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NO_x COMPLIANCE TEST REPORT FOR CITY OF STURGIS SV-ENG-6 February 13, 2018

City of Sturgis
130 N. Nottawa
Sturgis, MI 29180

Job # 18-027

Test Report Date: 03-08-18

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 NO_x 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 were Tim Moody, Levi Creek, and Jamek Russell from Grace Consulting, Inc. Dennis Dunlap and Dave Patterson with MDEQ were present to observe the testing.

The tests were performed on February 13, 2018. 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

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

NO_X EMISSIONS

Run	Date	NO_X ppm	NO_X lb/hr	grams/hp-hr	DSCFM
1	2-13-18	994.40	182.97	10.005	25685
2	2-13-18	1008.20	178.92	9.784	24772
3	2-13-18	1016.70	182.71	9.991	25085
AVG.		1006.43	181.54	9.927	25181

STRATIFICATION

Date		Point 1	Point 2	Point 3	Average	Greatest Deviation
2-13-18	NO_X	993.9	1000.6	986.2	993.5	0.73%
2-13-18	O_2	11.8	11.8	11.8	11.8	0.00%
2-13-18	CO_2	7.3	7.5	7.6	7.5	2.67%

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

Grace Consulting, Inc.

Sampling System Bias Check and Measured Value Correction

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

Date: 2/13/2018
Pollutant: NOx
Monitor Span: 1033

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	993.5	-1.07	1.21	0.22	500.34	502.43	0.20	501.80	994.40
2	1009.3	1.21	1.32	0.01	502.43	503.54	0.11	501.80	1008.20
3	1015.5	1.32	1.45	0.01	503.54	500.25	-0.32	501.80	1016.70

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

where:

Cgas = Effluent gas concentration, dry basis, ppm
Cavg = Average gas concentraiton indicated by gas analyzer, dry basis, ppm
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
Cma = Actual concentration of the upscale calibration gas, ppm

SAMPLING SYSTEM BIAS CORRECTION

EMISSION CALCULATION
(CFR 40, Part 60, Appendix A)

Eq. 6C-1

$$C_{gas} = \left(\bar{C} - C_o\right)\frac{C_{ma}}{C_m - C_o}$$

Where:

C_{gas} = Effluent gas concentration, dry basis, ppm.
$\bar{C}$ = 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.

VELOCITY NOMENCLATURE

A	=	cross-sectional area of stack, (ft^2)
acf	=	actual cubic feet
acfm	=	actual cubic feet per minute
B_{ws}	=	water vapor in the gas stream, proportion by volume
C_p	=	pitot tube coefficient, dimensionless
dscf	=	dry standard cubic feet
dscm	=	dry standard cubic meters
fps	=	feet per second
gm-mole	=	gram-mole
ΔH	=	orifice pressure drop in inches water, average
hr	=	hour
I	=	percent of isokinetic sampling
In. Hg	=	inches mercury
lbs	=	pounds
lb-mole	=	pound-mole
%M	=	percent moisture by volume
mmBtu	=	million Btu
M_s	=	molecular weight of stack gas, wet basis, (lb/lb-mole)
n	=	total number of traverse points
P_b	=	barometric pressure at the sampling site, (In Hg)
P_f	=	static pressure in flue in inches water, average
P_s	=	absolute stack gas pressure, (in. Hg)
P_{std}	=	standard absolute pressure, (29.92 in. Hg) (14.7 psia)
P_t	=	total pressure in inches of water
P_v	=	average velocity pressure in inches of water
Q_{sd}	=	dry volumetric stack gas flow rate corrected to standard conditions, (dscf/hr)
R	=	universal gas constant, (1545 ft lb/mole, °R)
$\sqrt{\Delta P}$	=	square root of velocity head in inches water, average
scf	=	standard cubic feet
scm	=	standard cubic meters
T_m	=	absolute average DGM temperature, (°R)
T_s	=	absolute average stack gas temperature, (°R)
T_{std}	=	standard absolute temperature, (528 °R)
V_l	=	volume of condensate through the impingers, ml
V_{lc}	=	total volume of liquid collected in impingers and silica gel, ml
V_m	=	volume of gas sample as measured by dry gas meter, (dcf)
$V_{m(std)}$	=	volume of gas sample measured by the dry gas meter, corrected to standard conditions, (dscf)
V_o	=	volume of flue gas at actual conditions in cubic feet per minute
$V_{w(std)}$	=	volume of water vapor in the gas sample, corrected to standard conditions, (scf)
V_{wc}	=	volume of water condensed in impingers corrected to standard conditions
V_{wsg}	=	volume of water collected in silica gel corrected to standard conditions
V_s	=	average stack gas velocity, (ft/sec)
W_{sg}	=	weight gain of impinger silica gel in grams
Y	=	dry gas meter calibration factor
*	=	total sampling time, min
V_p	=	mass of flue gas (lb/hr)