OPERATIONAL PROCESS CONTROL PARAMETERS

To be read in conjunction with Operational Process Control Parameters - Lab Reference Handout, Version 7, Issued 19/03/2021

Analytical Parameter	Sample Location	Site	Range of Values	Actions to be undertaken once value has reached or exceeded the trigger value
pH	RWBT	All Sites except Twinwoods	LOW pH DANGER < 4.000	Undertake a retest ASAP, making sure the sample is representative & tank mixing is operational & that the test has been undertaken following the correct procedure
				Alert Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Consider reducing or removing the addition of ferric chloride
				Consider reducing the input of food into the digester(s)
				Assess the degree and source of recirculation & alter if applicable
				Monitor the pH of the digester(s)
				Increase monitoring frequency
				Note: Some sites are not required to undertake repetitive daily retests if the RWBT pH is < 4. A comment will be present on any low pH danger PCP breaches for which this is applicable. These sites usually recirculate RWBT material rather than digestate
			ACCEPTABLE 4.000 - 5.999	Continue as normal
			HIGH pH DANGER ≥ 6.000	Undertake a retest ASAP, making sure the sample is representative & tank mixing is operational & that the test has been undertaken following the correct procedure
				Alert Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Consider reducing or removing the addition of ferric chloride
				Consider reducing the level of the tank (if possible)
				Assess the degree and source of recirculation & alter if applicable
				Increase monitoring frequency
		Twinwoods	LOW pH DANGER < 4.000	Undertake a retest ASAP, making sure the sample is representative & tank mixing is operational & that the test has been undertaken following the correct procedure
				Alert Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Consider reducing or removing the addition of ferric chloride
				Consider reducing the input of food into the digester(s)
				Assess the degree and source of recirculation & alter if applicable
				Monitor the pH of the digester(s)
				Increase monitoring frequency
			ACCEPTABLE 4.000 - 6.999	Continue as normal
			HIGH pH DANGER ≥ 7.000	Undertake a retest ASAP, making sure the sample is representative & tank mixing is operational & that the test has been undertaken following the correct procedure
				Alert Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Consider reducing or removing the addition of ferric chloride
				Consider reducing the level of the tank (if possible)
				Assess the degree and source of recirculation & alter if applicable
				Increase monitoring frequency
				Note: TW has a slightly higher PCP level compared to the other sites due to the inclusion of pig slurry & its resultant impact on RWBT pH
	Digesters	All Sites	LOW pH EXTREME DANGER < 6.500	Undertake a retest ASAP, making sure the sample is representative & tank mixing is operational & that the test has been undertaken following the correct procedure
				Alert Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Reduce the feed to the digester(s) in question
				Check that the most recent digester alkalinity & VFA concentrations are within the defined parameters
				Check the indicated temperature reading(s) of the digester(s) in question including cross checking with a handheld thermometer
				Prevent / restrict the addition of new or acidic feedstocks
				Stop the addition of ferric chloride to the plant
				Increase monitoring frequency
			LOW pH DANGER 6.500 - 6.999	Undertake a retest ASAP, making sure the sample is representative & tank mixing is operational & that the test has been undertaken following the correct procedure
				Alert Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Consider reducing the feed to the digester(s) in question
				Check that the most recent digester alkalinity & VFA concentrations are within the defined parameters
				Check the indicated temperature reading(s) of the digester(s) in question including cross checking with a handheld thermometer
				Prevent / restrict the addition of new or acidic feedstocks
				Consider reducing or removing the addition of ferric chloride to the plant
				Increase monitoring frequency
			ACCEPTABLE ≥ 7.000	Continue as normal
	Storage Tanks / Digestate	All sites	LOW DANGER < 7.000	There is no 'official' storage tank pH PCP value, however, the pH of each sample sent for external analysis should be measured and should be equal to or greater than 7 (although each site should know what is 'normal' for them & alert the Plant Manager, Research Manager, Regional Operations Manager & Compliance Director to any significant variation from that "normal" level)
			ACCEPTABLE ≥ 7.000	Continue as normal

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Alkalinity Ratio	**Digesters**	All Sites	LOW DANGER < 0.200	Provide the intermediate and partial alkalinities to the Research Team for assessment
				Research Team to assess overall plant biology and advise
				Undertake a retest ASAP, making sure the sample is representative & tank mixing is operational & that the test has been undertaken following the correct procedure
				Alert the Plant Manager, Research Manager & Regional Operations Manager
			ACCEPTABLE 0.200 - 0.499	Continue as normal
			HIGH BEWARE 0.500 - 0.799	Undertake a retest ASAP, making sure the sample is representative & tank mixing is operational & that the test has been undertaken following the correct procedure
				Alert Plant Manager, Research Manager, Regional Operations Manager, Compliance Director & Operations Director
				Check the indicated temperature reading(s) of the digester(s) in question including cross checking with a handheld thermometer
				Research Team to review latest Organic Loading Rate data for the digester(s) in question
				Consider reducing feed to the digester(s) in question
				Review delivery schedule to identify any sources / types of feedstock which may have caused biological instability
				Increase monitoring frequency
			HIGH DANGER ≥ 0.800	Undertake a retest ASAP, making sure the sample is representative & tank mixing is operational & that the test has been undertaken following the correct procedure
				Alert Plant Manager, Research Manager, Regional Operations Manager, Compliance Director & Operations Director
				Plant Manager or Research Manager to alert the Commercial Team
				Increase monitoring frequency
				Check the indicated temperature reading(s) of the digester(s) in question including cross checking with a handheld thermometer
				Prevent / restrict the addition of new or acidic feedstocks
				Research Team to review latest Organic Loading Rate data for the digester(s) in question
				Reduce the feed and consider stopping the feed to digester(s) in question
				Check the most recent pH and VFA concentrations are within the defined parameters
				Check that the volume of TEA prescribed by the Research Team has been inputted to the digester(s)
				Research Team to check the TEA dosing volumes are sufficient given the recent inputs to the plant
				Re-analyse the sample for VFA if deemed appropriate by the Research Team
				Provide the intermediate and partial alkalinity values to the Research Team for assessment
				Review delivery schedule to identify any sources / types of feedstock which may have caused biological instability
				Consider re-testing the TEA concentrations in the digester(s) in question
				If values are persistently high - consider mixing with a biologically healthy seed

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VFA	**Digesters**	All Sites	ACCEPTABLE < 2,500 mg/l	Continue as normal
			HIGH BEWARE 2,500 - 4,999 mg/l	Confirm that the sample taken was representative (check pH & alkalinity measured prior to dispatch) & the mixing was operational Alert Plant Manager, Research Manager, Regional Operations Manager, Compliance Director & Operations Director Check that the most recent digester pH, alkalinity ratio & other digester VFA concentrations are within the defined parameters Consider undertaking a re-test ASAP Check that the volumes of TEA prescribed by the Research Team have been inputted to the digester(s) Research Team to check the TEA dosing volumes are sufficient given the recent inputs to the plant Consider increasing monitoring frequency
			HIGH DANGER ≥ 5,000 mg/l	Confirm that the sample taken was representative (check pH & alkalinity measured prior to dispatch) & the mixing was operational Alert Plant Manager, Research Manager, Regional Operations Manager, Compliance Director & Operations Director Check that the most recent digester pH, alkalinity ratio & other digester VFA concentrations are within the defined parameters Undertake a re-test ASAP Check that the volumes of TEA prescribed by the Research Team have been inputted to the digester(s) Research Team to check the TEA dosing volumes are sufficient given the recent inputs to the plant Increase the monitoring frequency Research Team to examine & assess the breakdown of individual VFA species & trends in Partial & Intermediate Alkalinity Review delivery schedule to identify any sources / types of feedstock which may have caused biological instability Consider reducing the feed to the digester(s) in question
	Storage Tanks / Digestate	All Sites	ACCEPTABLE < 4,000 mg/l	Continue as normal
			HIGH BEWARE ≥ 4,000 mg/l	Confirm that the sample taken was representative (check pH measured prior to dispatch) & the mixing was operational Alert Plant Manager, Research Manager, Compliance Director, Regional Operations Manager & Operations Director Retests will be decided on a case by case basis & will be advised by the Research Team. If there is a sudden increase in VFAs or if the sample is close to the date when a RBP test is due then retesting may be undertaken
Ammonium N	**Digesters**	All Sites	ACCEPTABLE < 7,000 mg/l	Continue as normal
			HIGH BEWARE 7,000 - 7,999 mg/l	No actions currently defined. Treatment requires significant variation in process flow. Control is administered by means of assessment of feedstock acceptance conducted by the Plant Manager, Research Manager, Regional Operations Manager and the Operations Director
			HIGH DANGER ≥ 8,000 mg/l	No actions currently defined. Treatment requires significant variation in process flow. Control is administered by means of assessment of feedstock acceptance conducted by the Plant Manager, Research Manager, Regional Operations Manager and the Operations Director
OLR	**Digesters**	All Sites	LOW BEWARE < 2.5 kg ODM m^3 day^{-1}	Research Team to alert Research Manager, Plant Manager, Regional Operations Manager, Compliance Director & Operations Director if values are consistently below this value
			ACCEPTABLE 2.5 - 4.999 kg ODM m^3 day^{-1}	Continue as normal
			HIGH BEWARE ≥ 5.0 kg ODM m^3 day^{-1}	Research Team to alert Research Manager, Plant Manager, Regional Operations Manager, Compliance Director & Operations Director if values consistently exceed this value
H_2S	**Biogas**	All Sites	ACCEPTABLE < 300 ppm	Continue as normal
			HIGH BEWARE 300 - 499 ppm	Guidance on ferric dosing issued by the Research Manager, Regional Operations Manager & the Operations Director
			HIGH DANGER ≥ 500 ppm	Guidance on ferric dosing issued by the Research Manager, Regional Operations Manager & the Operations Director

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Temperature	RWBT	All Sites except Holbeach & Retford	ACCEPTABLE < 20.0°C	Continue as normal
			HIGH BEWARE 20 - 34.9°C	Daily decisions should be made on the basis of tank level, potential production of foam, origin of recirculation material & the information contained within the 'RWBT Control' section in order to decide whether it is appropriate to dose ferric chloride or whether the source of the recirculation can be altered in order to try and assist the temperature control
			HIGH DANGER ≥ 35.0°C	Daily decisions should be made on the basis of tank level, potential production of foam, origin of recirculation material & the information contained within the 'RWBT Control' section in order to decide whether it is appropriate to dose ferric chloride or whether the source of the recirculation can be altered in order to try and assist the temperature control
	Digesters	Digesters	LOW DANGER ≤ 37.0°C	Alert the Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Investigate the heating & circulatory systems & take appropriate corrective action
				Consider cross checking the temperature with a handheld probe if temperatures are persistently or significantly lower than PCP
				Monitor digester biology carefully (particularly the VFA concentrations)
			ACCEPTABLE 37.1 - 40.4°C	Continue as normal
			HIGH DANGER ≥ 40.5°C	Alert the Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Turn off the hot water supply for the HEX until temperatures have stabilised
				Consider cross checking the temperature with a handheld probe if temperatures are persistently or significantly higher than PCP
				Monitor digester biology carefully (particularly the VFA concentrations)
Biology	RWBT Control	All Sites except Holbeach & Retford	RWBT High Level Alarm Alerts	Alert Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Stop ferric chloride addition to RWBT
			RWBT Level Reading Greater than 85%	Alert Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Stop ferric chloride addition to RWBT
			Temperature ≥ 35 ° C **AND** level ≥ 80 % **AND** difference of 10 % in reading of level via Pressure Pad and Radar ***	Alert Plant Manager, Research Manager, Regional Operations Manager & Operations Director
				Stop processing into the RWBT
				Stop the mixing on the RWBT
				Stop ferric chloride addition to RWBT
				Increase digester feeds by 50% (to those digesters in a biologically healthy condition only)
			*** As the two different level measurements are at different locations and using different technologies, then it is unlikely that they are in agreement even without foaming, therefore in conjunction with the Operations Director, each site is required to determine its own “base line discrepancy” between the two, and how to best make use of this figure	