Sulfur Dioxide Mass Emission Rate Test Results

Prepared for:

Red Leaf RNG, LLC

April 17, 2024

IMPACT
COMPLIANCE & TESTING

P1268_TEST_20240221

Report Certification

Sulfur Dioxide Emission Test

Red Leaf RNG. LLC
113 North Lee Road, Saranac, Michigan

I certify that the testing was conducted in accordance with the referenced test methods unless otherwise specified in this report. I believe the information provided in this report and its attachments are true, accurate, and complete.

Prepared By:

Renee Fromwiller

Renee Fromwiller
Environmental Consultant

Reviewed By:

Robert L. Harvey
Services Director

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APPENDICES

List of Tables, Figures and Drawings

1 Introduction

Red Leaf RNG retained Impact Compliance & Testing (ICT) to conduct Digester gas analyses for the gas stream to the Thermal Oxidizer at its Biogas to Renewable Natural Gas (RNG) Facility in Saranac, Michigan.

The gas sampling was performed on February 21st, 2024, to determine mass potential SO_2 emissions from the Thermal Oxidizer, identified as EUGCU, in the Permit to Install (PTI) No. 89-22. After receiving analytical results that indicated a considerably higher sulfur content than expected, a re-test was requested and was approved by the Department of Environment, Great Lakes, and Energy – Air Quality division (EGLE-AQD). The retest was performed on April 10th, 2024, as requested by Red Leaf RNG.

The names, addresses and telephone numbers of those involved with the gas analysis are listed in Table 1.1 below:

Table 1.1 – Contact Information

Name and Title	Company/Address	Phone Number
Chris Anglin Director of Safety and Environmental Permitting	Novilla RNG Red Leaf RNG, LLC 435 Joe Hall Drive Ypsilanti, MI	(734) 915-2384
Renee Fromwiller Environmental Consultant	ICT 37660 Hills Tech Dr Farmington Hills, MI	(313) 920-1116
Max Fierro Environmental Consultant	ICT 4180 Keller Rd. Ste B, Holt, MI	(734) 357-8397

2 Summary of Results

The gas stream to the Thermal Oxidizer at the Red Leaf Biogas to RNG Facility was sampled and analyzed for total sulfur content.

ICT performed the gas analysis in accordance with the test methods as described in Section 3 of this report. This section presents a summary of the results of the analysis.

Table 2.1 – February 21, 2024, Laboratory Results Summary

Analyte	Test Method	Measured Result
Average Total Sulfur Content	ASTM D-5504	23,279 PPMV[1]
Average TOX Flow	USEPA Method 2D	147 SCFM[2]

1 Results based on an average of three lab results.

2 Results based on an average of three, one-hour tests.

Table 2.2 – February 21, 2024, EUGCU SO_2 MASS POTENTIAL TO EMIT

Test Date	Equation	Mass Potential to Emit
2/21/2024	$SO_2 \frac{lb}{hr} = \frac{(C_{TRS}) \times (Q_{WG}) \times \left(60 \frac{min}{hr}\right) \times \left(\frac{64\ lbSO_2}{385\ scf}\right)}{10^6}$	34.3 PPH
Emission Limit		49.79 PPH

Table 2.3 – February 21, 2024, On-Site Analytical Results

Date / Time	Analyte Tested	Test Method	Results
2/21/2024 9:10	H_2S	Colorimetric Indicator Tube	10,500 PPM
2/21/2024 11:00	H_2S	Colorimetric Indicator Tube	10,000 PPM
2/21/2024 12:20	H_2S	Colorimetric Indicator Tube	10,000 PPM
2/21/2024 9:10-10:10	H_2S	Average Tox H_2S Monitor[1]	10,874 PPM
2/21/2024 11:00-12:00	H_2S	Average Tox H_2S Monitor[1]	10,263 PPM
2/21/2024 12:20-:1:20	H_2S	Average Tox H_2S Monitor[1]	10,958 PPM

1 These results are based on an average of one-hour monitoring

Table 2.4 – April 10, 2024, Laboratory Results Summary

Analyte	Test Method	Measured Result
Average Total Sulfur Content	ASTM D-5504	10,390 PPMV[1]
Average TOX Flow	USEPA Method 2D	167 SCFM[2]

1 Results based on an average of three lab results.

2 Results based on an average of three, one-hour tests.

Table 2.5 – April 10, 2024, EUGCU SO_2 MASS POTENTIAL TO EMIT

Test Date	Equation	Mass Potential to Emit
4/10/2024	$SO_2 \frac{lb}{hr} = \frac{(C_{TRS}) \times (Q_{WG}) \times \left(60 \frac{min}{hr}\right) \times \left(\frac{64\ lbSO_2}{385\ scf}\right)}{10^6}$	17.3
Emission Limit		49.79 PPH

Table 2.6 – April 10, 2024, On-site Analytical Results

Date / Time	Analyte Tested	Test Method	Results
4/10/2024 8:30	H_2S	Colorimetric Indicator Tube	10,000 PPM
4/10/2024 9:35	H_2S	Colorimetric Indicator Tube	11,000 PPM
4/10/2024 10:45	H_2S	Colorimetric Indicator Tube	11,000 PPM
4/10/2024 8:30-9:30	H_2S	Average Tox H_2S Monitor[1]	10,627 PPM
4/10/2024 9:35-10:35	H_2S	Average Tox H_2S Monitor[1]	10,789 PPM
4/10/2024 10:45-11:45	H_2S	Average Tox H_2S Monitor[1]	10,955 PPM

1 These results are based on an average of one-hour monitoring

3 Sampling and Analytical Procedures

ICT conducted the measurements in accordance with the test procedures summarized below.

3.1 Determination of Total Sulfur Content (ASTM D-5504)

On February 21st, 2024, ICT used Method ASTM D-5504 to determine the total sulfur levels of the Biogas stream to the Thermal Oxidizer. ICT obtained three (3) one-hour integrated gas samples into Evacuated SUMMA Canisters and submitted the samples to AAC laboratory in Ventura, California. AAC analyzed the sample for total sulfur concentration. The AAC analytical report is presented in Appendix A. The averages of the analysis are included in Table 2.1. The sulfur content was also verified on-site using three (3) Colorimetric indicator tubes prior to the collection of the gas samples. These results are included in Appendix C.

A re-test was requested by Red Leaf RNG after receiving analytical results that indicated a considerably higher sulfur content than expected. This re-test was approved by the Department of Environment, Great Lakes, and Energy – Air Quality division (EGLE-AQD). The retest was performed on April 10th, 2024.

On April 10th, 2024, during a re-test, ICT used Method ASTM D-5504 to determine the total sulfur levels of the Biogas stream to the Thermal Oxidizer. ICT obtained three (3) one-hour integrated gas samples into conditioned Tedlar Bags and submitted the samples to SPL laboratory in Traverse City, Michigan. SPL analyzed the sample for total sulfur concentration. The SPL analytical report is presented in Appendix B. The averages of the analysis are included in Table 2.4. The sulfur content was also verified on-site using three (3) Colorimetric indicator tubes prior to the collection of the gas samples. These results are included in Appendix C.

3.2 Determination of Mass Potential to Emit Sulfur Dioxide

ICT used the total mass flow of sulfur-bearing compounds into the Thermal Oxidizer to calculate the mass emission rate of SO_2 based on the complete conversion of sulfur to SO_2. The total sulfur content in PPMV was obtained from the results of the laboratory analysis. The average waste gas flowrate in SCFM was obtained from the data recorded by the on-site flow meter. ICT used the equation below to calculate the mass potential to emit SO_2 under the assumption will be that all sulfur content is converted to SO_2 using the ideal gas law. Assuming that each atom of sulfur is capable of only creating one molecule of SO_2. Data for each on hour period is presented in tables 3.1 and 3.2 at the end of this report.

$$SO_2 \frac{lb}{hr} = \frac{(C_{TRS}) \times (Q_{WG}) \times \left(60 \frac{min}{hr}\right) \times \left(\frac{64\ lbSO_2}{385\ scf}\right)}{10^6}$$

Where:
CTRS = Concentration of total sulfur in waste gas in ppmv
QWG = Waste gas flowrate in scfm

Table 3.1 – February 21 Summary of results

	Test 1	Test 2	Test 3
On-Site			
Flow meter (1-hour average)	131 SCFM	156 SCFM	153 SCFM
Sulfur meter (1-hour average)	10,874 PPM	10,263 PPM	10,958 PPM
Colorimetric Indicator Tubes	10,500 PPM	10,000 PPM	10,000 PPM
Lab Data			
Total Sulfur PPMV (D-5504)	25,299 PPMV	22,335 PPMV	22,205 PPMV
SO2 Emissions lb/hr	33 PPH	34.8 PPH	33.9 PPH

Table 3.2 – April 10 Summary of results

	Test 1	Test 2	Test 3
On-Site			
Flow meter (1-hour average)	165 SCFM	169 SCFM	166 SCFM
Sulfur meter (1-hour average)	10,627 PPM	10,789 PPM	10,955 PPM
Colorimetric Indicator Tubes	10,000 PPM	11,000 PPM	11,000 PPM
Lab Data			
Total Sulfur PPMV (D-5504)	10,000 PPMV	10,600 PPMV	10,570 PPMV
SO2 Emissions lb/hr	16.5 PPH	17.8 PPH	17.5 PPH