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CO COMPLIANCE TEST REPORT FOR CITY OF STURGIS STURGIS, MI SV-ENG-6 Inlet & Outlet September 17, 2013

Job # 13-344

Test Report Date: 10-14-13



NO YELPOPERAN

October 14, 2013

I, Tim Moody, hereby certify that the data obtained for the City of Sturgis, in Sturgis, MI on SV-ENG-6 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.

in Model /25 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

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INTRODUCTION

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INTRODUCTION

This report presents the results of the emissions tests performed for the City of Sturgis, in Sturgis, MI on SV-ENG-6.

The purpose of the tests was to determine the CO emissions of the unit while burning gas and oil 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 were Tim Moody, Audie Wright, Leonard Campbell, Andy Kendall, Colin Oakes, Chris Hinson, and Steve Noppenberger from Grace Consulting, Inc. Russ Melin with the City of Sturgis was present to observe the testing.

The tests were performed on September 17, 2013. The testing was completed in accordance with USEPA test methods as published in the July 1, 2013 Federal Register, - "Standards of Performance for New Stationary Sources" and subsequent revisions.

The sampling and analytical procedures can be found in the Sampling and Analytical Procedures 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

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SUMMARY OF TEST RESULTS

The following presents the results of the emissions tests performed for the City of Sturgis, in Sturgis, MI on SV-ENG-6 Inlet and Outlet.

CO EMISSIONS

Run	Unit	Date	Fuel	CO PPM	CO Ib/mmBtu	CO <u>Ibs/hr</u>	CO @ 15% O2	O2 Percent	Percent Reduction
1	Inlet	09-17-13	Oil	173.90	0.311	16.79	131.54	13.10	
2	Inlet	09-17-13	Oil	117.90	0.181	11.69	76.44	11.80	
3	Inlet	09-17-13	Oil	79.40	0.120	7.66	50.92	11.70	
AVG.				123.73	0.204	12.04	86.30	12.20	
1	Outlet	09-17-13	Oil	22.20	0.035	1.98	14.88	12.10	88.7%
2	Outlet	09-17-13	Oil	23.00	0.035	2.24	14.91	11.80	80.5%
3	Outlet	09-17-13	Oil	23.50	0.036	2.13	15.24	11.80	70.1%
AVG.				22.90	0.035	2.12	15.01	11.90	79.8%
-	Tenlah	00-17-17	Can	242 60	0.245	25 10	162 01	11 CO	
⊥ 2	Inter	09-17-13	Gas	242.00	0.343	20.00	707 34 T3373T	11.60	
3	Inlet	09-17-13	Gas	321.20	0.438	29.00	199.48	11.40	
AVG.				295.30	0.416	26.28	185.91	11.53	
1	Outlet	09-17-13	Gas	61.50	0.095	5.11	42.19	12.30	72.6%
2	Outlet	09-17-13	Gas	59.80	0.092	4.89	41.03	12.30	79.98
3	Outlet	09-17-13	Gas	58.90	0.092	4.53	40.88	12.40	79.5%
AVG.				60.07	0.093	4.84	41.37	12.33	77.3%

*Percent Reduction based on CO ppm015% O2

STRATIFICATION

inlet

Date	·····	Point 1	Point 2	Point 3	Average	Greatest Deviation
09-17-13	co	180.49	170.78	173.15	174.78	3.27%
09-17-13	CO2	6.87	6.93	6.98	6.92	0.83%
09-17-13	O2	13.28	13.20	13.14	13.21	0.53%

STRATIFICATION Outlet

Date		Point 1	Point 2	Point 3	Average	Greatest <u>Deviation</u>
09-17-13	со	21,49	21.73	21,95	21.72	1.07%
09-17-13	COz	6,31	6.53	6.61	6,48	2.698
09-17-13	O ₂	12,51	12,23	12.13	12.29	1,79%

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

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Sampling System Bias Check and Measured Value Correction

City of Sturgis Sturgis, MI - Unit SV-ENG-6 -Inlet

Date: 9/17/2013 Pollutant: CO Monitor Span: 497.4

Initial Fînal Corrected Average Run Initial Zero Final Zero Zero Gas Upscale Calibration Measured Upscale Upscale Value, Drv Number Gas Bias Gas Bias Drift Gas Drift Gas Gas Bias Basis Value Gas Bias 2.13 2.18 231.76 -0.34 232.20 173.90 1 174.78 0.01 233.43 2 119.80 2.18 1.55 -0.13 231.76 236.70 0.99 232.20 117.90 3 82.03 1.55 2.88 0.27 236.70 234.65 -0.41 232.20 79.40

 $Cgas = (Cavg - Co) * Cma / (Cm - Co) \qquad Eq. 6C-1$

where:

Cgas = Effluent gas concentration, dry basis, ppm

Cavg = Average gas concentration indicated by gas analyzer, dry basis, ppm

Fuel: Oil

Co = Average of initial and final system calibration bias check responses

for the zero gas, ppm

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

Sampling System Bias Check and Measured Value Correction

City of Sturgis Sturgis, MI - Unit SV-ENG-6 -Inlet

9/17/2013 Date: Pollutant: CO2 Fuel: Oil Monitor Span: 20.2 Initial Final Average Calibration Percent, Dry Corrected Run Initial Zero Final Zero Zero Gas Upscale Measured Upscale Upscale Number Gas Bias Gas Bias Drift Gas Drift Gas Percent Gas Bias Gas Bias Basis 6.92 0.11 0.23 0.59 1 11.22 11.12 -0.50 11.23 6.90 2 0.13 6.54 0.23 -0.50 11.12 11.16 0.20 11.23 6.50 -0.05 3 6.60 0.13 0.12 -0.05 11.16 11.15 11.23 6.60

Cgas = (Cavg - Co) * Cma / (Cm - Co) Eq. 6C-1

where:

Cgas = Effluent gas concentration, dry basis, percent

Cavg = Average gas concentration indicated by gas analyzer, dry basis, percent

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

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

Sampling System Bias Check and Measured Value Correction

City of Sturgis Sturgis, MI - Unit SV-ENG-6 -Inlet

Date:	9/17/2013
Poliutant:	02
Monitor Span:	22

Fuel: Oil

Run Number	Average Measured Percent	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 Percent, Dry Basis
1	13.21	0.14	0.11	-0.14	11.12	11.17	0.23	11.04	13.10
2	11.91	0.11	0.11	0.00	11.17	11.12	-0.23	11.04	11.80
3	11.78	0.11	0.15	0.18	11. 12	11.12	0.00	11.04	11.70

Cgas = (Cavg - Co) * Cma / (Cm - Co) Eq. 6C-1

where:

Cgas = Effluent gas concentration, dry basis, percent

Cavg = Average gas concentration indicated by gas analyzer, dry basis, percent

Co = Average of initial and final system calibration bias check responses

for the zero gas, percent

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

Grace Consulting, Inc. Moisture Calculations (Runs 1 - 3)

Client: City of Sturgis Site: Sturgis, MI Date: 09/17/13 Unit Number: SV-ENG-8 -Inlet Load: Oll

Run:	1	2	3
Total Impinger Content:	43.00	35.00	34.00
Volume Metered:	22,469	22.330	22.325
Motor Temperature:	64.00	73.00	77.00
Delta H'	1.931	1.931	1.931
Barometric Pressure:	30.37	30.37	30.37
Meter Correction Factor:	1.012	1.012	1.012
Volume Measured (DSCE)	23.36	22.82	22.64
Water Volume (SCF):	2.03	1.65	1.60
% Moisture in Flue Gas:	8.00	6.70	6.60

Velocity Traverse Calculations and Results

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Client:	City of Sturgls
Site:	Sturgis, MI
Date:	09/17/13
Unit Number:	SV-ENG-6 -Inlet
Load:	Oll

Run:		4	2	3
Start Time:		09:30	11:17	12:29
End Time:		09:38	11:37	12:40
Pitot Coefficient:		0.84	0.84	0.84
Barometric Pressure:	In. Hg.	30.37	30.37	30.37
Static Pressure:	In. H20	8.3	8.3	8.3
Square Root of Delta-P:		2.233	2,275	2.219
Flue Temperature:	Deg. F.	831.40	845.10	854.40
Percent CO2:	%	6.90	6.50	6.60
Percent O2:	%	13.10	11.80	11.70
Percent Moisture:	%	8.00	6.70	6.60
Area of Flue:	Sq. Ft.	4.909	4.909	4.909
Absolute Flue Pressure:	In. Hg.	30.98	30.98	30.98
Molecular Weight:	Lb/Lb Mole	28.70	28.74	28.76
Velocity of Flue Gas:	FPS	193.26	197.79	193.53
Volume of Flue Gas:	ACFM	56923	58257	57002
Volume of Flue Gas:	DSCFM	22162	22760	22136
Volume of Flue Gas:	KSCFM	24.09	24.39	23.70
Volume of Flue Gas:	KSCFH	1445.34	1463.68	1422.03
Volume of Flue Gas:	SCFH	1445000	1464000	1422000

Sampling System Blas Check and Measured Value Correction

City of Sturgis Sturgis, MI - Unit SV-ENG-6 Outlet

9/17/2013 Date: Pollutant: CO 100.9 Monitor Span:

Initial Final Average Corrected Calibration Run Initial Zero Final Zero Zero Gas Upscale Measured Upscale Upscale Value, Dry Gas Bias Gas Bias Gas Drift Number Drift Gas Gas Bias Value Gas Bias Basis 22.20 1 21.72 0.60 0.60 0.00 49.00 48.60 -0.40 50.64 2 22.41 0.60 0.60 0.00 48.60 48.80 0.20 50.64 23.00 3 23.01 0.60 0.60 0.00 48.80 48.80 0.00 50.64 23.50 Cgas = (Cavg - Co) * Cma / (Cm - Co)Eq. 6C-1

where:

Cgas = Effluent gas concentration, dry basis, ppm

Cavg = Average gas concentration indicated by gas analyzer, dry basis, ppm

Fuel: Oil

Co = Average of initial and final system calibration bias check responses

for the zero gas, ppm

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

Sampling System Bias Check and Measured Value Correction

	City of Sture	jis
Sturgis,	MI - Unit SV-EN	\G -6
	· 0	utlet

Date:	9/17/2013
Pollutant:	CO2
Monitor Span:	20.51

Run Number	Average Measured Percent	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 Percent, Dry Basis
1	6.48	0.40	0.10	-1.46	11.40	11.40	0.00	11.38	6.40
2	6.64	0.10	0.20	0.49	11.40	11.30	-0.49	11.38	6.60
3	6.54	0.20	0.00	-0.98	11.30	11.20	-0.49	11.38	6.60

Cgas = (Cavg - Co) * Cma / (Cm - Co) Eq. 6C-1

where:

Cgas = Effluent gas concentration, dry basis, percent

Cavg = Average gas concentration indicated by gas analyzer, dry basis, percent

Fuel: Oil

Co = Average of initial and final system calibration bias check responses

for the zero gas, percent

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

Sampling System Bias Check and Measured Value Correction

City of Sturgis Sturgis, MI - Unit SV-ENG-6 3 Outlet

Date: 9/17/2013 Pollutant: O2 Monitor Span: 21.78

Average Initial Final Initial Final Corrected Run Zero Gas Upscale Calibration Measured Zero Gas Zero Gas Upscale Upscale Percent. Number Drift Gas Drift Gas Percent Bias Bias Gas Bias Gas Bias **Dry Basis** 1 12.29 0.60 0.10 -2.30 11.40 12.10 11.30 -0.46 11.14 2 12.01 0.10 0.00 -0.46 11,30 11.40 0.46 11.14 11.80 3 12.10 0.00 0.30 1.38 11.40 11.50 0.46 11.14 11.80

Cgas = (Cavg - Co) * Cma / (Cm - Co) Eq. 6C-1

where:

Cgas = Effluent gas concentration, dry basis, percent

Cavg = Average gas concentration indicated by gas analyzer, dry basis, percent

Fuel: Oil

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

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

Grace Consulting, Inc. Moisture Calculations (Runs 1 - 3)

Client: City of Sturgis Site: Sturgis, MI Date: 09/17/13 Unit Number: SV-ENG-6-Outlet Load: Oil

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37.00	38.00	39.00
21.287	21.018	21,264
60.00	67.00	71.00
1.923	1.923	1.923
30.37	30.37	30.37
0.999	0.999	0.999
22.01	21,44	21.53
1.74	1.79	1.84
7.30	7.70	7.90
	1 37.00 21.287 60.00 1.923 30.37 0.999 22.01 1.74 7.30	1 2 37.00 38.00 21.287 21.018 60.00 67.00 1.923 1.923 30.37 30.37 0.999 0.999 22.01 21.44 1.74 1.79 7.30 7.70

Velocity Traverse Calculations and Results

Client:	City of Sturgis
Site:	Sturgis, MI
Date:	09/17/13
Unit Number:	SV-ENG-6
Load:	Oil

Run:		1	2	3
Start Time:		09:30	11:19	12:26
End Time:		09:50	11:48	12:41
Pitot Coefficient:		0.84	0.84	0.84
Barometric Pressure:	In. Hg.	30.37	30.37	30,37
Static Pressure:	In. H20	7.2	7.2	7.2
Square Root of Delta-P:		2.029	2.258	2.105
Flue Temperature:	Deg. F.	811.60	840.60	844.00
Percent CO2:	%	6.40	6.60	6.60
Percent O2:	%	12.10	11.80	11.80
Percent Moisture:	%	7.30	7.70	7.90
Area of Flue:	Sq. Ft.	4.909	4.909	4.909
Absolute Flue Pressure:	In. Hg.	30.90	30.90	30.90
Molecular Weight:	Lb/Lb Mole	28.67	28.64	28.62
Velocity of Flue Gas:	FPS	174.57	196.57	183.57
Volume of Flue Gas:	ACFM	51419	57898	54068
Volume of Flue Gas:	DSCFM	20432	22397	20815
Volume of Flue Gas:	KSCFM	22.04	24.26	22.60
Volume of Flue Gas:	KSCFH	1322.44	1455.90	1356.02
Volume of Flue Gas:	SCFH	1322000	1456000	1356000

Sampling System Bias Check and Measured Value Correction

City of Sturgis Sturgis, MI - Unit SV-ENG-6 -Inlet

Мо	Date: Poilutant: onitor Span:	9/17/2013 CO 497.4		-				Fuel:	Gas
Run Number	Average Measured Value	Initial Zero Gas Bias	Final Zero Gas Bias	Zero Gas Drift	lnitial Upscale Gas Bias	Final Upscale Gas Bias	Upscale Gas Drift	Calibration Gas	Corrected Value, Dry Basis
1	241.00	1.76	1.76	0.00	230.73	230.73	0.00	232.20	242.60
2	318.04	1.76	2.15	0.08	230.73	228.87	-0.37	232.20	322.10

-0.43

Cgas = (Cavg - Co) * Cma / (Cm - Co)Eq. 6C-1

228.87

where:

2.15

0.01

316.06

3

Cgas = Effluent gas concentration, dry basis, ppm

Cavg = Average gas concentration indicated by gas analyzer, dry basis, ppm

228.76

-0.02

232.20

321.20

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

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

Sampling System Bias Check and Measured Value Correction

City of Sturgis Sturgis, MI - Unit SV-ENG-6 -Inlet

Date: 9/17/2013 Pollutant: CO2 Fuel: Gas Monitor Span: 20.2 Average Initiat Final Calibration Percent, Dry Corrected Run Initial Zero Final Zero Zero Gas Upscale Measured Upscale Upscale Number Gas Bias Gas Bias Drift Gas Drift Percent Gas Bias Gas Bias Basis 1 5.34 0.09 0.14 0.25 11.02 11.03 0.05 11.23 5.40 2 5.37 0.14 0.05 -0.45 11.03 11.14 0.54 5.40

0.35

Cgas = (Cavg - Co) * Cma / (Cm - Co)Eq. 6C-1

11.14

where:

0.05

0.12

3

5.36

Cgas = Effluent gas concentration, dry basis, percent

Cavg = Average gas concentration indicated by gas analyzer, dry basis, percent

11.15

11.23

11.23

5.40

0.05

Co = Average of initial and final system calibration bias check responses

for the zero gas, percent

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

Sampling System Bias Check and Measured Value Correction

City of Sturgis Sturgis, MI - Unit SV-ENG-6 -Inlet

Date:	9/17/2013
Pollutant:	02
Monitor Span:	22

Fuel: Gas

Run Number	Average Measured Percent	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 Percent, Dry Basis
1	11.64	0.08	0.12	0.18	11.14	11.04	-0.45	11.04	11.60
2	11.59	0.12	0.02	-0.45	11.04	11.07	0.14	11.04	11.60
3	11.56	0.02	0.03	0.05	11.07	11.23	0.73	11.04	11.40

Cgas = (Cavg - Co) * Cma / (Cm - Co) Eq. 6C-1

where:

Cgas = Effluent gas concentration, dry basis, percent

Cavg = Average gas concentration indicated by gas analyzer, dry basis, percent

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

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

Grace Consulting, Inc. Moisture Calculations (Runs 1 - 3)

Client:	City of Sturgis
Site:	Sturgis, MI
Date:	09/17/13
Unit Number:	SV-ENG-6 -Inlet
Load:	Gas

Run:	1	2	3
Total impinger Content:	48.00	44.00	50.00
Volume Metered:	22,585	22.534	22.365
Motor Tomperature:	80.00	80.00	81.00
Delta H	1.931	1.931	1.931
Barometric Pressure'	30.37	30,37	30.37
Meter Correction Factor:	1.012	1.012	1.012
(aluma Maggurod (DSCE))	22 78	22.73	22.52
Volume Weasured (DSOF).	2.26	2.07	2.36
% Moisture in Flue Gas:	9.00	8.40	9.50

Velocity Traverse Calculations and Results

Client:	City of Sturgis
Site:	Sturgis, MI
Date:	09/17/13
Unit Number:	SV-ENG-6 -Inlet
Load:	Gas

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Run:		1	2	3
Start Time:		13:07	15:06	16:42
End Time:		13:57	15:14	16:52
Pitot Coefficient:		0.84	0.84	0.84
Barometric Pressure:	In. Hg.	30.37	30.37	30,37
Static Pressure:	In. H20	8.3	8.3	8,3
Square Root of Delta-P:		2.04	2,105	2.113
Flue Temperature:	Deg. F.	856.70	862.40	864.10
Percent CO2:	%	5.40	5.40	5.40
Percent O2:	%	11.60	11.60	11.40
Percent Molsture:	%	9.00	8.40	9.50
Area of Flue:	Sq. Ft.	4.909	4.909	4.909
Absolute Flue Pressure:	In. Hg.	30.98	30,98	30.98
Molecular Weight:	Lb/Lb Mole	28.31	28.38	28.24
Velocity of Flue Gas:	FPS	179,50	185.40	186.66
Volume of Flue Gas:	ACFM	52870	54607	54977
Volume of Flue Gas:	DSCFM	19969	20671	20535
Volume of Flue Gas:	KSCFM	21.94	22,57	22.69
Volume of Flue Gas:	KSCFH	1316.63	1354.03	1361.47
Volume of Flue Gas:	SCFH	1317000	1354000	1361000

Sampling System Bias Check and Measured Value Correction

City of Sturgis Sturgis, MI - Unit SV-ENG-6 Outlet

Date: 9/17/2013 Pollutant: CO Monitor Span: 100.9

Initial Final Corrected Average Calibration Run Initial Zero Final Zero Zero Gas Upscale Value, Dry Measured Upscale Upscale Gas Bias Gas Bias Drift Gas Drift Gas Number Value Gas Bias Gas Bias Basis 0.60 0.50 -0.40 50,64 61.50 1 58.93 -0.10 48.80 48.40 0.40 2 57.23 0.50 0.90 48.40 48.80 0.40 50.64 59.80 3 56,26 0.90 0.80 -0.10 48.80 48,10 -0.69 50.64 58.90 Caas = (Cava - Co) * Cma / (Cm - Co)Eq. 6C-1

where:

Cgas = Effluent gas concentration, dry basis, ppm

Cavg = Average gas concentration indicated by gas analyzer, dry basis, ppm

Fuel: Gas

Co = Average of initial and final system calibration bias check responses

for the zero gas, ppm

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

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Sampling System Bias Check and Measured Value Correction

			Sturgi	City of s, MI - Unit S	Sturgis SV-ENG-6				
I	Date: Pollutant: Vionitor Span:	9/17/2013 CO2 20.51			Outlet			Fuel:	Gas
Run Numbe	Average Measured Percent	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 Percent, Dry Basis
1	4.95	0.00	0.20	0.98	11.20	11.30	0.49	11.38	5.00
2	4.93	0.20	0.30	0.49	11.30	11.10	-0.98	11.38	4.90
З	4.97	0.30	0.00	-1.46	11.10	10.90	-0.98	11.38	5.10

Cgas = (Cavg - Co) * Cma / (Cm - Co) Eq. 6C-1

where:

Cgas = Effluent gas concentration, dry basis, percent

Cavg = Average gas concentration indicated by gas analyzer, dry basis, percent

Co = Average of initial and final system calibration bias check responses

for the zero gas, percent

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

Sampling System Bias Check and Measured Value Correction

City of Sturgis Sturgis, MI - Unit SV-ENG-6 9/17/2013 Outlet

Fuel: Gas

Run Number	Average Measured Percent	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 Percent, Dry Basis
1	12.53	0.30	0.20	-0.46	11.50	11.30	-0.92	11.14	12.30
2	12.51	0,20	0.20	0.00	11.30	11.40	0.46	11.14	12.30
3	12.51	0.20	0.40	0.92	11.40	11.20	-0.92	11.14	12.40

Cgas = (Cavg - Co) * Cma / (Cm - Co) Eq. 6C-1

where:

02

21.78

Date:

Pollutant:

Monitor Span:

Cgas = Effluent gas concentration, dry basis, percent

Cavg = Average gas concentration indicated by gas analyzer, dry basis, percent

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

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

Grace Consulting, Inc. Moisture Calculations (Runs 1 - 3)

Client: City of Sturgis Site: Sturgis, MI Date: 09/17/13 Unit Number: SV-ENG-6-Outlet Load: Gas

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Run:	1	2	3	
Total Impinger Content:	49.00	41.00	36.00	
Volume Metered:	21.204	21.051	21.132	
Meter Temperature:	74.00	75.00	76.00	
Delta H:	1,923	1.923	1.923	
Barometric Pressure:	30.37	30.37	30.37	
Meter Correction Factor:	0.999	0.999	0.999	
Volume Measured (DSCF):	21.35	21.16	21.20	
Water Volume (SCF):	2.31	1.93	1.70	
% Moisture in Flue Gas;	9,80	8.40	7.40	
Meter Correction Factor: Volume Measured (DSCF): Water Volume (SCF): % Moisture in Flue Gas;	0.999 21.35 2.31 9.80	0.999 21.16 1.93 8.40	0.99 21.2 1.70 7.40	

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Velocity Traverse Calculations and Results

Client:	City of Sturgis
Site:	Sturgis, MI
Date:	09/17/13
Unit Number:	SV-ENG-6
Load:	Gas

Run:		1	2	3
Start Time:		13:55	15:05	16:22
End Time:		14:03	15:21	16:33
Pitot Coefficient:		0.84	0.84	0.84
Barometric Pressure:	In, Hg.	30.37	30.37	30.37
Static Pressure:	In. H20	7.2	7.2	7.2
Square Root of Delta-P:		1.961	1.91	1.783
Flue Temperature:	Deg, F.	854.00	858.40	859.10
Percent CO2:	%	5.00	4.90	5.10
Percent O2:	%	12.30	12.30	12.40
Percent Moisture:	%	9,80	8.40	7.40
Area of Flue:	Sq. Ft.	4.909	4.909	4.909
Absolute Flue Pressure:	In. Hg.	30.90	30.90	30.90
Molecular Weight:	Lb/Lb Mole	28.19	28.33	28.47
Velocity of Flue Gas:	FPS	172.97	168,33	156.77
Volume of Flue Gas:	ACFM	50948	49580	46176
Volume of Flue Gas:	DSCFM	19063	18776	17669
Volume of Flue Gas:	KSCFM	21.13	20.50	19.08
Volume of Flue Gas:	KSCFH	1268.05	1229.88	1144.85
Volume of Flue Gas:	SCFH	1268000	1230000	1145000

SAMPLING AND ANALYTICAL PROCEDURES

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Test Methods used at City of Sturgis, SV-ENG-6, Inlet

Method 1, 2 and 4

GCI performed 3 Method 2 test runs while burning Oil and while burning Gas to determine the SCFH of flue gas exiting the stack. A 16 point traverse was tested for each Method 2 test run.

One moisture test was performed for each hour of Method 2 testing.

Method 3A

 CO_2 and O_2 concentrations were determined with 3 Method 3A test runs while burning Oil and while burning Gas. The sampling was performed at 3-points. GCI used a monitor range of 0-20.2% for CO_2 and a monitor range of 0-22% for O_2 .

Method 10

CO emissions were determined with 3 Method 10 test runs while burning Oil and while burning Gas. The sampling was performed at 3-points. GCI used a monitor span of 497.4 ppm for CO.

Test Methods used at City of Sturgis, SV-ENG-6, Outlet

Method 1, 2 and 4

GCI performed 3 Method 2 test runs while burning Oil and while burning Gas to determine the SCFH of flue gas exiting the stack. A 16 point traverse was tested for each Method 2 test run.

One moisture test was performed for each hour of Method 2 testing.

Method 3A

 CO_2 and O_2 concentrations were determined with 3 Method 3A test runs while burning Oil and while burning Gas. The sampling was performed at 3-points. GCI used a monitor range of 0-20.51% for CO_2 and a monitor range of 0-21.78% for O_2 .

Method 10

CO emissions were determined with 3 Method 10 test runs while burning Oil and while burning Gas. The sampling was performed at 3-points. GCI used a monitor span of 100.9 ppm for CO.

