

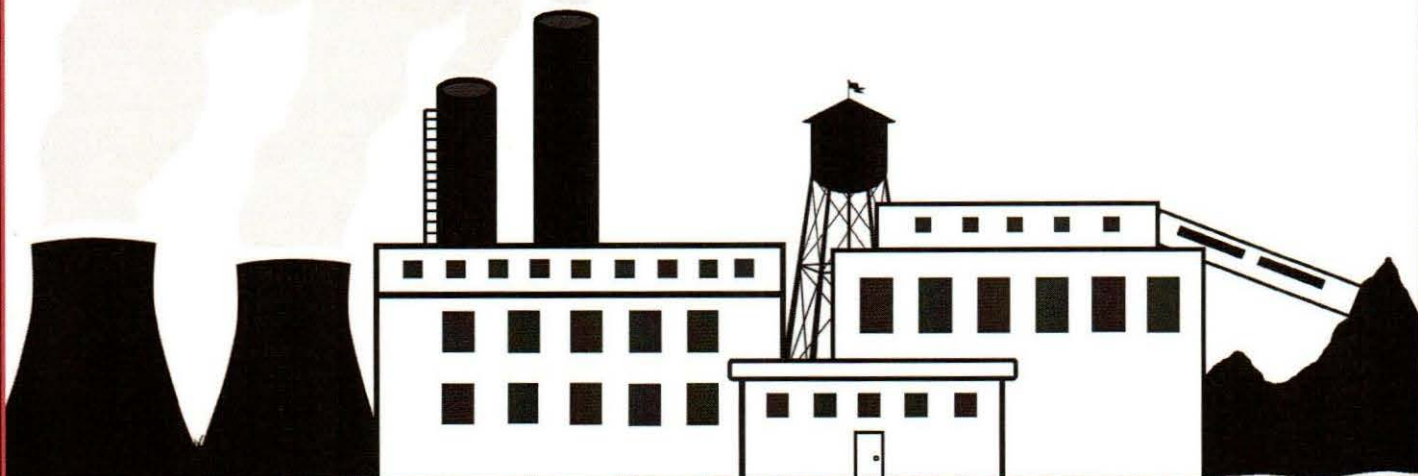


RELATIVE ACCURACY TEST REPORT

SRN: N1685

FRS: 110056958225

ORIS: 50835



TES FILER CITY GENERATING STATION

TES Filer City Generating Station
700 Mee Street
Filer City, MI 49634



EUBoiler01: Unit 1 Outlet and Inlet

Job # 23-103

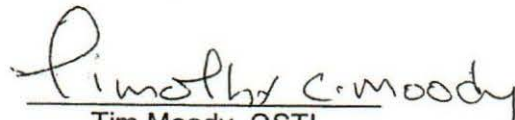
Test Date: 08-14-23 & 08-16-23
Report Date: 09-14-23





September 14, 2023


I, Tim Moody, hereby certify that the data obtained at the TES Filer City Generating Station on Unit 1 Outlet and Inlet 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
timmoody@gcitest.com

I, Stacy Sword, hereby certify that the report was prepared under my direction in conformance with the requirements of ASTM D7036. To the best of my knowledge the data and results are complete and accurate.


Stacy Sword, QSTI
Office Manager
stacysword@gcitest.com

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. GCI operated in conformance with the requirements of the ASTM D7036 during the test project.


Carl Vineyard, P.E., QSTI
Test Engineer
carlvineyard@gcitest.com

INTRODUCTION	.	.	.	.	.	.	1-2
SUMMARY OF TEST RESULTS	.	.	.	.	.	.	3-5
INTERMEDIATE CALCULATIONS	.	.	.	.	.	.	6-28
METHODS AND DISCUSSION	.	.	.	.	.	.	29-32
APPENDIX							33
Sample Calculations	.	.	.	.	.	.	34-45
Test Data Sheets	.	.	.	.	.	.	46-71
GCI Calibration Data	.	.	.	.	.	.	72-93
Calibration and Gas Certification Sheets	.	.	.	.	.	.	94-107
Plant Data	.	.	.	.	.	.	108-148
Accreditation	.	.	.	.	.	.	149-153

INTRODUCTION

INTRODUCTION

This report presents the results of the Relative Accuracy test performed at the TES Filer City Generating Station on Unit 1 Outlet and Inlet.

The purpose of the tests was to determine the Relative Accuracy of the plant CEMS of the unit. 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, Tim P. Moody, Eli Moody, and Sean Ewing. Also present during the testing were Thomas Schmelter with Consumers Energy's Regulatory Compliance Testing Section (RCTS) and Austin Swiatlowski with TES Filer City Generating Station. Jeremy Howe with Michigan Department of Environment, Great Lakes and Energy (EGLE) observed the testing too.

The tests were performed on August 14 & 16, 2023. The testing was completed in accordance with USEPA test methods as published in the Federal Register.

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 Relative Accuracy tests performed at the TES Filer City Station on Unit 1 Outlet and Inlet.

RELATIVE ACCURACY Outlet

Date	Monitor	Units	Difference	RA	Allowable	Results
8/16/2023	NO _x	lb/mmBtu		2.43%	20%	PASS
8/16/2023	NO _x	ppm		3.71%	10%	PASS
8/16/2023	SO ₂	lb/mmBtu		2.46%	20%	PASS
8/16/2023	SO ₂	ppm		4.31%	10%	PASS
8/16/2023	CO	lb/mmBtu		1.64% *	5%	PASS
8/16/2023	CO	ppm	3.402		± 5 ppm	PASS
8/16/2023	CO ₂	Percent		3.43%	10%	PASS
8/16/2023	Flow (H/N)	SCFH		3.17%	10%	PASS

*Average RM CO lb/mmBtu emissions were less than 50% of the facility emissions limit of 0.3 lb/mmBtu, the emissions limit was used in the denominator of the RA calculation in lieu of the average RM value per §13.2 of 40 CFR Part 60, Appendix B, Performance Specification 2. The CO ppm RA calculation uses the difference plus the 2.5% confidence coefficient pursuant to Section 13.2 of PS4A.

Analyzer Information

Stack			Inlet		
NO _x	Thermo Model 42i	S/N 0623017966	SO ₂	Thermo Model 43i	S/N 0622717879
SO ₂	Thermo Model 43i	S/N 0622717877			
CO	Thermo Model 48i	S/N 0622717887			
CO ₂	Thermo 410i	S/N 0622717869			
Flow	Air Monitor/MasstronII/CEM	S/N 59413A			

BIAS TEST RESULTS

Date	Monitor	Monitor Designation	Mean of Difference	Confidence Coefficient	Bias Results Factor Required	Bias Adj. Factor
8/16/2023	NO _x	ppm	-5.756	1.838	No	N/A
8/16/2023	SO ₂	ppm	-3.467	1.384	No	N/A
8/16/2023	Flow (H/N)	SCFH	141888.889	51918.361	Yes	1.024

RELATIVE ACCURACY Inlet

Date	Monitor	Units	RA	Allowable	Results
8/14/2023	SO ₂	lb/mmBtu	4.24%	20%	PASS

NO_x CONVERTER EFFICIENCY

Date	NO ₂ Gas Value	Recorded Value	Converter Efficiency %
8/16/2023	45.68	43.97	96.26%

**PROTOCOL GAS
Outlet**

Gas Type	Low (zero)	Mid	PGVP#	Exp. Date	High	PGVP#	Exp. Date
NO _x	CC39092	CC445042	B62023	4/25/2031	AAL070626	B62018	3/14/2026
SO ₂	CC39092	SG9198910BAL	B62023	4/17/2031	CC3800	B62017	10/9/2025
CO	CC39092	CC187122	B62023	4/21/2031	CC237189	B62021	4/15/2029
CO ₂	CC445042	CC39092	B62023	7/25/2031	EB0013323	B62020	11/3/2028
O ₂	CC445042	CC39092	B62023	7/25/2031	EB0013323	B62020	11/3/2028

**PROTOCOL GAS
Inlet**

Gas Type	Low (zero)	Mid	PGVP#	Exp. Date	High	PGVP#	Exp. Date
SO ₂	CC39092	CC24165	B62019	11/4/2027	CC312633	B62016	12/27/2024
CO ₂	CC24165	CC39092	B62023	7/25/2031	EB0013323	B62020	11/3/2028

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

INTERMEDIATE CALCULATIONS

RECEIVED

OCT 04 2023

AIR QUALITY DIVISION

Grace Consulting, Inc.

TES Filer City Station Unit 1 Outlet
 Relative Accuracy Test Audit
 Relative Accuracy Calculations and Results
 NOx lb/mmBtu
 8/16/2023

Use	Run	Start Time	Stop Time	Steam Flow	NOx lb/mmBtu		
					RM	CEMS	Difference
Y	1	7:00	7:20	292	0.375	0.384	-0.009
N	2	7:42	8:02	290	0.368	0.396	-0.028
Y	3	8:13	8:33	294	0.360	0.384	-0.024
Y	4	8:45	9:05	292	0.382	0.388	-0.006
Y	5	9:22	9:42	289	0.392	0.390	0.002
Y	6	9:55	10:15	293	0.386	0.388	-0.002
Y	7	10:37	10:57	292	0.389	0.381	0.008
Y	8	12:25	12:45	293	0.393	0.388	0.005
Y	9	13:00	13:20	297	0.390	0.384	0.006
Y	10	13:37	13:57	299	0.393	0.383	0.010
Averages				293	0.384	0.386	-0.001

Standard Deviation 0.011
 Confidence Coefficient 0.008
 Relative Accuracy 2.43

Grace Consulting, Inc.

TES Filer City Station Unit 1 Outlet
 Relative Accuracy Test Audit
 Relative Accuracy Calculations and Results
 NOx PPM
 8/16/2023

Use	Run	Start Time	Stop Time	Steam Flow	NOx PPM		
					RM	CEMS	Difference
Y	1	7:00	7:20	292	199.800	208.900	-9.100
N	2	7:42	8:02	290	199.800	213.000	-13.200
Y	3	8:13	8:33	294	197.700	207.300	-9.600
Y	4	8:45	9:05	292	205.300	210.200	-4.900
Y	5	9:22	9:42	289	207.700	210.600	-2.900
Y	6	9:55	10:15	293	207.900	210.900	-3.000
Y	7	10:37	10:57	292	202.800	208.900	-6.100
Y	8	12:25	12:45	293	207.800	212.900	-5.100
Y	9	13:00	13:20	297	208.100	212.500	-4.400
Y	10	13:37	13:57	299	206.200	212.900	-6.700
Averages				293	204.811	210.567	-5.756

Standard Deviation 2.391
 Confidence Coefficient 1.838
 Relative Accuracy 3.71

 Bias Test Pass/Fail PASS
 Bias Adjustment Factor 1.000

Grace Consulting, Inc.

TES Filer City Station Unit 1 Outlet
 Relative Accuracy Test Audit
 Relative Accuracy Calculations and Results
 SO2 lb/mmBtu
 8/16/2023

Use	Run	Start Time	Stop Time	Steam Flow	SO2 lb/mmBtu		
					RM	CEMS	Difference
Y	1	7:00	7:20	292	0.246	0.254	-0.008
N	2	7:42	8:02	290	0.339	0.360	-0.021
Y	3	8:13	8:33	294	0.277	0.292	-0.015
Y	4	8:45	9:05	292	0.264	0.273	-0.009
Y	5	9:22	9:42	289	0.329	0.331	-0.002
Y	6	9:55	10:15	293	0.352	0.352	0.000
Y	7	10:37	10:57	292	0.270	0.265	0.005
Y	8	12:25	12:45	293	0.263	0.256	0.007
Y	9	13:00	13:20	297	0.278	0.272	0.006
Y	10	13:37	13:57	299	0.368	0.362	0.006
Averages				293	0.294	0.295	-0.001

Standard Deviation 0.008
 Confidence Coefficient 0.006
 Relative Accuracy 2.46

Grace Consulting, Inc.

TES Filer City Station Unit 1 Outlet
 Relative Accuracy Test Audit
 Relative Accuracy Calculations and Results
 SO2 PPM
 8/16/2023

Use	Run	Start Time	Stop Time	Steam Flow	SO2 PPM		
					RM	CEMS	Difference
Y	1	7:00	7:20	292	94.200	100.000	-5.800
N	2	7:42	8:02	290	132.600	139.300	-6.700
Y	3	8:13	8:33	294	109.200	113.500	-4.300
Y	4	8:45	9:05	292	102.000	106.400	-4.400
Y	5	9:22	9:42	289	125.200	128.300	-3.100
Y	6	9:55	10:15	293	136.400	137.700	-1.300
Y	7	10:37	10:57	292	101.300	104.500	-3.200
Y	8	12:25	12:45	293	100.000	101.200	-1.200
Y	9	13:00	13:20	297	106.600	108.500	-1.900
Y	10	13:37	13:57	299	138.900	144.900	-6.000
Averages				293	112.644	116.111	-3.467

Standard Deviation 1.800
 Confidence Coefficient 1.384
 Relative Accuracy 4.31
 Bias Test Pass/Fail PASS
 Bias Adjustment Factor 1.000

Grace Consulting, Inc.

TES Filer City Station Unit 1 Outlet
 Relative Accuracy Test Audit
 Relative Accuracy Calculations and Results
 CO lb/mmBtu
 8/16/2023

Use	Run	Start Time	Stop Time	Steam Flow	CO lb/mmBtu		
					RM	CEMS	Difference
Y	1	7:00	7:20	292	0.076	0.075	0.001
Y	2	7:42	8:02	290	0.034	0.031	0.003
Y	3	8:13	8:33	294	0.044	0.042	0.002
Y	4	8:45	9:05	292	0.047	0.043	0.004
Y	5	9:22	9:42	289	0.061	0.056	0.005
Y	6	9:55	10:15	293	0.049	0.044	0.005
N	7	10:37	10:57	292	0.057	0.050	0.007
Y	8	12:25	12:45	293	0.067	0.062	0.005
Y	9	13:00	13:20	297	0.051	0.047	0.004
Y	10	13:37	13:57	299	0.079	0.074	0.005
Averages				293	0.056	0.053	0.004

Standard Deviation 0.001
 Confidence Coefficient 0.001
 Relative Accuracy 1.64

$$RA = \frac{|Diff| + cc}{Std} \times 100$$

Standard = 0.3 lb/mmBtu

Grace Consulting, Inc.

TES Filer City Station Unit 1 Outlet
 Relative Accuracy Test Audit
 Relative Accuracy Calculations and Results
 CO PPM
 8/16/2023

Use	Run	Start Time	Stop Time	Steam Flow	CO PPM		
					RM	CEMS	Difference
Y	1	7:00	7:20	292	66.700	67.700	-1.000
Y	2	7:42	8:02	290	30.500	27.500	3.000
Y	3	8:13	8:33	294	39.800	36.900	2.900
Y	4	8:45	9:05	292	41.500	38.400	3.100
Y	5	9:22	9:42	289	53.300	50.000	3.300
N	6	9:55	10:15	293	43.300	38.900	4.400
Y	7	10:37	10:57	292	48.800	45.300	3.500
Y	8	12:25	12:45	293	58.000	55.600	2.400
Y	9	13:00	13:20	297	44.800	42.300	2.500
Y	10	13:37	13:57	299	68.000	67.800	0.200
Averages				293	50.156	47.944	2.211

Standard Deviation 1.550
 Confidence Coefficient 1.191
 Relative Accuracy 3.402

*Relative Accuracy = Absolute Difference + Confidence Coefficient

Grace Consulting, Inc.

TES Filer City Station Unit 1 Outlet
 Relative Accuracy Test Audit
 Relative Accuracy Calculations and Results
 CO2 Percent
 8/16/2023

Use	Run	Start Time	Stop Time	Steam Flow	CO2 Percent		
					RM	CEMS	Difference
Y	1	7:00	7:20	292	10.300	10.500	-0.200
Y	2	7:42	8:02	290	10.500	10.400	0.100
Y	3	8:13	8:33	294	10.700	10.500	0.200
Y	4	8:45	9:05	292	10.500	10.600	-0.100
Y	5	9:22	9:42	289	10.400	10.600	-0.200
Y	6	9:55	10:15	293	10.500	10.600	-0.100
Y	7	10:37	10:57	292	10.200	10.700	-0.500
Y	8	12:25	12:45	293	10.300	10.700	-0.400
Y	9	13:00	13:20	297	10.400	10.800	-0.400
N	10	13:37	13:57	299	10.200	10.800	-0.600
Averages				292	10.422	10.600	-0.178

Standard Deviation 0.233
 Confidence Coefficient 0.179
 Relative Accuracy 3.43

Grace Consulting, Inc.

TES Filer City Station Unit 1 Inlet
 Relative Accuracy Test Audit
 Relative Accuracy Calculations and Results
 SO2 lb/mmBtu
 8/14/2023

Use	Run	Start Time	Stop Time	Steam Flow	SO2 lb/mmBtu		
					RM	CEMS	Difference
Y	1	7:10	7:30	283	1.406	1.499	-0.093
Y	2	7:43	8:03	281	1.490	1.554	-0.064
Y	3	8:27	8:47	284	1.507	1.563	-0.056
Y	4	9:00	9:20	281	1.531	1.587	-0.056
Y	5	9:36	9:56	284	1.665	1.600	0.065
N	6	10:23	10:43	286	1.715	1.688	0.027
Y	7	10:55	11:15	286	1.719	1.742	-0.023
Y	8	11:27	11:47	290	1.708	1.728	-0.020
Y	9	11:59	12:19	288	1.809	1.730	0.079
Y	10	12:36	12:56	288	1.647	1.689	-0.042
Averages				285	1.609	1.632	-0.023

Standard Deviation 0.058
 Confidence Coefficient 0.045
 Relative Accuracy 4.24

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

TES Filer City Station - Unit 1 Outlet

Date: 8/16/2023
 Pollutant: NOx
 Monitor Span: 503.70

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	Percent Moisture	Corrected Value, Dry Basis	Corrected Value, Wet Basis
1	238.3	0.26	1.87	0.32	231.43	229.76	-0.33	232.00	16.7	239.8	199.8
2	236.9	1.87	1.84	-0.01	229.76	228.54	-0.24	232.00	16.7	239.9	199.8
3	233.7	1.84	1.73	-0.02	228.54	228.54	0.00	232.00	16.7	237.3	197.7
4	243.1	1.73	1.65	-0.02	228.54	229.43	0.18	232.00	16.7	246.4	205.3
5	242.2	1.65	1.51	-0.03	229.43	229.54	0.02	232.00	15.2	244.9	207.7
6	242.0	1.51	2.25	0.15	229.54	228.54	-0.20	232.00	15.2	245.2	207.9
7	240.5	2.25	2.14	-0.02	228.54	229.65	0.22	232.00	16.8	243.7	202.8
8	243.9	2.14	2.21	0.01	229.65	228.65	-0.20	232.00	15.9	247.1	207.8
9	243.1	2.21	2.26	0.01	228.65	227.65	-0.20	232.00	15.9	247.4	208.1
10	242.5	2.26	2.54	0.06	227.65	229.54	0.38	232.00	16.3	246.3	206.2

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o)$$

Eq. 6C-1

where:

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

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

TES Filer City Station - Unit 1 Outlet

Date: 8/16/2023
 Pollutant: SO2
 Monitor Span: 231.40

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	Percent Moisture	Corrected Value, Dry Basis	Corrected Value, Wet Basis
1	110.5	1.30	1.34	0.02	100.76	98.23	-1.09	101.70	16.7	113.1	94.2
2	153.0	1.34	1.41	0.03	98.23	98.25	0.01	101.70	16.7	159.2	132.6
3	126.1	1.41	1.65	0.10	98.25	98.04	-0.09	101.70	16.7	131.1	109.2
4	117.6	1.65	1.89	0.10	98.04	97.89	-0.06	101.70	16.7	122.5	102.0
5	140.4	1.89	1.84	-0.02	97.89	96.63	-0.54	101.70	15.2	147.7	125.2
6	152.3	1.84	2.15	0.13	96.63	97.43	0.35	101.70	15.2	160.8	136.4
7	115.7	2.15	2.32	0.07	97.43	96.45	-0.42	101.70	16.8	121.8	101.3
8	113.0	2.32	2.48	0.07	96.45	97.54	0.47	101.70	15.9	118.9	100.0
9	120.9	2.48	2.41	-0.03	97.54	97.51	-0.01	101.70	15.9	126.7	106.6
10	157.3	2.41	2.48	0.03	97.51	97.22	-0.13	101.70	16.3	165.9	138.9

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o)$$

Eq. 6C-1

where:

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

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

TES Filer City Station - Unit 1 Outlet

Date: 8/16/2023
 Pollutant: CO
 Monitor Span: 101.90

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	Percent Moisture	Corrected Value, Dry Basis	Corrected Value, Wet Basis
1	79.1	0.18	0.11	-0.07	49.78	48.90	-0.86	49.91	16.7	80.1	66.7
2	35.8	0.11	0.14	0.03	48.90	48.74	-0.16	49.91	16.7	36.6	30.5
3	46.7	0.14	0.14	0.00	48.74	48.77	0.03	49.91	16.7	47.8	39.8
4	48.6	0.14	0.14	0.00	48.77	48.71	-0.06	49.91	16.7	49.8	41.5
5	61.3	0.14	0.21	0.07	48.71	48.65	-0.06	49.91	15.2	62.9	53.3
6	49.5	0.21	0.26	0.05	48.65	48.11	-0.53	49.91	15.2	51.1	43.3
7	56.7	0.26	0.28	0.02	48.11	48.36	0.25	49.91	16.8	58.7	48.8
8	67.2	0.28	0.21	-0.07	48.36	48.95	0.58	49.91	15.9	69.0	58.0
9	52.3	0.21	-0.05	-0.26	48.95	48.93	-0.02	49.91	15.9	53.3	44.8
10	79.4	-0.05	-0.09	-0.04	48.93	48.55	-0.37	49.91	16.3	81.3	68.0

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o)$$

Eq. 6C-1

where:

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

RECEIVED
 OCT 04 2023
 AIR QUALITY DIVISION

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

TES Filer City Station - Unit 1 Outlet

Date: 8/16/2023
 Pollutant: CO2
 Monitor Span: 19.76

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	Percent Moisture	Corrected Value, Dry Basis	Corrected Value, Wet Basis
1	12.4	0.15	0.12	-0.15	11.16	11.21	0.25	11.18	16.7	12.4	10.3
2	12.6	0.12	0.18	0.30	11.21	11.22	0.05	11.18	16.7	12.6	10.5
3	12.8	0.18	0.22	0.20	11.22	11.16	-0.30	11.18	16.7	12.8	10.7
4	12.6	0.22	0.15	-0.35	11.16	11.31	0.76	11.18	16.7	12.6	10.5
5	12.4	0.15	0.21	0.30	11.31	11.33	0.10	11.18	15.2	12.3	10.4
6	12.6	0.21	0.22	0.05	11.33	11.41	0.40	11.18	15.2	12.4	10.5
7	12.4	0.22	0.17	-0.25	11.41	11.34	-0.35	11.18	16.8	12.2	10.2
8	12.4	0.17	0.08	-0.46	11.34	11.31	-0.15	11.18	15.9	12.3	10.3
9	12.6	0.08	0.03	-0.25	11.31	11.44	0.66	11.18	15.9	12.4	10.4
10	12.5	0.03	-0.03	-0.30	11.44	11.42	-0.10	11.18	16.3	12.2	10.2

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o)$$

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

TES Filer City Station - Unit 1 Outlet

Date: 8/16/2023
 Pollutant: O2
 Monitor Span: 21.87

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	Percent Moisture	Corrected Value, Dry Basis	Corrected Percent, Wet Basis
1	6.2	0.12	0.13	0.05	11.08	11.16	0.37	11.26	16.7	6.2	5.2
2	6.3	0.13	0.15	0.09	11.16	11.08	-0.37	11.26	16.7	6.3	5.2
3	6.1	0.15	0.21	0.27	11.08	11.13	0.23	11.26	16.7	6.1	5.1
4	6.1	0.21	0.22	0.05	11.13	11.14	0.05	11.26	16.7	6.1	5.1
5	6.1	0.22	0.24	0.09	11.14	11.04	-0.46	11.26	15.2	6.1	5.2
6	6.0	0.24	0.21	-0.14	11.04	11.15	0.50	11.26	15.2	6.0	5.1
7	6.0	0.21	0.22	0.05	11.15	11.21	0.27	11.26	16.8	5.9	4.9
8	6.0	0.22	0.14	-0.37	11.21	11.32	0.50	11.26	15.9	5.9	5.0
9	5.8	0.14	0.05	-0.41	11.32	11.11	-0.96	11.26	15.9	5.8	4.9
10	5.7	0.05	0.12	0.32	11.11	11.17	0.27	11.26	16.3	5.7	4.8

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o)$$

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.
Moisture Calculations (Runs 1 - 6)

Site: TES Filer City Station
 Date: 08/16/23
 Unit Number: 1 Outlet
 Load: High

Run:	1	2	3
Total Impinger Content:	90.50	90.50	89.90
Volume Metered:	22.160	22.160	22.121
Meter Temperature:	68.00	68.00	72.00
Delta H:	1.787	1.787	1.787
Barometric Pressure:	29.25	29.25	29.25
Meter Correction Factor:	0.982	0.982	0.982
Volume Measured (DSCF):	21.36	21.36	21.16
Water Volume (SCF):	4.27	4.27	4.24
% Moisture in Flue Gas:	16.7	16.7	16.7

Run:	4	5	6
Total Impinger Content:	89.90	80.30	80.30
Volume Metered:	22.121	22.215	22.215
Meter Temperature:	72.00	74.00	74.00
Delta H:	1.787	1.787	1.787
Barometric Pressure:	29.25	29.25	29.25
Meter Correction Factor:	0.982	0.982	0.982
Volume Measured (DSCF):	21.16	21.17	21.17
Water Volume (SCF):	4.24	3.79	3.79
% Moisture in Flue Gas:	16.7	15.2	15.2

Grace Consulting, Inc.
Moisture Calculations (Runs 7 - 10)

Site: TES Filer City Station
 Date: 08/16/23
 Unit Number: 1 Outlet
 Load: High

Run:	7	8	9
Total Impinger Content:	90.40	83.60	83.60
Volume Metered:	22.232	22.075	22.075
Meter Temperature:	77.00	80.00	80.00
Delta H:	1.787	1.787	1.787
Barometric Pressure:	29.25	29.25	29.25
Meter Correction Factor:	0.982	0.982	0.982
Volume Measured (DSCF):	21.07	20.81	20.81
Water Volume (SCF):	4.26	3.94	3.94
% Moisture in Flue Gas:	16.8	15.9	15.9

Run:	10
Total Impinger Content:	86.40
Volume Metered:	22.221
Meter Temperature:	81.00
Delta H:	1.787
Barometric Pressure:	29.25
Meter Correction Factor:	0.982
Volume Measured (DSCF):	20.90
Water Volume (SCF):	4.07
% Moisture in Flue Gas:	16.3

Grace Consulting, Inc.

Velocity Traverse Calculations and Results

Site: TES Filer City Station
 Date: 08/16/23
 Unit Number: 1 Outlet
 Load: High

Run:		1	2	3
Start Time:		07:00	07:39	08:13
End Time:		07:11	07:50	08:26
Pitot Coefficient:		0.829	0.829	0.829
Barometric Pressure:	In. Hg.	29.25	29.25	29.25
Static Pressure:	In. H2O	-0.35	-0.50	-0.43
Square Root of Delta-P:		1.105	1.091	1.093
Flue Temperature:	Deg. F.	186.70	185.10	185.10
Percent CO2:	%	12.40	12.60	12.80
Percent O2:	%	6.20	6.30	6.10
Percent Moisture:	%	16.7	16.7	16.7
Area of Flue:	Sq. Ft.	31.5	31.5	31.5
Absolute Flue Pressure:	In. Hg.	29.22	29.21	29.22
Molecular Weight:	Lb/Lb Mole	28.19	28.22	28.24
Velocity of Flue Gas:	FPS	69.39	68.40	68.49
Volume of Flue Gas:	ACFM	131139	129273	129453
Volume of Flue Gas:	DSCFM	87079	86021	86156
Volume of Flue Gas:	KSCFM	104.54	103.27	103.43
Volume of Flue Gas:	KSCFH	6272.23	6195.97	6205.68
Default WAF:	WAF	0.995	0.995	0.995
Volume of Flue Gas:	Adj. KSCFH	6240.87	6164.99	6174.65
Volume of Flue Gas:	SCFH	6241000	6165000	6175000

Grace Consulting, Inc.

Velocity Traverse Calculations and Results

Site: TES Filer City Station
 Date: 08/16/23
 Unit Number: 1 Outlet
 Load: High

Run:		4	5	6
Start Time:		08:51	09:22	10:00
End Time:		09:01	09:34	10:10
Pitot Coefficient:		0.829	0.829	0.829
Barometric Pressure:	In. Hg.	29.25	29.25	29.25
Static Pressure:	In. H2O	-0.50	-0.50	-0.47
Square Root of Delta-P:		1.115	1.076	1.078
Flue Temperature:	Deg. F.	185.80	188.00	186.60
Percent CO2:	%	12.60	12.30	12.40
Percent O2:	%	6.10	6.10	6.00
Percent Moisture:	%	16.7	15.2	15.2
Area of Flue:	Sq. Ft.	31.5	31.5	31.5
Absolute Flue Pressure:	In. Hg.	29.21	29.21	29.22
Molecular Weight:	Lb/Lb Mole	28.21	28.36	28.37
Velocity of Flue Gas:	FPS	69.95	67.45	67.48
Volume of Flue Gas:	ACFM	132204	127474	127545
Volume of Flue Gas:	DSCFM	87876	85965	86205
Volume of Flue Gas:	KSCFM	105.49	101.37	101.66
Volume of Flue Gas:	KSCFH	6329.59	6082.40	6099.44
Default WAF:	WAF	0.995	0.995	0.995
Volume of Flue Gas:	Adj. KSCFH	6297.94	6051.99	6068.94
Volume of Flue Gas:	SCFH	6298000	6052000	6069000

Grace Consulting, Inc.

Velocity Traverse Calculations and Results

Site: TES Filer City Station
 Date: 08/16/23
 Unit Number: 1 Outlet
 Load: High

Run:		7	8	9
Start Time:		10:37	12:25	12:58
End Time:		10:47	12:36	13:09
Pitot Coefficient:		0.829	0.829	0.829
Barometric Pressure:	In. Hg.	29.25	29.25	29.25
Static Pressure:	In. H2O	-0.43	-0.55	-0.51
Square Root of Delta-P:		1.101	1.059	1.071
Flue Temperature:	Deg. F.	186.80	187.70	186.90
Percent CO2:	%	12.20	12.30	12.40
Percent O2:	%	5.90	5.90	5.80
Percent Moisture:	%	16.8	15.9	15.9
Area of Flue:	Sq. Ft.	31.5	31.5	31.5
Absolute Flue Pressure:	In. Hg.	29.22	29.21	29.21
Molecular Weight:	Lb/Lb Mole	28.14	28.26	28.27
Velocity of Flue Gas:	FPS	69.21	66.48	67.17
Volume of Flue Gas:	ACFM	130801	125643	126959
Volume of Flue Gas:	DSCFM	86720	84059	85053
Volume of Flue Gas:	KSCFM	104.23	99.95	101.13
Volume of Flue Gas:	KSCFH	6253.83	5997.07	6068.00
Default WAF:	WAF	0.995	0.995	0.995
Volume of Flue Gas:	Adj. KSCFH	6222.57	5967.09	6037.66
Volume of Flue Gas:	SCFH	6223000	5967000	6038000

Grace Consulting, Inc.

Velocity Traverse Calculations and Results

Site: TES Filer City Station
Date: 08/16/23
Unit Number: 1 Outlet
Load: High

Run:		10
Start Time:		13:37
End Time:		13:48
Pitot Coefficient:		0.829
Barometric Pressure:	In. Hg.	29.25
Static Pressure:	In. H2O	-0.58
Square Root of Delta-P:		1.090
Flue Temperature:	Deg. F.	185.80
Percent CO2:	%	12.20
Percent O2:	%	5.70
Percent Moisture:	%	16.3
Area of Flue:	Sq. Ft.	31.5
Absolute Flue Pressure:	In. Hg.	29.21
Molecular Weight:	Lb/Lb Mole	28.19
Velocity of Flue Gas:	FPS	68.41
Volume of Flue Gas:	ACFM	129294
Volume of Flue Gas:	DSCFM	86337
Volume of Flue Gas:	KSCFM	103.15
Volume of Flue Gas:	KSCFH	6189.01
Default WAF:	WAF	0.995
Volume of Flue Gas:	Adj. KSCFH	6158.07
Volume of Flue Gas:	SCFH	6158000

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

TES Filer City Station - Unit 1 Inlet

Date: 8/14/2023
 Pollutant: SO2
 Monitor Span: 890.90

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	722.3	1.23	1.44	0.02	495.67	496.78	0.12	500.50	729.1
2	760.1	1.44	1.67	0.03	496.78	494.87	-0.21	500.50	768.1
3	758.1	1.67	2.34	0.08	494.87	492.32	-0.29	500.50	769.8
4	767.1	2.34	3.12	0.09	492.32	491.24	-0.12	500.50	782.3
5	794.2	3.12	3.56	0.05	491.24	490.02	-0.14	500.50	812.3
6	829.8	3.56	4.03	0.05	490.02	489.76	-0.03	500.50	850.5
7	829.6	4.03	4.12	0.01	489.76	491.23	0.17	500.50	849.4
8	838.5	4.12	3.84	-0.03	491.23	488.78	-0.28	500.50	859.4
9	846.9	3.84	2.94	-0.10	488.78	487.65	-0.13	500.50	870.8
10	774.7	2.94	3.93	0.11	487.65	485.61	-0.23	500.50	798.9

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o)$$

Eq. 6C-1

where:

C_{gas} = Effluent gas concentration, dry basis, ppm

C_{avg} = Average gas concentration indicated by gas analyzer, dry basis, ppm

C_o = Average of initial and final system calibration bias check responses for the zero gas, ppm

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm

C_{ma} = Actual concentration of the upscale calibration gas, ppm

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

TES Filer City Station - Unit 1 Inlet

Date: 8/14/2023
 Pollutant: CO2
 Monitor Span: 19.76

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	13.1	0.13	0.15	0.10	11.22	11.16	-0.30	11.18	13.1
2	13.1	0.15	0.13	-0.10	11.16	11.22	0.30	11.18	13.1
3	13.1	0.13	0.25	0.61	11.22	11.09	-0.66	11.18	13.2
4	13.1	0.25	0.31	0.30	11.09	11.02	-0.35	11.18	13.3
5	12.4	0.31	0.23	-0.40	11.02	10.95	-0.35	11.18	12.7
6	12.9	0.23	0.20	-0.15	10.95	11.05	0.51	11.18	13.1
7	13.0	0.20	0.12	-0.40	11.05	11.15	0.51	11.18	13.1
8	13.3	0.12	0.14	0.10	11.15	11.23	0.40	11.18	13.3
9	12.9	0.14	0.16	0.10	11.23	11.31	0.40	11.18	12.8
10	13.0	0.16	0.21	0.25	11.31	11.35	0.20	11.18	12.9

$$C_{gas} = (C_{avg} - C_o) * C_{ma} / (C_m - C_o)$$

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 the TES Filer City Generating Station on Unit 1 Outlet and Inlet

Methods 2 and 4

GCI performed 10 Method 2 test runs on the Normal (High) load to determine the KSCFH of flue gas exiting the stack for a Relative Accuracy Test Audit of the in-stack flow monitor. A 12-point traverse was tested for each Method 2 test run. The standard Wall Adjustment Factor of 0.9950 was used to correct each test run for wall effects.

One moisture test was performed for each hour of Method 2, 3A, 6C, 7E, and 10 testing on the Normal (High) load.

Method 3A

CO₂ and O₂ concentrations were determined with 10 Method 3A test runs. GCI used a monitor range of 0-19.76% for CO₂ and a monitor range of 0-21.87% for O₂ on the Outlet and Inlet.

Method 6C

SO₂ emissions were determined with 10 Method 6C test runs on the Normal load. GCI used a monitor span of 231.4 ppm for SO₂ on the Outlet and 890.9 ppm for SO₂ on the Inlet.

Method 7E

NO_x emissions were determined with 10 Method 7E test runs on the Normal load. GCI used a monitor span of 503.7 ppm for NO_x.

Method 10

CO emissions were determined with 10 Method 10 test runs on the Normal load. GCI used a monitor span of 101.9 ppm for CO.

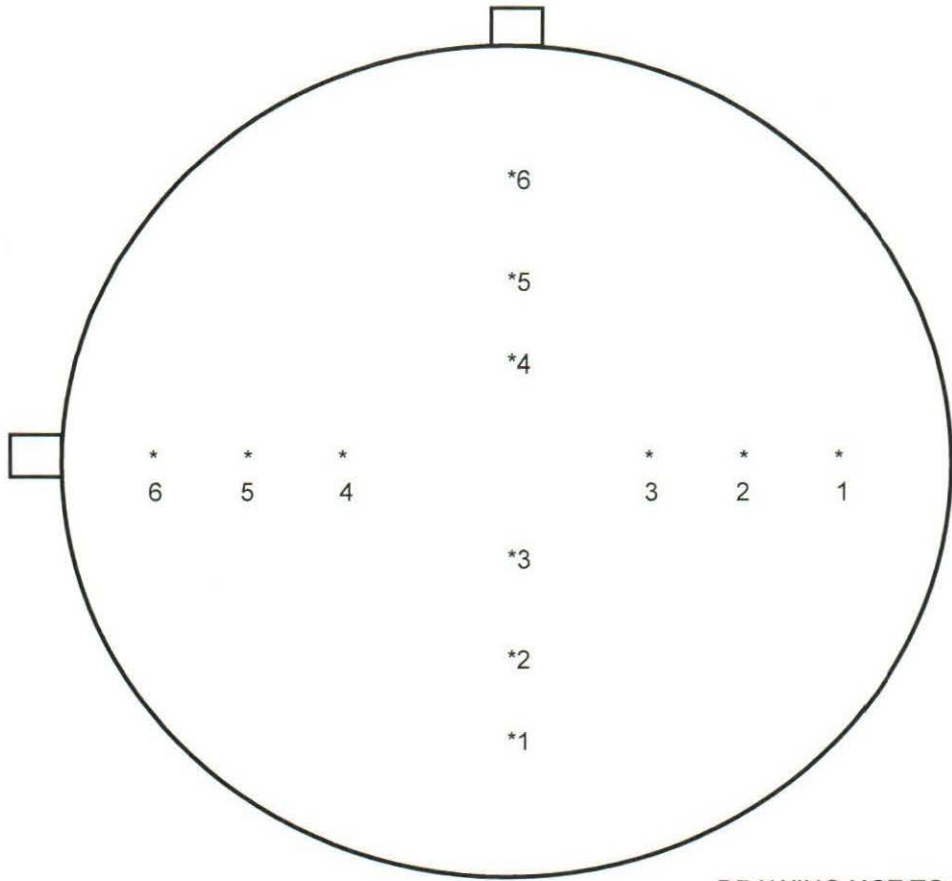
All gaseous sampling was performed at 16.7, 50.0 and 83.3 percent of the measurement line.

Discussion

Environmental conditions did not adversely affect the test results.

Inlet Run 6 was thrown out due to interference with the data logger signal.

Testing was completed by following GCI's Internal Site Specific Test Plan #23-103 with no deviations.



DRAWING NOT TO SCALE

POINTS DISTANCE FROM INSIDE WALL

1)	72.652 "
2)	64.901 "
3)	53.501 "
4)	22.495 "
5)	11.095 "
6)	3.344 "

STACK AREA = 31.5 sq ft
 STACK DIAMETER = 6.33 '

TES Filer City Station
 Unit 1



Grace Consulting, Inc.
 Emissions Testing Services

APPENDIX