QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PLAN
FOR
ROCKLAND SEWER DISTRICT #1

Agreement # - 43235

12/8/21

Submitted to:

New York State Energy Research and Development Authority
17 Columbia Circle
Albany, NY 12203-6399

Rockland County Sewer District #1
4 Route 340
Orangeburg, NY 10962

Submitted by:

L&S Energy Services, Inc.
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PROJECT PARTICIPANTS

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NYSERDA DER Website Contractor (CHP Website Contractor)	Frontier Energy. Contact: Daniel Robb PO Box 641 Cazenovia, NY 13035 315-655-1063 x20 drobb@frontierenergy.com

Introduction

Rockland County Sewer District No. 1 owns and operates a sewage treatment plant located at 4 Route 340, in Orangeburg. The plant utilizes existing municipal wastewater and an activated sludge process with primary and secondary treatment. The waste solids from the process are treated and reduced by two existing mixed high rate anaerobic digesters. Rockland County Sewer District's contractor will upgrade the existing digesters.

This NYSERDA funding awarded through ADG PON 2828 is in support of the upgrade the digesters, install of a new engine/generator, and install of a new gas conditioning system to provide the biogas generator with conditioned biogas. Before upgrade the existing digesters were found to produce some 81.86 Million ft^3/year of biogas. This biogas was used to maintain the digester heat requirements, as well as serve the building heat in the winter using sludge heaters and a boiler located in the digester building. However, some 59% of the generated gas was being flared. With the upgrades to the digesters and the GE Jenbacher 633 kW capacity engine/generator, the percent flared will be reduced to 7.5%, and 92.5% will be converted into electricity.

In addition to the engine/generator, a Martin Energy Group gas treatment system will be installed to treat the sewer gas by removing the H2S, moisture, particulates, and Siloxane to produce clean dry biogas to combust in the engine generator. Sewer gas from the digesters is fed to the two H2S Scrubbers, which are located outside the Digester Building for H2S removal. The treated sewer gas then flows through the glycol cooled moisture removal skid located in the Digester Building compressor room. The glycol is cooled by a chiller located outside the Digester Building. After being reduced to 10 ppmv of H2S and dried to 40% RH, the biogas compressor on the drying skid, transports the biogas over 1000 feet in a 6-inch HDPE pipe to the Sludge Dewatering Building cogeneration room. Here the biogas is again mechanically dewatered in a condensate separator to remove any moisture generated during its conveyance from the compressor room. To prepare the biogas for Siloxane removal, the biogas is heated in a heat exchanger by engine intercooler water and then passed through two Siloxane filters prior to combustion in the engine.

This plan describes the approach to monitor the performance of the upgraded digesters, the new engine/generator, and the H_2S removal system. The system will be installed to measure and collect the quantity of both the biogas consumed by the engine and the electricity produced by the generator, as well as the pre- & post-treatment H_2S levels. The data collected will serve as the basis for payment of a capacity incentive to help offset the capital expenses associated with the procurement of the new equipment as well as performance incentives over a ten (10) year period, in accordance with Standard Performance Contract (#43235) with NYSERDA.

ADG System Notes

The existing digesters have a working volume of 148,890 ft^3 and 142,080 ft^3, totaling 290,970 ft^3. If the upgraded digesters continue to produce some 90 million cubic feet of biogas per year, the biogas production will yield approximately 45,180 MMBtu/year of biogas assuming a 502 Btu/ft^3 heating value. If 7.5% of the gas is flared, the 92.5% of the biogas delivered to the genset will

provide 41,792 MMBtu/year for power production and heat recovery. The GE engine generator system proposed has a capacity of 633 kW. Using a conversion efficiency of 83%, as would be expected from the Technical Data for the genset when generating the Contracted Capacity of 492 kW, the 41,792 MMBtu/year should be more than sufficient to produce that contracted amount. a 8,716 Btu/kW conversion (39.2% efficiency).

Figure 1: GE 633 KW Engine/Generator

0.01 Technical Data (at genset)

			100%	75%	50%
Power input	[2]	MBTU/hr	5,517	4,282	3,061
Gas volume	*)	scfhr	12,713	9,867	7,052
Mechanical output	[1]	bhp	881	661	441
Electrical output	[4]	kW el.	633	473	312
Heat to be dissipated	[5]				
~ Intercooler 1st stage (Engine jacket water cooling circuit)	[9]	MBTU/hr	332	120	28
~ Intercooler 2nd stage (Low Temperature circuit)		MBTU/hr	101	74	32
~ Lube oil (Engine jacket water cooling circuit)		MBTU/hr	263	239	194
~ Jacket water		MBTU/hr	727	628	512
~ Surface heat	ca. [7]	MBTU/hr	209	~	~
Spec. fuel consumption of engine electric	[2]	BTU/kWel.hr	8,712	9,057	9,823
Spec. fuel consumption of engine	[2]	BTU/bhp.hr	6,262	6,477	6,937
Lube oil consumption	ca. [3]	gal/hr	0.06	~	~
Electrical efficiency			39.2%	37.7%	34.7%
Fuel gas LHV		BTU/scft	434		

*) approximate value for pipework dimensioning
☐ Explanations: see 0.10 - Technical parameters

All heat data is based on standard conditions according to attachment 0.10. Deviations from the standard conditions can result in a change of values within the heat balance, and must be taken into consideration in the layout of the cooling circuit/equipment (intercooler; emergency cooling; ...). In the specifications in addition to the general tolerance of ±8 % on the thermal output a further reserve of +5 % is recommended for the dimensioning of the cooling requirements.

Gas Conditioning System Description

Martin Energy Group designed the H_2S conditioning system to remove H2S, moisture and Siloxanes from the digester gas prior to being combusted in the engine generator to produce electricity.

The H2S scrubber system, shown in Figure 2, is located on a concrete pad outside the Digester Building. The system is designed to remove all H2S up to 2,000 ppmv and designed for the normal loading of 500 ppmv of H2S. The Drying Skid, shown in Figure 3, located in the Digester Building compressor room removes moisture from the biogas using a chilled water heat exchanger and transports the biogas to the engine generator via a gas compressor. Particulates are removed by the system with final removal of moisture and particulates in the mechanical knock out filter in the Cogen Building Condensate Pit shown in Figure 4. Figure 5 shows the Siloxane removal filters and the gas preheat heat exchanger to ensure optimum biogas quality is delivered to the engine generator for continued performance. The Martin Energy Group gas conditioning system described above has a Sewerin Multitec BioControl 4 biogas analyzer system, shown in Figure 6, and is supported by Tedlar bag or gas tube sampler measurements of CH4, CO2, and H2S when required. Figure 7 shows the biogas engine generator with the heat recovery system. Figure 8 shows schematic diagrams for the engine generators and for the overall anaerobic digestion system

Table 1. Clean Methane Gas Treatment Design Specifications

Gas Conditioning System Vendor	Martin Energy Group
System Design Operation	Temperature Inlet: 100 °F Temperature Outlet: 80 °F
Designed Digester Gas Flowrate	100-205 scfm
Design Gas Pressure	Inlet: 8-10” WC Outlet: 5-7 psi
Design Composition (est.)	CH4 Inlet: 50-60 % CH4 Outlet: 50-60% RH Inlet: 100% RH Outlet: 40% H_2S Inlet: 500 ppmv Maximum H_2S Outlet: 10 ppmv Siloxanes (L2,3,4,5, D3,4,5,6) Inlet: 4,000 ppbv Maximum Siloxanes Outlet: 100 ppbv

Figure 2 H2S Scrubber System

Figure 3 Drying Skid

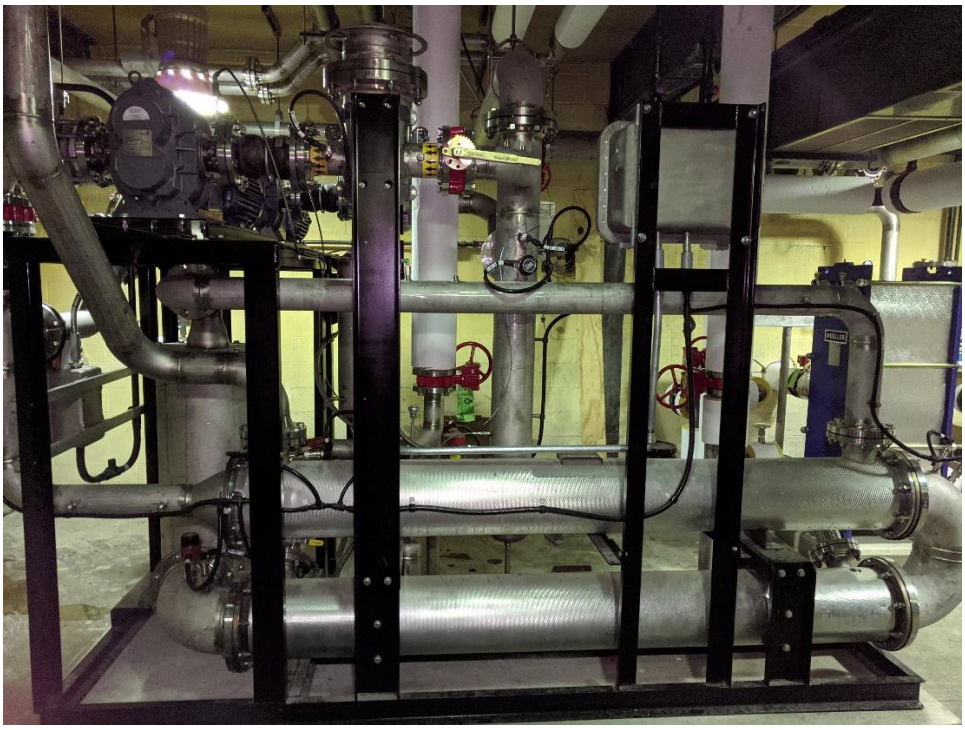


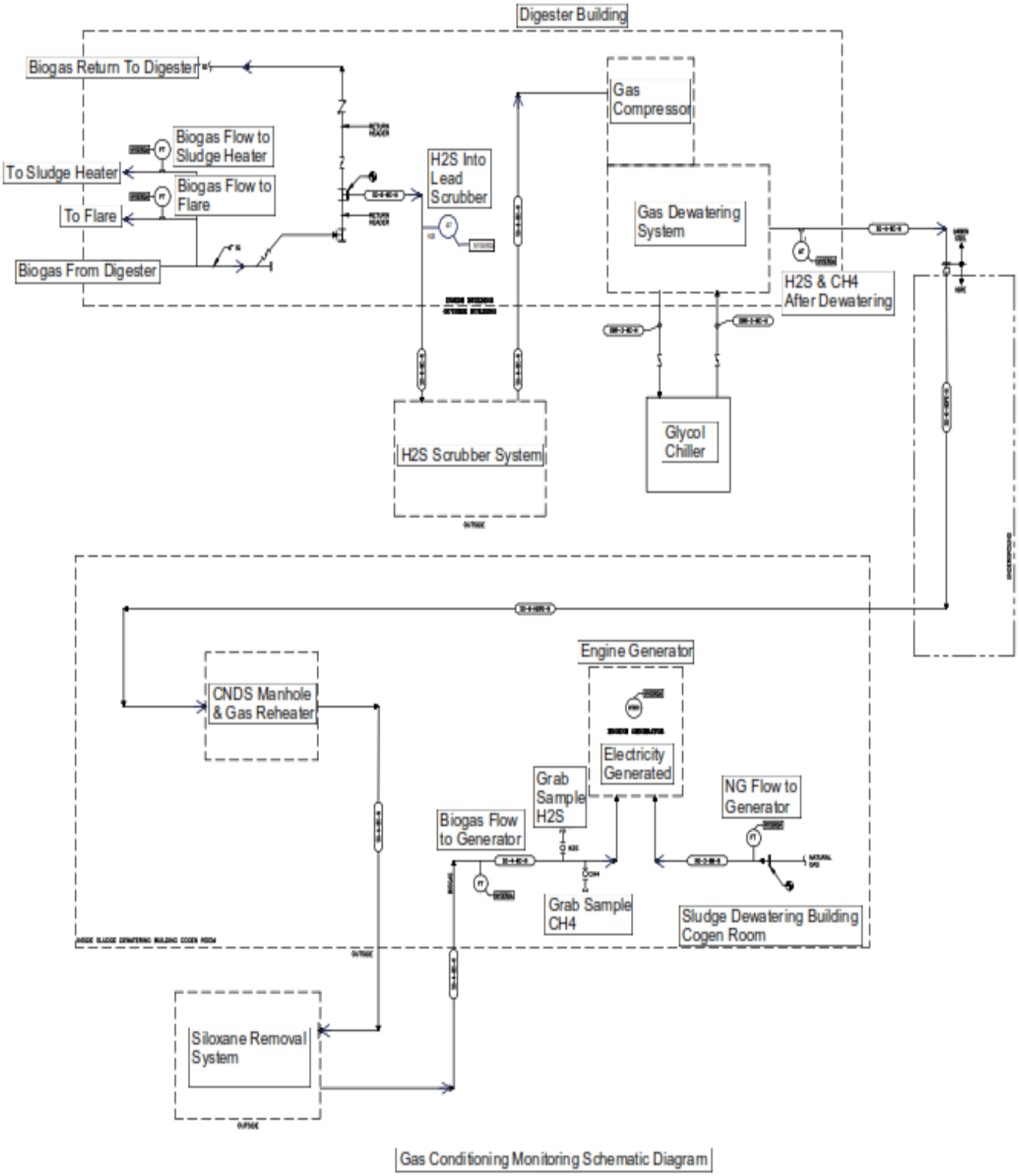
Figure 4 Underground Gas Supply Piping & Condensate Pit

Figure 5 Siloxane Filter & Gas Preheat HX

Figure 6 Biogas Analyzer System

Figure 7 Biogas Engine Generator with Heat Recovery

Figure 8: Schematic Diagram



Capacity Payment Descriptions

This Section describes the Capacity Incentive Payments included in the Agreement, the payment milestones to be achieved in order to receive payment, and the deliverables to be provided in achieving these milestones. For this new engine generator system and the H_2S cleanup, the available Capacity Payments are Capacity Payments 1, 2, 3, 4, 5, and 6, which are presented below.

Capacity Payment #1: Up to 15% of Total Capacity Incentive is payable for reimbursement of project costs once Rockland County provides evidence sufficient to demonstrate payments for major equipment (e.g. power generation system, anaerobic digester system, biogas clean-up and handling systems etc.) and/or engineering design.

Capacity Payment #2: Up to 45% of the Anaerobic Digester component of Total Capacity Incentive is payable for reimbursement once L&S Energy Services has verified that construction/installation/upgrade of the anaerobic digestion system has been completed. For this Agreement the upgrades include: replacement of a digester cover on one of the digester tanks (Digester 2), installation of a new gas handling system to recover all of the biogas produced, and the rehabilitation of the mixing system inside Digester 2 and of the gas storage sphere.

Capacity Payment #3: Up to 45% of the Power Generation component of Total Capacity Incentive is payable once Rockland County has provided sufficient documentation to NYSERDA verifying that the power generation system has been delivered to the site (e.g. delivery receipt).

Capacity Payment #4: Up to 45% of the Project Enhancement Component of the Total Capacity Incentive is payable once L&S Energy Services has verified that construction/installation of the Project Enhancement has been completed or the required documentation for the Project Enhancement, according to applicable sections of *Using the Incentive Calculation Tool* of Exhibit D has been submitted to NYSERDA. Rockland County may request payment at this time for any Project Enhancements that have been completed and verified. Payment for Project Enhancements completed and verified after the request for Capacity Payment #4 had been made may be requested with the Capacity Payment #6. The one Project Enhancement for this Agreement is the H2S removal process.

Capacity Payment #5: 20% of Total Capacity Incentive is payable once documentation has been provided to NYSERDA that sufficiently verifies successful operation of the newly installed system and completion of interconnection, if applicable (e.g. interconnection acceptance test documentation from the utility). Verification of successful operation for example may include documentation of operation of the equipment with data from meters or hand-held biogas measurement equipment or other methods of documentation satisfactory to NYSERDA.

Capacity Payment #6: Up to 100% of the Total Capacity Incentive is payable once the newly installed system is successfully commissioned. Commissioning includes (a) operating the ADG-fueled energy generation system at a minimum biogas fueled kWh output of 75% average capacity factor (369 kW) over seven (7) consecutive days, and (b) demonstrating the ability to upload data generated by the system to NYSERDA's CHP website, if applicable. A project Commissioning Report must also be completed detailing the installation and commissioning activities and include

design updates and as-built diagrams. Any project Enhancements payments that were not made with the Capacity Payment #4 may be requested with this payment.

Performance Incentive Description

There are 10 Performance Incentive payments. Each payment shall be based on the verified electricity generated and verified H_2S levels that satisfy requirements for the Martin Energy Group system during each of the 10 consecutive years during which Performance Incentives are offered, known as the Performance Period.

Performance Incentive payments shall be made after the following:

The Annual Performance Report, prepared by L&S Energy Services, has been approved by NYSERDA. Rockland County is responsible for ensuring that data provided in the Annual Performance Reports accurately represent the operation of the ADG-to-Electricity System in accordance with the QA/QC plan.

- An invoice has been submitted to NYSERDA for the previous year's Performance Incentives.
- A statement has been submitted to NYSERDA stating whether or not a Federal Grant via 1603 Treasury Grant, USDA REAP and/or NRCS/EQIP digester funding has been received for one or more components of the project. RCSD may be required and hereby agrees to provide NYSERDA with any necessary authority for NYSERDA to independently verify the existence and amount of any federal grant and to execute any documents necessary for NYSERDA to do so. If no such funding is applicable, this statement can be provided by completing the relevant question in the invoice form.

In general, 10% of the Power Generation component of the Total Performance Incentive (based on the biogas-fueled kWh production times $0.025) will be paid by NYSERDA in each year, not to exceed a cumulative total of 100% of the Power Generation component of the Total Performance Incentive. The Annual Performance Report will include (a) the actual verified electricity produced by the new engine generator, (b) the biogas input into the new engine, (c) the methane content of the biogas, and (d) the natural gas input into the new engine.

The percentage paid in a given year will be calculated based on the ratio of the actual verified electricity produced compared to the total electrical generation stipulated in the contract agreement. If, in a given year, Rockland County is unable to produce 10% of the total electrical generation from biogas expected over the 10 year period, that production deficit can be made up in subsequent years provided the cumulative percentage of the total Performance Incentives paid by that year does not exceed the cumulative percentage of years that the system had been in production. For example, a maximum of only 80% of the total Performance Incentives can be paid for production at the end of the 8^{th} year of the Performance Period.

Additionally, the H_2S Reduction Processes component of the annual Performance Incentives payments is based on the hourly outlet H_2S readings (up to a max. of 90% of the hours in a year) that are below the minimum H_2S threshold of 400 ppm for the iron sponge-based treatment system.

Therefore+, the H_2S Reduction component of annual Performance Incentive payment is determined by multiplying the Contract Capacity (492 kW), times the factor 0.83333, times the verified hourly samples below the min H_2S threshold, times the H_2S Performance Incentive variable of $0.004/kWh.

Monitoring System Equipment, Installation, Operation, and Maintenance

Payment for the power generation performance is based on the measurement of the kWh produced from biogas, the quantities of biogas and natural gas used to fuel the genset, and the CH4 content of the biogas. Information about the measuring instruments is contained in Table 2 below. The locations of the monitoring points are shown in the schematic in Figure 2.

Payment for the H2S reduction incentive shall be based on the ability of the system to reduce H_2S levels to less than 400 ppm, as supported by collected data. Measurements of biogas that has been treated in the H_2S cleanup system will be made with continuous automatic gas sampling and analysis, or by other methods found acceptable to NYSERDA. For this project a Sewerin Multitec BioControl 4 biogas analyzer will be used to measure the H_2S concentrations into the selected lead scrubber (H2S_IN) and after exiting the scrubbers and the dewatering equipment (H2S_OUT). Normally valves will be set to have scrubbers operate in sequence, but parallel operation with similar flows can also be set in which case both scrubbers can be considered the lead or co-lead scrubber.
The one-page schematic diagram in Figure 8 shows the locations of the biogas measurement equipment and sampling points. Information on these data points is shown in Table 2.

Table 2. Monitored Data Points

Line #		Data Provided to NYSERDA Database Contractor					
2	**Table 2 Montored Data Points**						
3	**Installer**	**Description / label of Schematic measurement point**	**Possible Website Point Name**	**Instrument Make and Model**	**Engineering Units**	**Instrument Range**	**Expected Range To Be Measured**
4	**Digester Building**						
5							
6	MEG	H2S Into Scrubber (ASP-1-1 or ASP -2-1)	H2S_IN	Sewerin Multitec BioControl 4	ppm	0 - 2,000 ppm	0-2,000 ppm
7	MEG	H2S After Scrubbers & Dewatering (ASP-4)	H2S_OUT	Sewerin Multitec BioControl 4	ppm	0 - 2,000 ppm	0-500 ppm
8	RCSD	Biogas Sent to Flare	FDG_FL	Sage Prime Gas Mass Flow Meter	CFM	0 - 3,000 CFM	0 - 300 CFM
9	RCSD	Biogas Sent to Sludge Heater	FDG _SH	Sage Prime Gas Mass Flow Meter	CFM	0 - 3,000 CFM	0 - 300 CFM
10	MEG	CH4 After Scrubbers & Dewatering (ASP-4)	CH4_OUT_SC	Sewerin Multitec BioControl 4	%	0 - 100%	0-65%
11							
12	**Sludge dewatering Building Cogen Room**						
13							
14	MEG	Electricity Generated	WG1	Shark Model #100T	kW	0 - 9,999 kW	0-650 kW
15	MEG	Natural Gas Inlet Flow to Generator	FG1	Romet Imperial RM7000	CFM	0 - 7,000 CFH	0-200 CFM
16	MEG	Biogas Inlet Flow to Generator	FDG1	Romet Imperial RM16000	CFM	0 - 16,000 CFH	0-300 CFM
17	MEG	CH4 into Generator QA Check	CH4_IN_GN	Tedlar bag or Draeger tube	%	0 - 100%	0-65%
18	MEG	H2S into Generator QA Check	H2S_IN_GN	Tedlar bag or Draeger tube	ppm		0-500 ppm

Monitoring activities will be performed using a cellular data transfer system and will be delivered daily to the NYSERDA database contractor. The cellular data transfer system pulls data from the GE engine and Generator PLC onto an interface that averages one-minute samples in 15-minute intervals for the daily upload. The upload consists of a CSV file with a timestamp.

The worksheet in Appendix B may be used as a template for documenting the capabilities of the H_2S cleanup system. Biogas flow and H_2S output will be documented for each hour of the year that samples are taken. The percentage of cumulative outlet H_2S samples (up to a maximum of 90% of the hours in a year - 7,884) with 399 ppm H_2S and below will be submitted to document adequate compliance with the requirement for payment. The summary of samples will show the percentage of cumulative samples with 399 ppm H_2S and below as well as the percentage of cumulative samples with 400 ppm H_2S and above.

Incentive calculation methods for the 6th Capacity Incentive Payment and the annual Performance Payments, which are based on kWh-related data and on H_2S data, are as follows:

- The revenue grade Shark Meter shall be used for measurements of kWh production for determining biogas-fueled kWh production incentive amounts. When any natural gas is also used in fueling the genset, the kWh from biogas shall be determined from the percentage of total fuel Btu heat input from biogas and natural gas that was provided by the biogas. The biogas heat content per cubic foot shall be determined from measurements of the CH4 content of the biogas by the Sewerin Multitech or from other methods approved by NYSERDA. The lower heating value of Natural Gas shall be 1,000 BTU/scf unless another value is approved by NYSERDA. The lower heating value of 100% CH4 shall be 913 BTU/scf unless another value is approved by NYSERDA.

- To satisfy H2S reduction requirements for the 6th Capacity Incentive payment 126 hourly H_2S outlet data values (representing 75% of the 168 hours in a week) must be below 400 ppm for a consecutive 7-day period when the following conditions are met for each of the 126 hours, or other documentation must be provided that is satisfactory to NYSERDA:

    1. The kWh output from the engine generators from biogas fuel is greater than 296 kW which is 50% of total contracted capacity of 492 kW or the flow of biogas through the H_2S cleanup system is greater than 4,400 cubic feet per hour (50% of the biogas needed to generate 492 kW based on an average efficiency of 38% and average 502 Btu's per cubic foot of biogas.), and
    2. The biogas meter reading for CH_4 (or other meter or other parameter acceptable to NYSERDA) is greater than 20% to document that the meter is operating, and that biogas is flowing through the system.

- The annual Performance Incentive payment for H_2S reduction is determined by multiplying the total of the Contract Capacity (492 kW), times the factor of 75% divided by 90%, times the verified hourly samples (not to exceed 7,884 hours/year) below the minimum H_2S threshold while the conditions 1 and 2 above are met, times the H_2S Performance Incentive variable for the gas cleanup ($0.004/kWh). NYSERDA will consider other formulations for calculating the Performance Incentive, in the event that

the H_2S cleanup system is unable to operate due to reasons outside of the operation itself. NYSERDA may direct its technical contractors to sample the biogas, determine H_2S removal efficiency, and compare the results to the data originally provided by the operator. For the annual Performance Incentive payments at least one sample of H_2S input will be measured each week and results provided for incorporation on the NYSERDA website. More frequent samples may be needed if the concentration of H_2S input is found to change significantly or be too high for the scrubbers.

Management of Monitoring System Data

Rockland County staff will perform the following quality assurance and quality control measures to ensure the data produced from the monitoring system accurately describes system performance.

On a daily basis, the manager (or other specified employee) will perform inspections of the H_2S cleanup equipment and record findings into the project log.

On a weekly basis, the manager (or other specified employee) will perform inspections of the QA/QC biogas analyzer installations and complete the routine maintenance on the analyzer, noting any abnormalities or unexpected readings.

On a weekly basis, the staff will review the data stored on the NYSERDA Integrated Data System website (https://der.nyserda.ny.gov/) and on a planned companion website to ensure the data are consistent with their observed performance of the ADG system and logged readings. The facility will review the data using the reporting features at the website, including plots and graphs and data in CSV file format.:

In addition, the facility staff will also setup and use the email reports that are available at the Integrated Data System website to help the track system performance, including:

- A periodic email report summarizing performance and the estimated incentive,
- An email report will be sent out if data are not received at web site or do not pass the quality checks.

The Technical Consultant will evaluate the quality of the collected data which may include using range checks and basic relational checks identified in the website Database Notes. The expected ranges for the sensors (Table 2) can be used for the range checks. For this facility any applicable relational checks will be made by the Technical Consultant during preparation of the Annual Performance Reports for the Rockland County invoices. Data that passes quality checks, such as the range and relational quality checks, can be used in the incentive reports listed above. However, all hourly data are available from the NYSERDA Integrated Data System website using the "Download (CSV file)" reporting option. Further details on range and relational data quality checks, including site specific ranges and relations, may be found in the sites "Database Notes" document on the NYSERDA Integrated Data System website.

In the event of a communications or analyzer failure, the facility personnel will work with L&S Energy Services to resolve the issue.

If unanticipated loss of data occurs, the facility will follow the procedures outlined in Exhibit D of their contract, i.e. using data from similar periods – either just before or after the outage – to replace the lost data. Facility personnel understand that they can use this approach for up to two (2) 36-hour periods within each 12-month performance reporting period. If more than two (2) such data outages occur, facility personnel will provide information from other acceptable data sources (e.g., weekly recorded logs) to establish data during the period in question in a manner acceptable to NYSERDA.

Amendment of the QA/QC Plan Provisions

The QA/QC methods and procedures described above have been determined to be appropriate and effective for the current configuration and operating procedures of the anaerobic digestion system at the Rockland County. Amendments to this QA/QC Plan can be proposed and considered at any time should they be found desirable to address such things as changes in the system or in the capabilities of QA/QC equipment. Proposed changes will be considered and approved by NYSERDA when shown to be warranted by acceptable rationale. Approved changes will be incorporated in updated versions of the QA/QC Plan.

Appendix A

Technical Data Sheet for Sewerin Gas Analyzer:

SEWERIN

Technical Data Sheet

BioControl 1/4/8

Device data	
Dimensions (W x D x H)	520 x 205 x 425 mm
Weight	15 kg
Product variants	BioControl 1 (1 gas connection) BioControl 4 (4 gas connections) BioControl 8 (8 gas connections)

Features	
Gas connections	1, 4 or 8 per gas connection: • 1 input for flow (4 – 20 mA) • 1 input for temperature (4 – 20 mA)
Display	7 inch touch screen, 256 colours, 800 x 480 pixels
Ports	• 1 x Ethernet (Modbus TCP) • 2 x RS-485 (Modbus RTU) • 2 x RS-232 • 1 x USB, expandable • on BioControl 4 and BioControl 8: 4 x analogue (0/4 – 20 mA) • optional: PROFIBUS
Data memory	USB stick: 2 GB Flash memory, can be expanded to 16 GB

Operating conditions	
Operating temperature	+5 °C – +40 °C
Storage temperature	-10 °C – +50 °C
Humidity	environment:< 85 % r.h., non-condensing gas: See data sheet for the mobile gas measuring device
Pressure at gas inlet	±100 mbar relative (depending on mobile gas measuring device)
Permitted operating environments	in frost-free, sufficiently ventilated space
Non-permitted operating environments	in potentially explosive zones
Operating position	wall mount (hanging)

Hermann Sewerin GmbH I Robert Bosch Straße 3 I D-33334 Gütersloh, Germany I www.sewerin.com I info@sewerin.com

Power supply	
Operating voltage	24 V DC (max. 2A), no stabilisation required

Data transmission	
Communication	CAN bus between mobile gas measuring device and BioControl

Gas types	
Standard	depending on mobile gas measuring device

Resolution of the gases in the combined measuring device	
CH4	0.1 % vol.
CO2	0.1 % vol.
O2	0.1 % vol.
H2S	2 ppm

Additional data	
Attachment option	loops for wall mounting

Assignment	
System components of	Multitec® BioControl
For use with	Multitec 540 from V 1.202, Multitec 545

107517– 14.04.2016 – Subject to technical changes.

Other Technical Data Sources for the Monitoring Equipment:

https://www.sewerin.com/fileadmin/redakteure/Prospekte/pro_BioControl_4_8_en.pdf

https://www.sewerin.com/fileadmin/redakteure/Prospekte/pro_multitec_540_en.pdf

https://www.sewerin.com/fileadmin/redakteure/Tech_Datenblatt/en/tdb_mt545_en.pdf

https://irp.cdn-website.com/a23fe8ce/files/uploaded/RM16000_Flanged.pdf

https://irp-cdn.multiscreensite.com/a23fe8ce/files/uploaded/RM7000%20Flanged.pdf

https://www.electroind.com/products/Shark100/pdf/brochures/Shark-100-100T-Meter-Brochure_E145702.pdf

https://sagemetering.com/datasheets/prime.pdf

Appendix B

H_2S Reduction Spreadsheet Sample

Worksheet to Document Ability of Biological Scrubber to Produce Measureed H2S Concentrations Less Then 400 ppmv for 75% of Samples								
Data to be Completed by Operator						Analysis which can be done by Technical Consultant		
A	B	C	D	E		F	G	H
Hour	Date of Sample	H2S in Biogas Before Cleanup (ppm)	H2S in Biogas After Cleanup (ppm)	CH4 in Biogas After Cleanup (%)		Total Number of Samples with <400 ppm H2S	Total Number of Samples with ≥ 400 ppm H2s	Total Number of Samples with ≥ 50% CH4
0:00	1	1,500	50	59%		18	6	18
1:00	1	1,600	50	59%				
2:00	1	2,000	250	54%		Total Samples		24
3:00	1	16,000	250	54%		% Under Maximum Range		75%
4:00	1	14,000	400	50%		% CH4 In Range		75%
5:00	1	1,250	150	56%				
6:00	1	1,300	150	56%				
7:00	1	1,500	150	56%				
8:00	1	2,000	200	55%				
9:00	1	1,500	250	54%				
10:00	1	1,500	250	54%				
11:00	1	1,600	150	56%				
12:00	1	800	250	54%				
13:00	1	800	350	51%				
14:00	1	1,200	350	51%				
15:00	1	1,100	450	49%				
16:00	1	1,300	350	51%				
17:00	1	1,400	350	51%				
18:00	1	1,500	350	51%				
19:00	1	1,400	550	46%				
20:00	1	1,300	550	46%				
21:00	1	1,500	350	51%				
22:00	1	2,000	950	36%				
23:00	1	800	550	46%				
Note: This is an example for 1 day's worth of data. This table will need to be extended to 7 days for the 6th Capacity Payment and 365 days for the Annual Performance Payments.								

12-8-21