	Zero Gas Drift	Initial Upscale Gas Bias	Final Upscale Gas Bias	Upscale Gas Drift	Calibration Gas	Corrected Value, Dry Basis
1	7.56	0.21	0.24	0.14	10.89	10.86	-0.14	10.94	7.50
2	7.60	0.24	0.25	0.05	10.86	10.81	-0.23	10.94	7.60
3	6.39	0.25	0.15	-0.46	10.81	10.88	0.32	10.94	6.40

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o) \quad \text{Eq. 6C-1}$$

where:

- C_{gas} = Effluent gas concentration, dry basis, percent
- C_{avg} = Average gas concentration indicated by gas analyzer, dry basis, percent
- C_o = Average of initial and final system calibration bias check responses for the zero gas, percent
- C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, percent
- C_{ma} = Actual concentration of the upscale calibration gas, percent

METHODS AND DISCUSSION

Test Methods used at Grand Haven Board of Light & Power, Unit 3

Method 3A

CO₂ and O₂ concentrations were determined with 3 Method 3A test runs that corresponded with the MATS testing. The sampling was performed at 3-points. GCI used a monitor range of 0-19.47% for CO₂ and a monitor range of 0-21.80% for the O₂.

Method 5

GCI performed 3 Method 5 test runs using Apex Instruments test equipment. The USEPA test procedures were followed as written with 24 test points sampled for 4 minutes each. Meter Box OH M5, with a meter correction factor of 0.989, was used. Each sample was analyzed following Method 5 analytical procedures. The Method 5 testing was conducted with the front half temperature box at 320°F ±25°F in accordance with 40 CFR 63 Subpart UUUUU Table 5, Item 1.

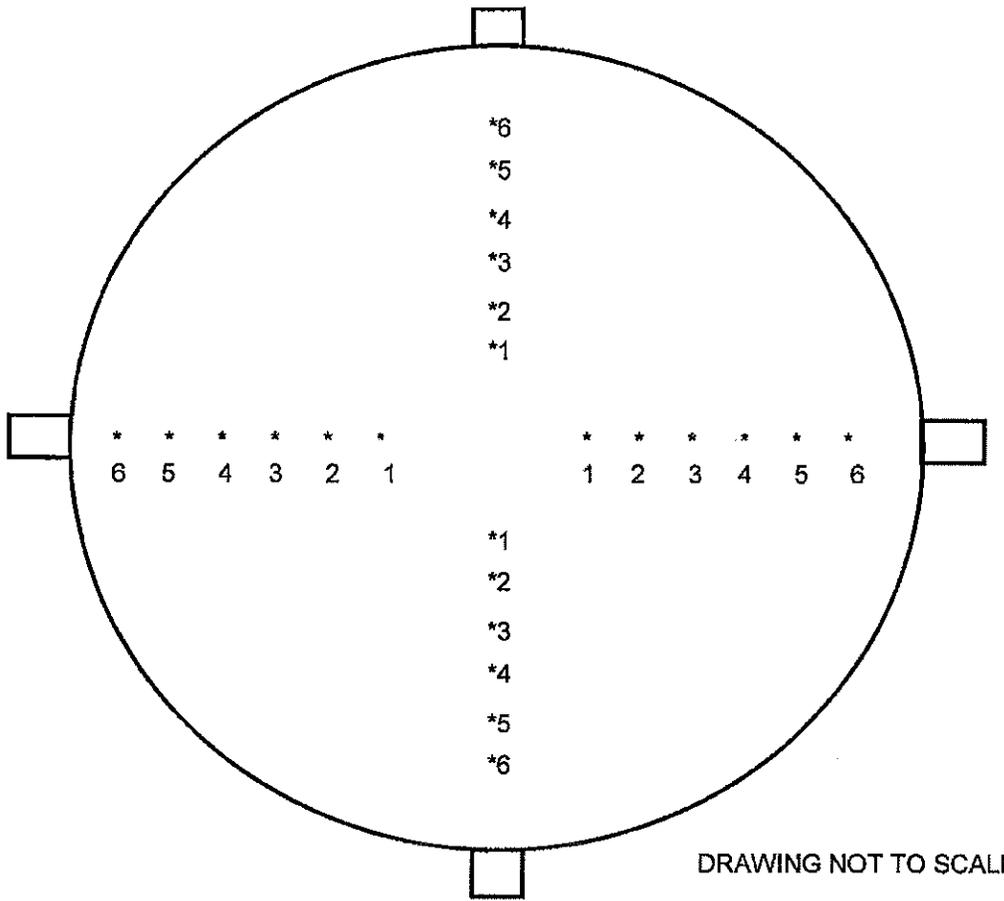
Method 26A

GCI performed 3 Method 26A test runs using Apex Instruments test equipment. The USEPA test procedures were followed as written with 24 test points sampled for 3 minutes each. Meter Box OH M5, with a meter correction factor of 0.989, was used.

Discussion

Environmental conditions did not adversely affect the test results.

Testing was completed by following GCI's Internal Site Specific Test Plan #17-135 with no deviations.



DRAWING NOT TO SCALE

POINTS DISTANCE FROM INSIDE WALL

1)	57.672 "
2)	40.500 "
3)	28.674 "
4)	19.116 "
5)	10.854 "
6)	3.402 "

STACK AREA = 143.1 sq ft
 STACK DIAMETER = 13.50 '

Grand Haven Board of Power & Light
 Unit 3



Grace Consulting, Inc.
 Emission Testing Services