Bradgate Bakery c/o Samworth Brothers

Trade Effluent Treatment Plant

Operating Manual and Instructions

Introduction

The source of trade effluent (TE) on site comes from CIPs and the washing down of production lines and vessels within the factory.

The TE treatment plant currently only manages the pH level but it should be considered as an essential part of the daily running of the site, and it is therefore important that it continues to run effectively.

Poor treatment can result in non-compliant pH levels being discharged to Severn Trent. This can result in the retraction or restriction of the license to discharge, increased monthly costs and potential fines to Samworth Brothers.

The following pages detail what is required for the optimal running of the TE treatment plant and guidance for its operation.

Responsibility

The TE Plant Operators are responsible for the day-to-day operation and monitoring of the effluent system and for taking prompt corrective action when faults or operating deviations occur.

The Site Services Engineering Manager and Site Engineering Manager are also responsible for providing technical support for the overall monitoring and control of the system and should be notified immediately of any significant changes or problems with the plant operation.

Consent Limits - TBC

Parameter	Max. Limit	Units
pH	6-10	-
TSS @pH 7	2000	mg/L
sCOD	6000	mg/L
sCOD	1000	Kg/d
Total flow	900	m^3
Flow rate (instantaneous)	11	L/s
SOGs	150	mg/L
Cyanides	1	mg/L
Sulphates as SO_4	1000	mg/L
Total sulphides	1	mg/L
Toxic metals	10,000	µg/L
Temperature	43.3	^oC
Aluminium	10,000	µg/L

Terminology

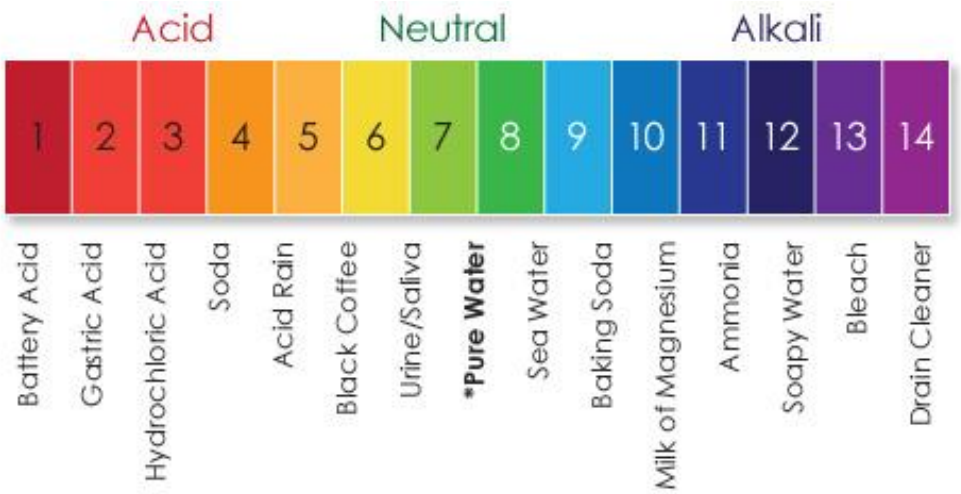
Aerobic: Relating to, involving, or requiring free oxygen.

Dissolved Air Floatation (DAF): Dissolved air floatation is a water treatment process that clarifies waste water by removing suspended solids.

Emulsify: To form a mixture of two liquids that are insoluble with each other. E.g. oil and water form an emulsion when mixed.

Flocculation: The addition of a flocculant or polymer acts as an adherent and causes the suspended solids to form small clumps or masses.

pH: The expression of the acidity or alkalinity of a solution on a numeric scale of 0-14, where 7 is neutral. The lower the value, the more acidic the solution. The higher the value, the more alkaline the solution. This is actually a calculation of the concentration of hydrogen ions in the solution. This is one of the parameters measured and monitored by United Utilities.

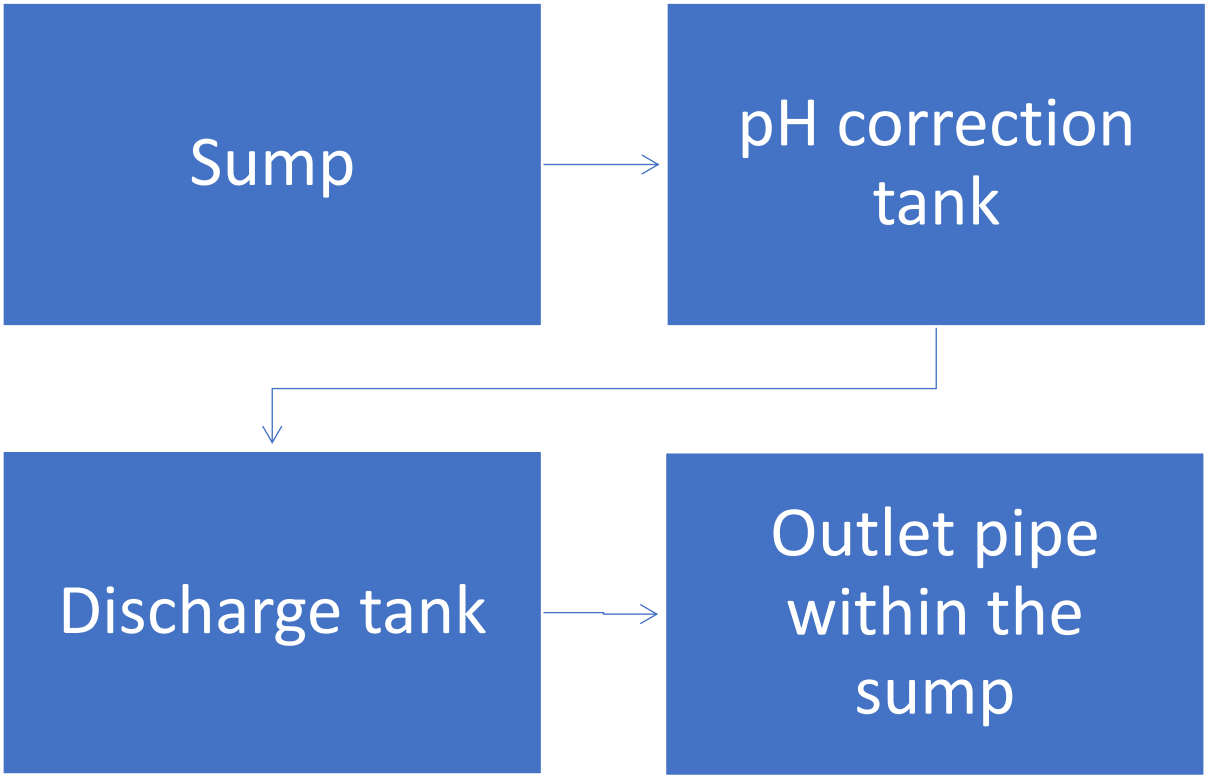


Settled Chemical Oxygen Demand (sCOD): A measure of the capacity of a substance or solution to consume oxygen when reacted. Oxygen is commonly consumed during the decomposition of organic matter and the oxidation of inorganic chemicals such as ammonia and nitrites. In this case, it is the *settled* COD, therefore, samples have been shaken and then left to stand for one hour. The analysis is then performed on the supernatant liquid. It is expressed as the mass of oxygen consumed over the volume of solution. (Units = mg/L). This is one of the parameters measured and monitored by United Utilities.

Total Suspended Solids (TSS): The total dry weight of solid particles suspended in a liquid, which will not pass through a filter. It is expressed as the total mass of dry solids over the volume of solution (Units = mg/L). This is one of the parameters measured and monitored by United Utilities.

Effluent flow

The following flow diagram shows the general path of the effluent from leaving the factory.



There are float balls to control the sump and discharge pumps.

There is one 6” and two 5” connector pipes from the pH correction tank to the discharge tank.

Sump

The sump has been modified to be used as a primary reception area for all effluent coming from the factory – this is located directly opposite reception. Duty/standby submersible pumps are controlled by float balls and send effluent from the sump to the pH correction tank in the container in the motorcycle bay.

There are also duty/standby high level alarm float balls to indicate a pump problem. Effluent will overflow into the discharge pipe without pH treatment in this case. This replicates the route of the effluent prior to the installation of the TE plant.

There are two non-return valves, two hand valves and a hoist to allow isolation and removal of either submersible pump, whilst the other pump is still operational.

The flexible pipework is covered 98% of the with ducting and should be checked four times daily for any breaches of integrity.

pH correction tank

pH

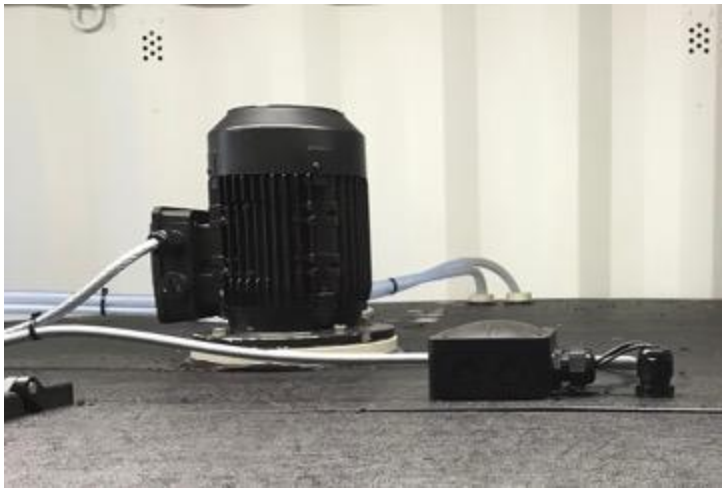
The pH of the effluent from the factory can vary hugely and is dependent on production and cleaning schedules. There are two separate systems for acid and caustic addition with 4-20mA pump control.

Acid, 4-20mA, pH 7 to 6

Caustic, 4-20mA, pH 10 to 9

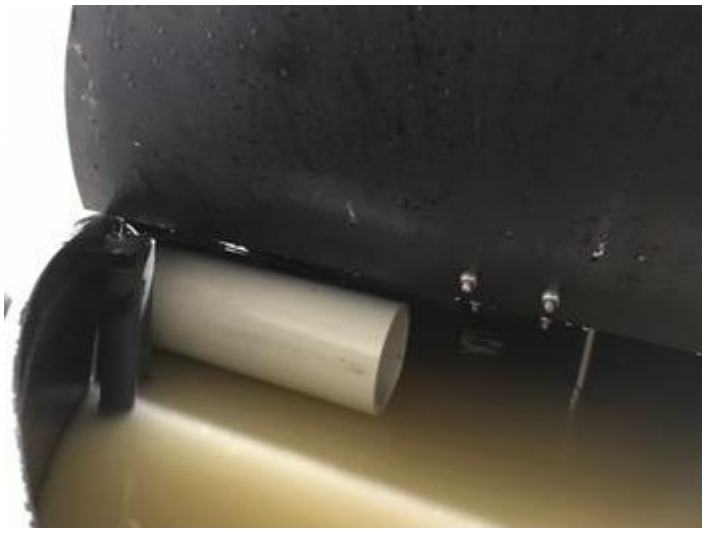
Both pH probes are located adjacent to each other so act as a method for checking the calibration – they should read the same +- 0.5 units.

The mixer operates 24/7.



There are duty/standby high level alarm finger floats to indicate a problem with the outlet into the discharge tank or too high a flow rate from the sump submersible pumps.

There is one 6” and two 5” connector pipes from the pH correction tank to the discharge tank.



The discharge pumps are duty/ standby and controlled by floats ball.

There are duty/standby high level alarm float balls to indicate a problem with the discharge pumps or too high a flow rate from the pH correction tank.

There are two non-return valves, two hand valves to allow isolation and removal of either discharge pump, whilst the other pump is still operational.

There are duty/standby high level alarm finger floats for the container to indicate a problem with the pH correction or discharge tanks or pumps.

All float devices should be checked daily.

Discharge to sewer

The existing flow meter and sampler are unchanged.

Chemicals

ENSURE THAT SAFETY DATA SHEETS ARE AVAILABLE NEARBY AT ALL TIMES

Sulphuric Acid

Sulphuric acid is used for adjusting the pH of the effluent prior to coagulation and flocculation. It is a colourless, highly acidic solution of 20% in water and is supplied in 1000L pump-overs.

In this case, the acid is dosed neat, straight from the storage tank using a peristaltic dosing pump and chemically-resistant tubing.

Health & Safety

Sulphuric acid is highly corrosive; therefore, care needs to be taken when handling. Eye protection, chemical-resistant gloves and protective clothing which fully covers the arms and legs must be worn during handling.

Clean up any spillages immediately with water. If it comes in contact with the skin, immediately flush the affected area under running water for at least 15 minutes. If there are any further concerns, refer to the safety data sheet and seek medical advice.

Sodium Hydroxide

Caustic is used for adjusting the pH of the effluent prior to coagulation and flocculation. It is a colourless, highly alkaline solution of 32% sodium hydroxide in water and is supplied in 1000L pump-overs.

In this case, the caustic is dosed neat, straight from the storage tank using a peristaltic dosing pump and chemically-resistant tubing.

Caustic should be stored above 15^{o}C at all times as it crystallises at low temperatures.

Health & Safety

Caustic is highly corrosive; therefore, care needs to be taken when handling. Eye protection, chemical-resistant gloves and protective clothing which fully covers the arms and legs must be worn during handling.

Clean up any spillages immediately with water. If it comes in contact with the skin, immediately flush the affected area under running water for at least 15 minutes. If there are any further concerns, refer to the safety data sheet and seek medical advice.

Monitoring & Maintenance

The competent monitoring and maintenance of the water treatment plant is essential to its everyday operation.

Maintenance of all elements of the water treatment system should be conducted in accordance with the manufacturer's recommendations, or more frequently where actual experience shows it to be necessary. The following recommendations are a guide.

An inventory of critical spare parts, prior arrangements for rapidly obtaining specialised assistance in the event of an equipment failure and other contingency measures to minimise down-time are necessary.

Daily Monitoring and Analysis

Parameter	Frequency	Comments
Pit level	Daily	
pH correction tank level	Daily	
Discharge tank level	Daily	
Mixer	Daily	
Alarms	Daily	
General condition of equipment	Daily	
Check pH probes for cleanliness and damage.	Daily	
Sense check pH readings on acid & alkali dosing controllers – calibrate if necessary	Daily	
Check level controllers for damage/debris	Daily	
Check all pumps are in operation	Daily	
Tanks – visual inspection	Daily	
Check monitoring plant is in working order	Daily	
Calibrate pH probe at monitoring station	4-daily	
General comments	Daily	

Name (print)	Date	Signature

Periodic Maintenance

Item	Action	Frequency
pH meters & probes	Check probe for cleanliness and damage. Calibrate probe and meter.	Daily As required – weekly or monthly or beyond.
Level controls (all pumps)	Visual check for damage or debris which could interfere.	Daily
Recirculation/feed/submersible pumps (all)	Visual and mechanical check, including seals. Remove and refurbish	Monthly Annually
Dosing lines and pumps (for all chemicals)	Visual pump and tubing check. Replace dosing line. Replace pump tube	Daily As required – weekly or monthly or beyond. Monthly
Tanks	Visual inspection	Every two weeks
Autosampler	Visual check for faults. Service and calibrate	Daily Bi-annual
Flow meter	Visual check for faults. Service and calibrate	Daily Bi-annual

Plant

Chemical	**4mA setting**	**20mA setting**
Caustic	7.00, 0.1%	6.00, 100%
Acid	9.00, 0.1%	10.00 100%

pH Probe Cleaning and Calibration

1. Turn off the mixer and open the lid
2. Remove the pH probe and clean with water and a soft cloth.
3. On the pH controller, use the directional arrows to highlight ‘PROBE’ and press the enter button. Press enter again (there is no password set). Press enter again to select ‘CALIBRATE’.
4. Place the pH probe in pH 7 buffer and allow the reading to stabilise.

5. Once stable, use the arrows to highlight ‘SET P1’ and press enter.
6. Remove the probe from the buffer and clean with water and a soft cloth.
7. Place the probe in the pH 4 buffer and allow the reading to stabilise.
8. Once stable, use the arrows to highlight ‘SET P2’ and press enter.
9. Highlight ‘SAVE’ and press enter to confirm. Press ‘ESC’ to return to the main screen.
10. Replace the probe, close the lid and turn on the mixer.

Troubleshooting

If any part of the system fails, it must be checked and corrected as soon as possible to reduce the impact of untreated effluent overloading the system and backing up.

Problem	**Possible Cause**	**Action**
A recirculation/feed/transfer pump keeps tripping out.	The pump is blocked. The pump is electrically overloaded. The pipework associated with the pump is blocked.	Check the pump for blockages and large pieces of debris. Check the motor for faults. Check the pipework for blockages.
A feed pump is not working.	The level control is faulty. The inlet pit is below the level of the floats.	Check the float switches/probes/sensors for entanglement and debris which could be affecting them. Check the level of the supply. Check the wiring between the sensor, controller and pump for damage/loose connections.
The pH of the treated effluent is outside of specification.	The caustic/acid stock has been depleted. The caustic/acid dosing pump is faulty.	Check the caustic/acid stock level. Check the caustic/acid dosing pump for faults. Replace the tubing, roller or dosing line as necessary.

Critical Spares

Prices correct as of February 2021.

Item	Price
pH controller	£1420
pH probe, 10ft fixed	£251
Chemical dosing pump	£4214
Chemical dosing pump tube	£80 per 3m
Chemical dosing pump – head	£1196
Sump pump, submersible	£4320
Antifoam dosing pump	£980
COD vials, box of 25	£95
Float ball	£42
Discharge pump	£3680
pH correction tank mixer	£912
4” hose, 30m roll and stainless hose mender	£710 and £103