

Berry Hill Bioresources Centre 13018

Digestion Process Monitoring Description

Scope:

This document provides a framework for anaerobic digestion monitoring at Berry Hill BC. It covers how monitoring is conducted, how the results are assessed and where the information is recorded.

Introduction:

Trigger point records, updated daily, are used to assess the performance of the digestion process and are available on site via SCADA (supervisory control and data acquisition) and Wessex Water telemetry (PRISM) for full visibility. SCADA and PRISM are used to monitor each parameter and to generate alarms for deviations outside the operating ranges. Any alarms generated are passed out to operational staff as per procedure ROCP200 'Guidance on response to telemetry alarms', who can then respond to the problem or issue using the mitigations available to them.

Any issue not easily rectified will be escalated to the Site Manager, Area Scientist or Technical Supervisor.

As well as SCADA and PRISM; operational staff also have Amulet available, this is an electronic data recording system which has the advantage of being able to access telemetry data from Prism and other Wessex Water systems such as the laboratory sample system and the work management system. Therefore, reports can be run which combine trends such as tank levels and recent sample data to provide a more comprehensive review of the digestion process and identify any issues more readily. Amulet allows data export for performance reports for senior management, Asset Strategy and other departments and teams.

The digestion monitoring table is included below and details the various parameters checked and monitored to ensure the digestion process is stable, and any negative trends are quickly picked up and resolved. The table also specifies frequency of monitoring and where information is stored as well as actions available for operational staff.

Sampling and data recording:

Digesters are routinely tested for operating parameters. The data is recorded and graphed using real time monitoring software to monitor the process performance as detailed in the table below.

Essential parameters such as throughput volume, temperature, pH, dry solids, biogas are monitored daily to determine the system performance and efficiency. Parameters like Volatile Fatty Acids (VFA), pH, Alkalinity, Organic Loading Rate (OLR) are monitored weekly using lab analysis. Responsibility for the weekly digester sampling rests with trained operators. The quality measurements and performance analysis are the responsibility of the Site Manager and Area Scientist.

Liquid and Solid Sludge Sampling

Once the samples are analysed the data is stored on Scientific Systems (SciSys), the online archive from LIMS (Laboratory Information Management System) and available under a unique pre-assigned sample point number. The data from the sample analysis is initially checked in the lab and then by Site Manager and Area Scientist. Any sample with analysis exceptions (where the result is outside prescribed limits) is flagged on a daily exception report and will be investigated.

Historical data for each sample point is available to spot any change in trends and imbalances in the digestion process. Sample results and flows can be used to calculate a mass balance. The trending data will help maintain a proper biological balance for h a stable digestion process.

Sampling points such as drainage valves are available, accessible, and clearly labelled at various points in the process including digester influent and effluent sampling points.

Samples are usually taken downstream while the feed pumps are in operation. The digester feed sample is mixed and equalized and representative of the sludge feedstock. Digester effluents are also mixed and sampled prior to any solid separation.

Prior to any sampling, valves are opened for a short period of time to flush any accumulated material in the taps and pipes. Samples are collected in sealed and clean bottles designed for the applicable analysis. To protect sample integrity, on-site samples will be analysed immediately. Samples that need lab analysis will be refrigerated on site and collected the from site and transported to our laboratories in a refrigerated vehicle.

Furthermore, to maintain sample integrity and chain of custody, all samples are dated, timed, and labelled.

Gas Sampling

Daily individual digester biogas composition readings are done using a handheld analyser, calibrated as per the manufacturer requirements. During calibration of the handheld monitor, Operations rely on daily combined gas analyser readings.

Additionally, gas composition analysis is done three times a year and analysed by an external laboratory, as required by EPR permit monitoring. Samples are sent in dated and timed containers as required for the analysis. Determinands include siloxanes, methane, hydrogen sulphide, carbon dioxide and hydrogen.

Digestion Monitoring Table:

Digester Key Parameters	Parameter	How is monitoring conducted	Frequency of Monitoring	Allowable ranges / Triggers	How do systems monitor parameters?	What controls are in place to prevent allowable range to be not met / exceeded	Specific actions in response to trigger	Where is data stored?
	% dry solids (%DS)	Manual sample	Daily	4-6 % DS	Online data trend	Alarms	Modulate thickening performance of gravity belt thickener	Online data storage and reporting - Amulet
	Digester Feed Volume / Sludge Feed	On-line	Continuous	Refer to TRTWPL005 HACCP CCP* See sub-table below.	In line flowmeter	Alarms	Operator intervention using PLC (control panel) (Programmable logic controller)	Online – SCADA archive
	Actual Tank Volume **	On-line	Continuous	Tank Level 90-95%	Level monitor	High Level alarm – inhibit	High tank level will result in automatic inhibit on digester feed	Online – SCADA archive
	Foaming	visual Check daily online level	Continuous	High level	Visual check is recorded on WAM / log sheet and then escalated	Dose antifoam	Modulate the digester feedstock in terms of volume and %DS thickness	Hydrostatic level on SCADA
	Volatile Fatty Acids (VFAs)	Manual (Lab samples)	Weekly	>300 mg/l	Online data trends	Weekly checks of lab sample	Modulate digester feedstock in terms of volume in line with HACCP CCP*	SCISYS & Online data storage and reporting - Amulet

	Alkalinity	Manual (Lab samples)	Weekly	< 3000 mg/l- 6000mg/l>	Online data trends	Weekly checks of lab sample	Modulate digester feedstock in terms of %DS thickness and volume fed	SCISYS & Online data storage and reporting - Amulet
	ALK/VFA ratio	Manual (Lab samples)	Weekly refresh	> 0.5	Online data trends & calculation	Weekly check of trends	Monitor VFA and PH Test Alkalinity Modulate feedstock within HACCP CCP* volumes accordingly.	Online Amulet Calculation
	Process temperature	On-line	Continuous	<32.7 - 38> degrees*	Online data trends & calculation	Daily reading checks	Digesters automatically inhibit feed rate on temperate set-points	SCADA
	Organic Loading rate (OLR)	Manual (Lab samples)	Weekly	1.5-3.5 kgVS/m3 /d	Online data trends & calculation	Weekly check of trends	Modulate feedstock with HACCP CCP*	Online Amulet Calculation
	pH	Manual (Lab sample) & (On-site spot check)	Weekly	>6.9-9<	Online data trends & calculation	Weekly check and on-site readings	Check VFA/Alkalinity ratio. Modulate feed to digester in line with HACCP CCP*	SCISYS & Online data storage and reporting - Amulet
	Hydraulic Retention Time	On-line recording (flowmeter)	Continuous	Refer to HACCP CCP*	Online data trends & calculation	Daily check of trends	Alter digester feedstock volumes if outside HACCP CCP*	Online Amulet Calculation
	Biogas methane (%)	On-line gas composition monitor	Continuous	<60%	Online data trends & calculation	Daily Readings	Check OLR- VFA, pH Modulate feed	Online Amulet SCADA
	Oxygen Level	On-line gas composition monitor	Continuous	< 2%	Online data trends & calculation	Daily Readings	Modulate digester feed volume	Online Amulet SCADA

	Digestate Ammonia	Manual (Lab samples)	Weekly	>1500mg/l	Online data trends & calculation	Weekly check of trends	Modulate the feedstock- Reduce OLR, check pH, Alkalinity AND VFA	SCISYS & Online data storage and reporting - Amulet
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*HACCP : Hazard Analysis and Critical Control Point Plan

*CCP : Critical Control Point

HACCP CCP Table:

CCP 1	Daily maximum sludge volume
Critical Limit Value	151m3 maximum/day (for each individual digester use)
Allowable Variability	None
Measurement	M3/day
Data record	Daily manual record on site log sheet TRTWF039
Compliance Check	Daily manual check against critical limit value

CCP 2	Temperature
Critical Limit Value	Minimum 32.7 °C
Allowable variability	None
Measurement	Degrees centigrade
Data record	Daily manual record on site log sheet TRTWF039

Compliance Check	Daily manual check against critical limit value
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** Actual tank volume =

Level monitoring on all tanks with high level alarms. The plant fed in 24 batches over a 24 hour period, sludge is moved through the plant in a reverse cascaded batch process. The feed is controlled by PLC and critical control points of flow and temperature.

Revision History:

Issue	Date	Description	Prepared by
1	October 2023	First edition	Waste Area Scientist