FACTORY
INSTALLATION SERVICES
INSTALLATION AND SERVICING OF FACTORY PROCESS

Comprehensive Guide to DAF and ASP Water Treatment Plant Operations for Operators

Essential knowledge for efficient trade effluent treatment processes

Agenda Overview

Part 1

- What is effluent and its makeup
- Fundamentals of Dissolved air flotation (DAF) plants.
- Core Processes in DAF Plants

Part 2

- Why do we need biological treatment
- Fundamentals of Activated Sludge Plants (ASP)
- Core Processes in ASP's

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What is Wastewater? Or more specific to us.. Factory Trade Effluent?

Pumping station

- During the process of manufacturing food in a food factory, lots of wastewater is produced from washing down production lines, cleaning equipment, spillages of food materials, disposal of ingredients, the sinks within the factory and if not separated, the foul waste from any toilets.

- All this matter goes down the drain and is collected into an underground pumping station before being pumped to a balance tank at a Water Treatment Plant.

Trade effluent produced from a food factory contains the following contaminants:

- Suspended Solids: Organic biodegradable material (e.g., food byproducts) or non-degradable particles (e.g., microplastics, silt, sand).
- Dissolved Inorganic Chemicals: Calcium, sulphite, cyanide, and metals.
- Toxic Metals: Elements like lead, aluminium, Iron and zinc that can inhibit biological treatment processes.
- Fats, Oils, and Grease (FOG): Common in food processing and manufacturing.
- Chemical Oxygen Demand (COD): A measure of the oxygen required to break down organic pollutants.
- pH Extremes: Highly acidic or alkaline waste that requires neutralization.
- Process Chemicals: Residues from specific manufacturing activities, cleaning processes such as CIPs with caustics and acids, detergents, or solvents.
- 7. Nutrients: Ammonia and Phosphorous

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How do these contaminants cause harm to the environment?

1. Fats Oils and Grease build up in sewers and pipelines causing blockages that cause overflows to water ways, disrupting oxygens levels in watercourses.
2. Suspended Solids reduce sunlight penetration for photosynthesis lowering oxygen levels, they can clog fish gills, damage fish eggs and transport metals and phosphorus.
3. Chemical Oxygen Demand (COD) is a measure of how much oxygen is required to oxidize organic and inorganic (the pollutant) matter. High levels of COD can deplete oxygen levels in water causing aquatic life to suffocate.
4. Biological Oxygen Demand (BOD) is a measure of how much dissolved oxygen is required by aerobic microorganisms to break down organic matter. High BOD levels signify high organic pollution and drop oxygen levels in water courses.
5. Ammonia – Phosphorus are toxic to fish and acts as a nutrient causing rapid algae growth, as excessive algae blooms die and decompose, microorganisms consume large amounts of oxygen causing dead spots where aquatic life cannot survive.

Permit to discharge to a water course

After trade effluent has gone through a treatment process it must be discharged to either a sewer or a water course i.e. a ditch, stream or river.

To legally discharge effluent the food factory must obtain a permit to discharge which will have set parameters and levels that must be met to legally discharge the effluent.

Failure to comply with a permit to discharge is a criminal offence potentially leading to unlimited fines, enforcement notices, suspension of activity and bad press for the company.

Typical permit parameters to discharge to a watercourse

Plant Design Parameters		Trade Effluent Standard (EA permit)	
FLOW DATA received from customer*		CONSENT	
Effluent daily flow	m³/day	1310	Do not exceed 1310m3 in a 24hr period
Effluent	m³/hour	54.5	Do not exceed a maximum 54.3m3h of flow rate
Effluent	l/s		
Contaminated surface water	m³/day	included	
Combined foul/trade effluent	m³/day	included	
EFFLUENT DATA received from customer *			
BOD load	kg/day		
BOD (=COD/1.5)	mg/l	20	BOD must not exceed 20 milligrams per liter
COD load	kg/day		
COD	mg/l	100	COD must not exceed 100 milligrams per liter
TSS load	kg/day		
TSS	mg/l	50	Suspended solids must not exceed 50 mg/l
FOG	mg/l	~ non visible	No visible traces of fats, oils, and grease
pH	units	6-8 range	pH must be above 6 and below 8
Total Nitrogen	mg/l	20	Total nitrogen must be below 20 mg/l
Total Phosporus	mg/l	2	Total phosphorous must be below 2 mg/l
Temperature	°C		

How do we achieve these parameters?

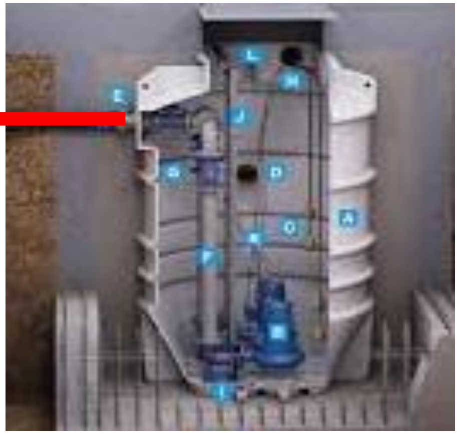
Part 1: chemically

Part 2: Biologically

PART 1

CHEMICAL PRIMARY TREATMENT:

1



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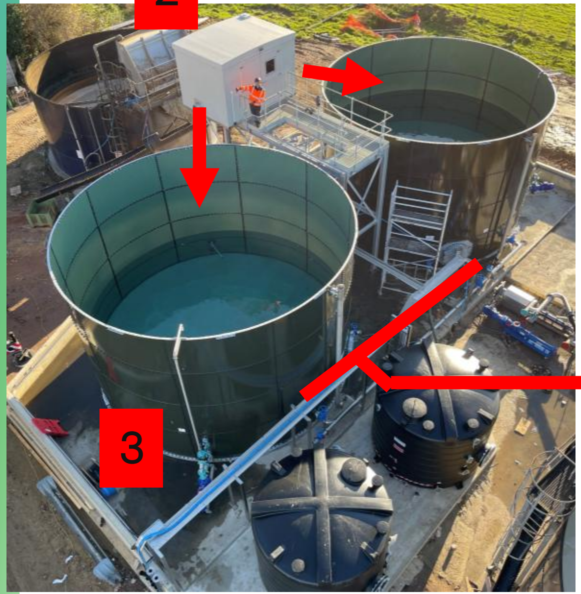
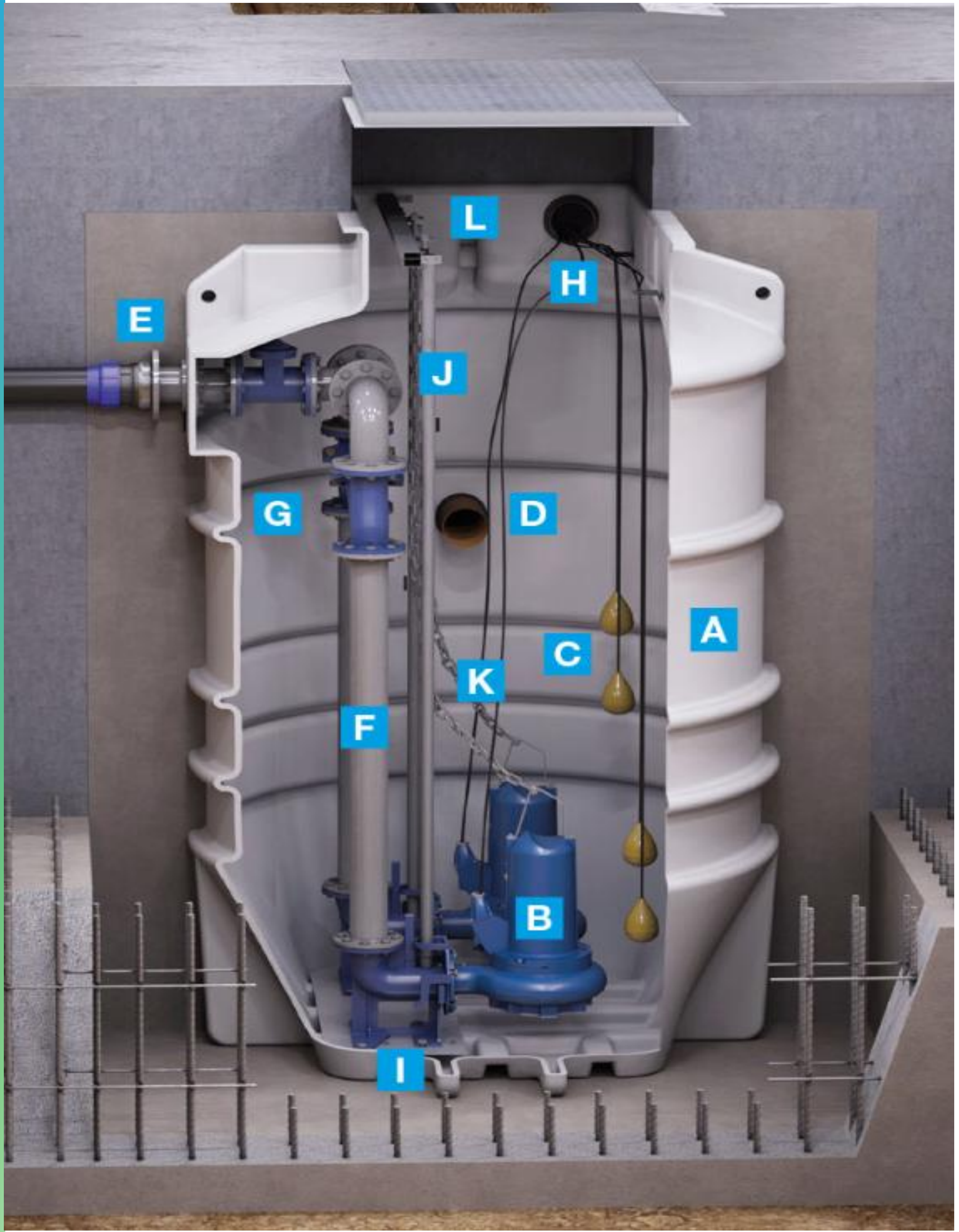


Used to remove the bulk of contaminants prior to secondary biological treatment – if discharging to a sewer system then primary treatment alone will most often achieve the levels of treatment required within the permit to discharge. .

1. Collection of factory trade effluent.
2. Screening and filtering of large debris.
3. Balancing and mixing of the variety of in coming liquids.
4. DAF stage removing pollutants from the liquor.

The Components of a Typical Pumping Station.



A. CHAMBER – the body of the pumping station normally mage from plastic or concrete.

B. SUBMERSIBLE PUMPS - centrifugal style pumps that are easily primed, can pump high flows and large solids. These pumps can also be fitted with macerating impellors to cut solids into smaller components protecting pipework and valves from blockages.

C. LEVEL CONCTROL – Used to control the switching of Pumps on and off and raise alarms if high levels of effluent occur during high flows or pump failure. The switches come in various types such as: FLOAT – ULTRASONIC – RADAR – PRESSURE

D. Inlet
E. Outlet
F. Pipework
G. Valves
H. Cable and vent ducts
I. Pedestals
J. Guide rails
K. Chains and shackles
L. Clear opening
M. Control panel

SCREENS

When effluent is pumped from a factory to an effluent plant the effluent will be run through a screen to remove any large debris such as: Food, gloves, hairnets, wood, stones, processing equipment, and anything that can fit down a drain.

Pictured left: is a rotatory screen – these are the more advanced types of screens, they have good self-cleaning systems, are multi speed, have high level alarms and are fully enclosed for protection of moving parts.
Other types of screen are pictured below.

ROTARY SCREEN

RUN DOWN SCREEN

RAKE SCREEN

Rotary screen

showing water passing through the 2mm holes on the drum whilst the solids remain on the outside before being scraped off the drum into a bin.

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BALANCE TANKS

The Effluent treatment process is most effective and efficiently managed when the effluent received from the factory is of a consistent make up, allowing pH set points to be achieved fast and efficiently and coagulation chemicals to be dosed at the correct amount without under or overdosing.

Without a balance tank the incoming effluent received by the effluent plant could vary significantly from clean water with a pH of 7 during times of wash down to hot dirty water with a pH of14 during times of CIP cleans or if spillages occur the effluent could contain high loads of FATs and COD with an acidic pH.

When all these different types of incoming effluent are received and mixed, they produce one consistent liquor that will get treated efficiently.

It is important that balance tanks have adequate means of mixing and entraining of oxygen. As the organic matter breaks down in the balance tank oxygen levels drop and anaerobic breakdown will occur dropping pH levels and creating odors.

If pH drops significantly chemicals will need to be dosed in the flocculation stage to neutralize the pH.

Balance tanks also allow a large volumes of mixed liquor to be collected and allow the treatment process to run for longer slower periods with a consistent flow rate.

The automated running and stopping of the plant is also generated from the balance tank level.

Note: Arrow showing Aerator mixers and barrels

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Venturi position

The discharge line with effluent passing through a venturi and mixing with air before being discharged back into the tank via an internal barrel.

Suction inlet of centrifugal Aerator mixer pump

Aerator Mixer Pump

.Centrifugal design

.Venturi air system

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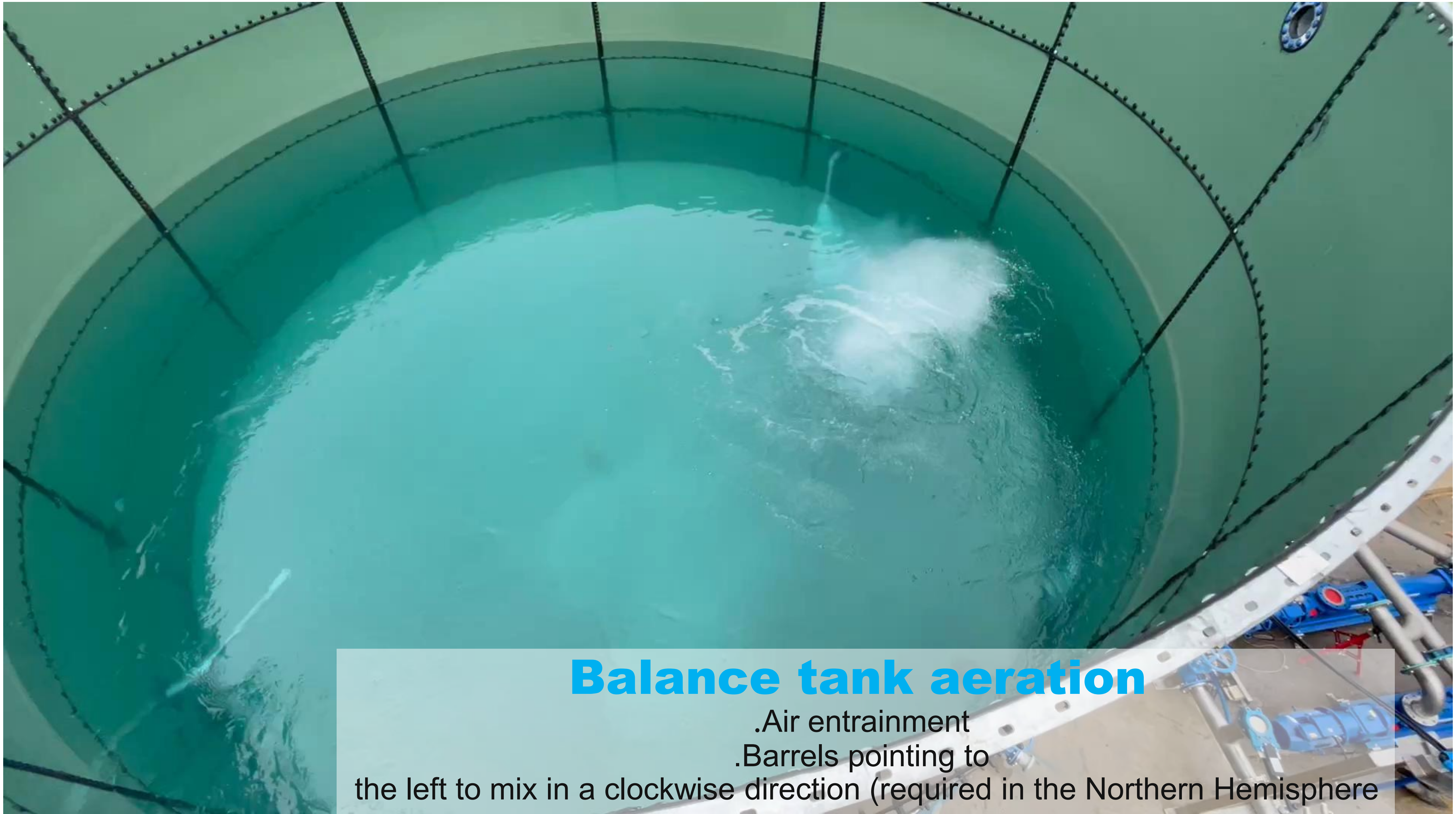

Balance tank aeration

.Air entrainment

.Barrels pointing to

the left to mix in a clockwise direction (required in the Northern Hemisphere

Dissolved Air Flotation (DAF) Plant

The DAF is a flotation vessel that uses white water or compressed oxygen to float chemically formed flocs to the top of the tank to form a sludge blanket which is scraped into a troth and then pumped to a sludge tank.

The flocs formed contain the pollutant matter separated from the effluent leaving treated (final Effluent) to flow from the outlet of the DAF tank.

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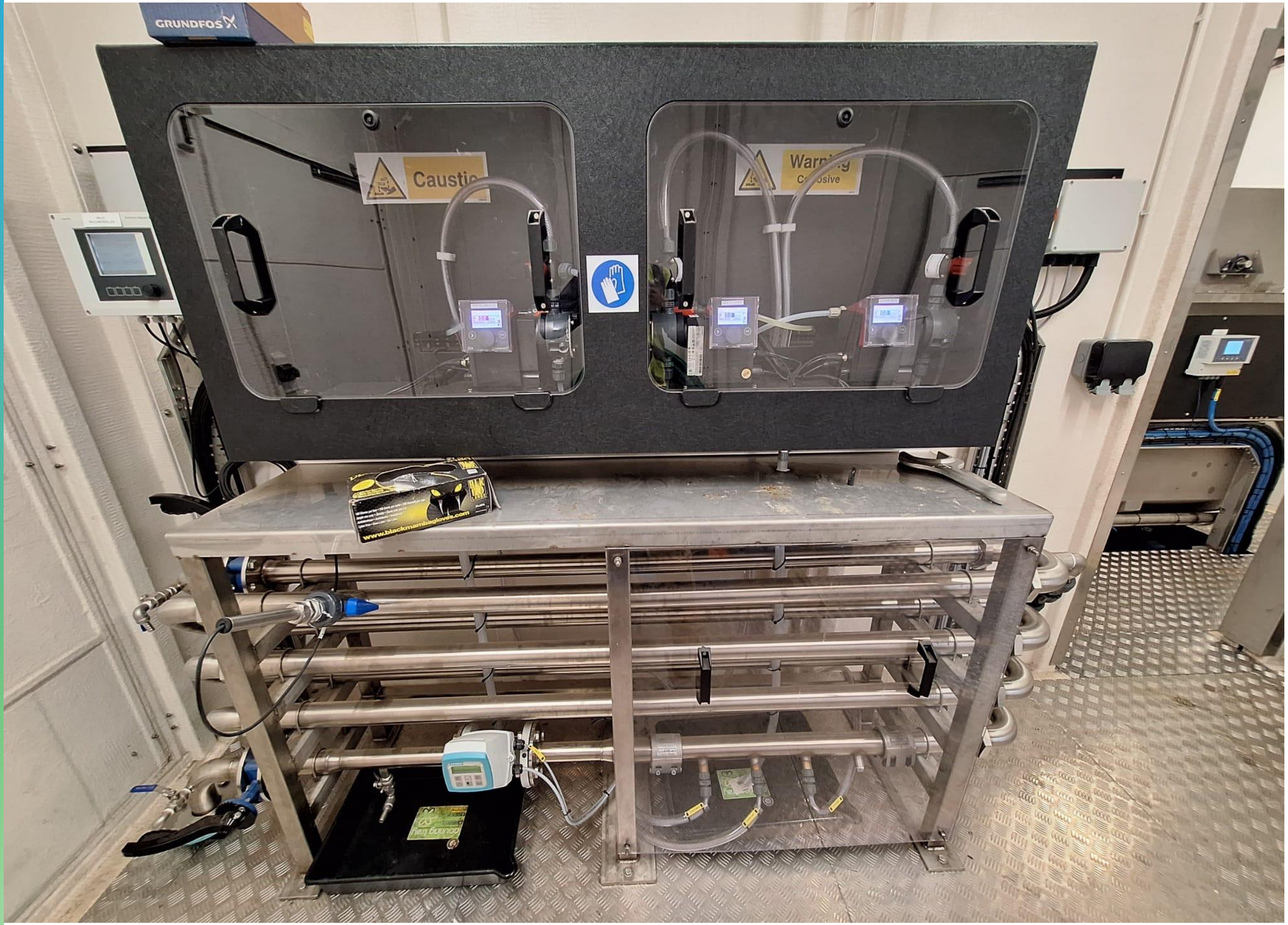
Pipe Flocculator and Chemical Dosing Pumps



When the effluent is pumped from the Balance tank to the DAF it passes through the chemical treatment phase via either a pipe flocculator as shown in the picture or a mix tank.

It is at this stage the pH is corrected, and the flocculant chemicals are dose to create a separation of the pollutant and water.

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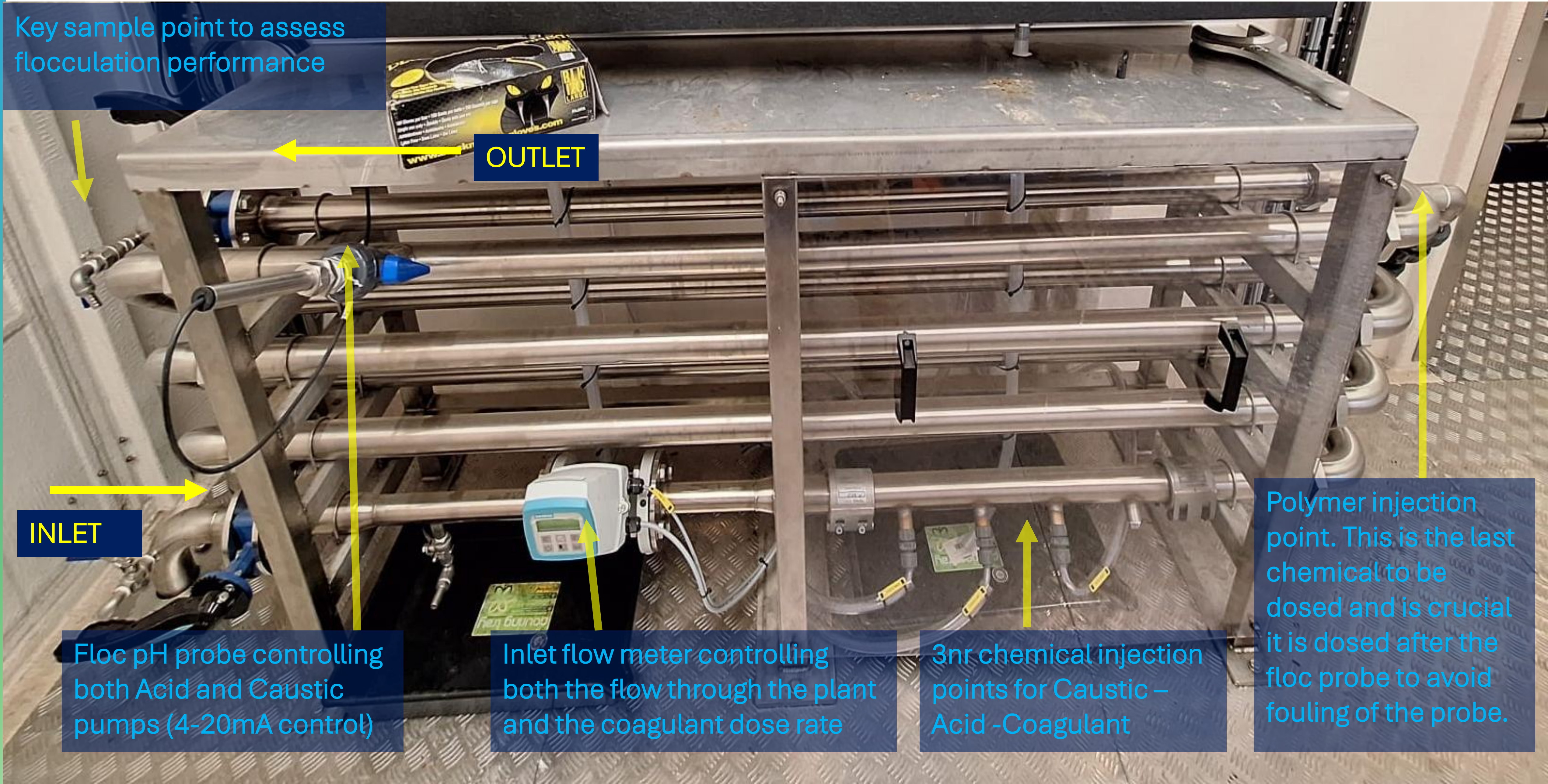
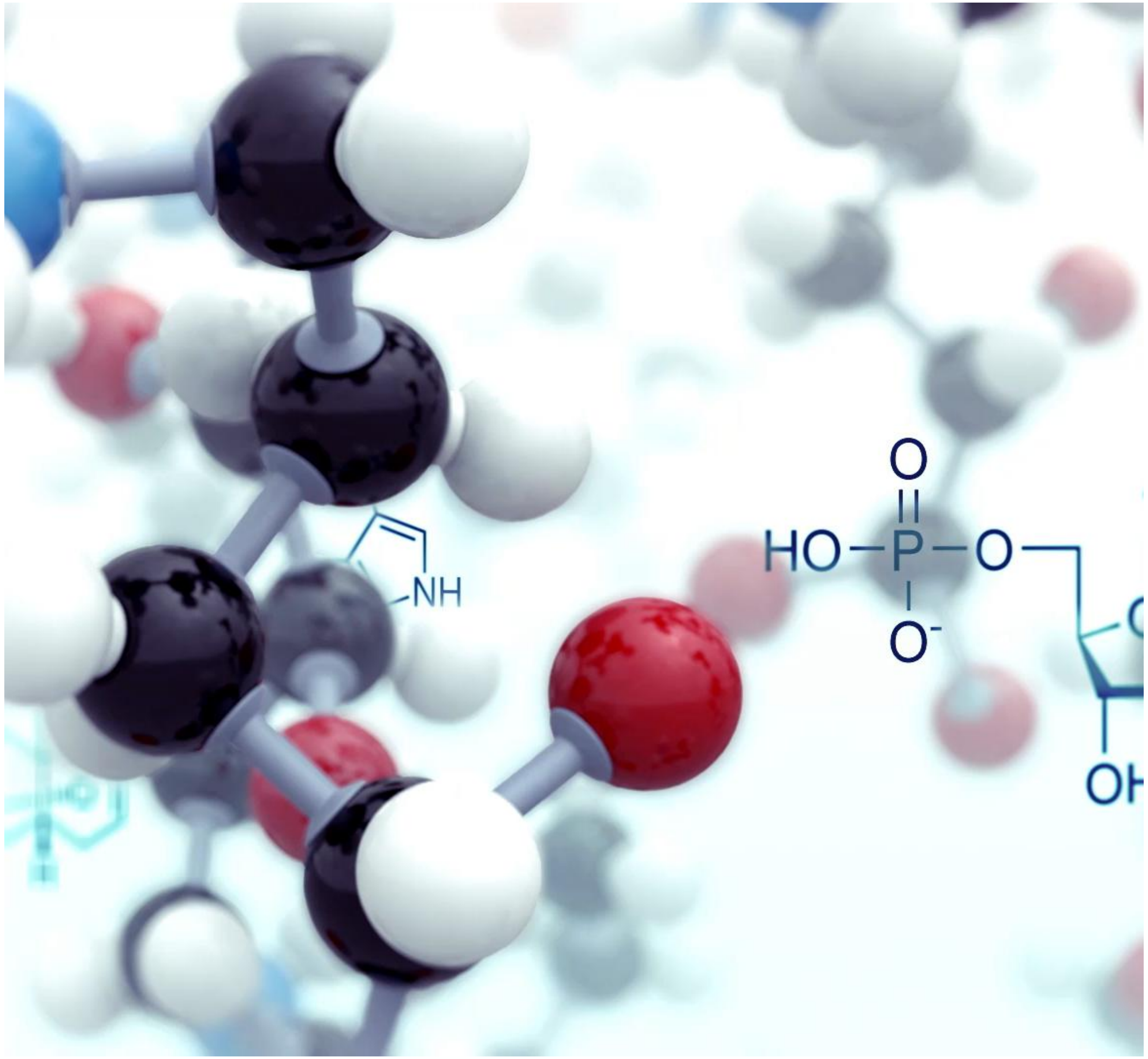


Common Chemicals Used in the DAF Treatment Process



Acids & Caustics for pH correction

Acid Types: Sulfuric Acid is the most common in the water treatment industry as it is strong, effective and economical.

Caustic soda (sodium hydroxide, NaOH) is commonly used in water treatment to raise pH , neutralize acidity and precipitate heavy metals (by transforming soluble dissolved metals into solid insoluble metal hydroxide solids – Typically between pH 7.5 and pH 11)

Many food factories use caustic during manufacturing in the cleaning process and can result in hi pH effluent being received at the effluent plant.

30% caustic soda can form crystals in temperatures below 10 degrees Celsius. These crystals cannot be changed back to their original state and result in chemical lines and ibc's needing replacement. To prevent this trace heating and ibc heaters are essential.

The Logarithmic pH Scale

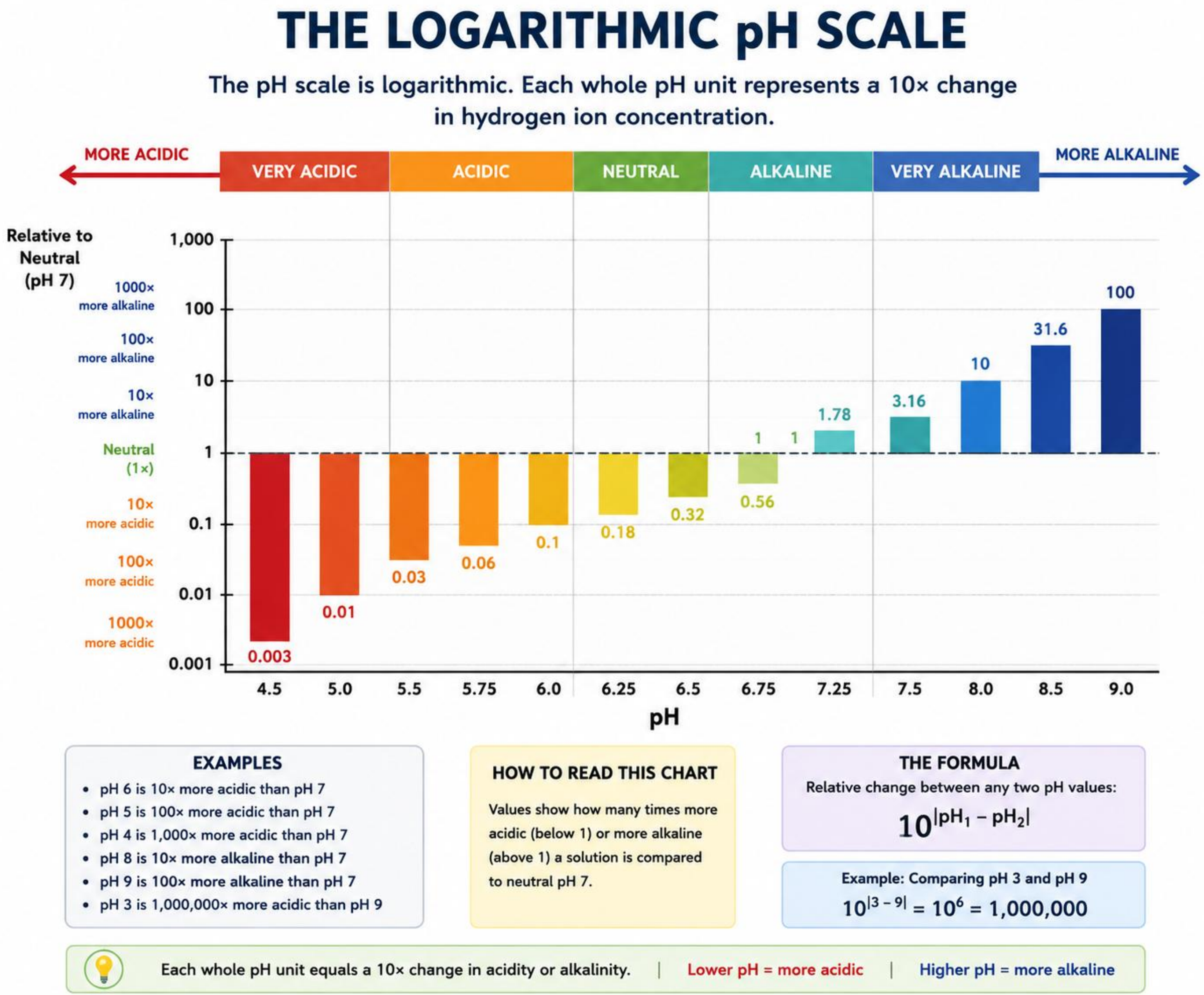
shows us that the more acidic a liquid is the more alkalinity is needed to neutralize it back to pH 7.

pH 6 is 10x acidic than pH 7,

pH 5 is 100x acidic than pH 7, and

pH is 4 is 1000x acidic than pH 7.

This also applies for Alkalinity pH ranges 7 to 14.



Coagulants

Common types used in water treatment:

Poly aluminium chloride (PAC) Positively charged and slightly acidic in nature and will drop the pH of the effluent slightly when dosed. Its general working pH range is from 5 to 9 and is classed as inorganic.

Ferric chloride: (iron based) positively charged and acidic in nature and has a general working pH range from 4.5 to 9.0 and is classed as inorganic. Ferric can generate more sludge in the coagulation process which carries a disposal cost .

Polytannate: Is a positively charged organic polymer derived from tree bark. It is safer and more environmentally friendly and has a large working pH range from 3 to 11.

Every effluent is different and which coagulant will be the most effective cannot be assumed and must be tested. This can be done with simple jar tests by taking a sample of raw effluent and adding a sample of coagulant. Things to consider when choosing which coagulant to use are the pH range, coagulation speed, does the floc naturally settle or float, and the cost.

Polymers

Types:

Anionic: (negatively charged) and are commonly used with inorganic solids like clays and silts.

Cationic: (positively charged) and are commonly used to settle organic solids such as animal waste, vegetation and food products.

Polymers come in various forms such as dry powder or liquid, and oil based or water based. Liquid water-based polymers are the most efficient and easiest to use in the wastewater industry.

So, what causes the coagulation and flocculation process happen?

The effluent is pumped from the balance tank to the DAF tank via the pipe flocculator.

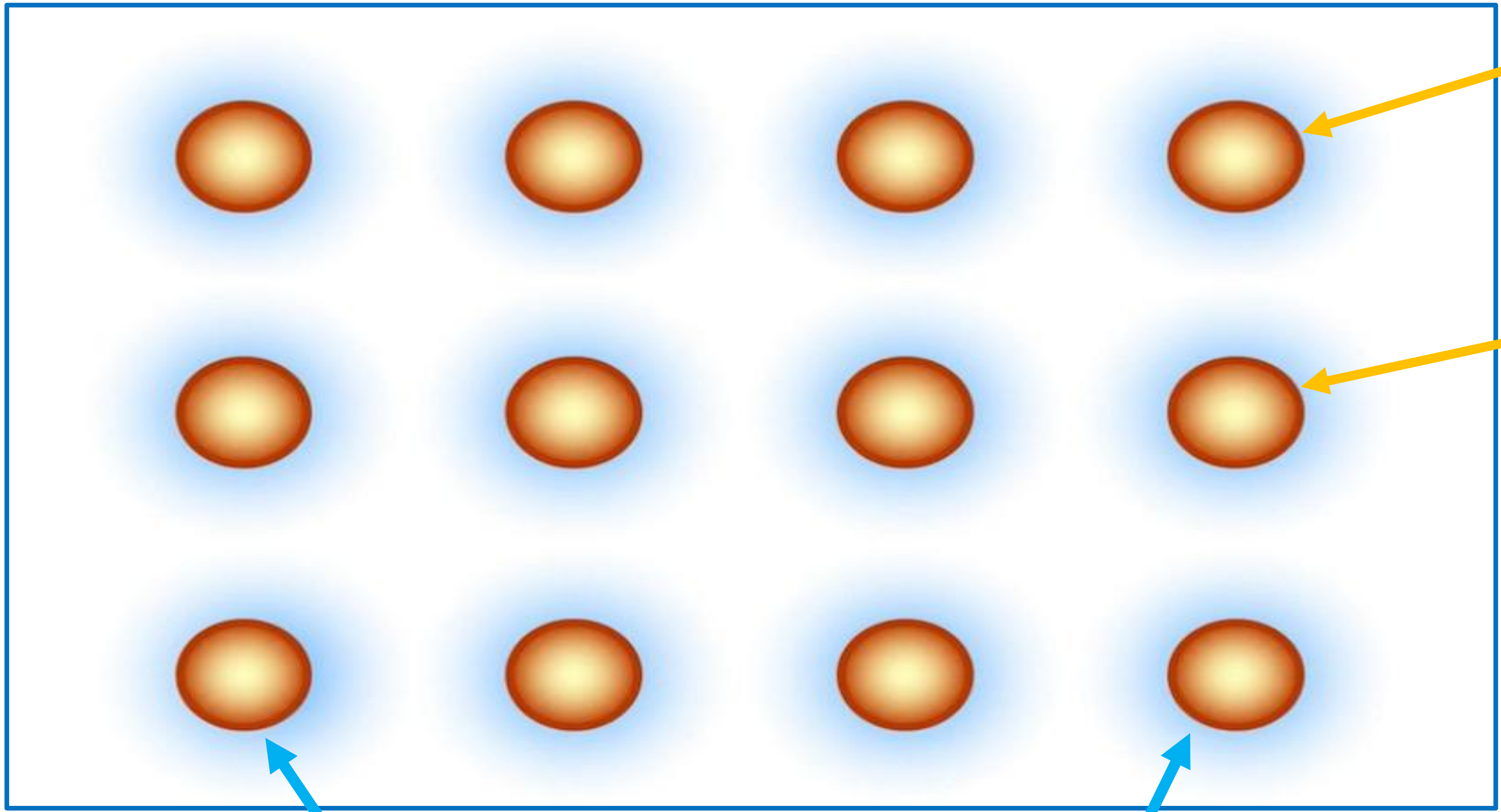
Step 1. The incoming effluent pH is measured in the pipe flocculator

and if needed.. will be adjusted to a set pH value by dosing in acid or caustic.

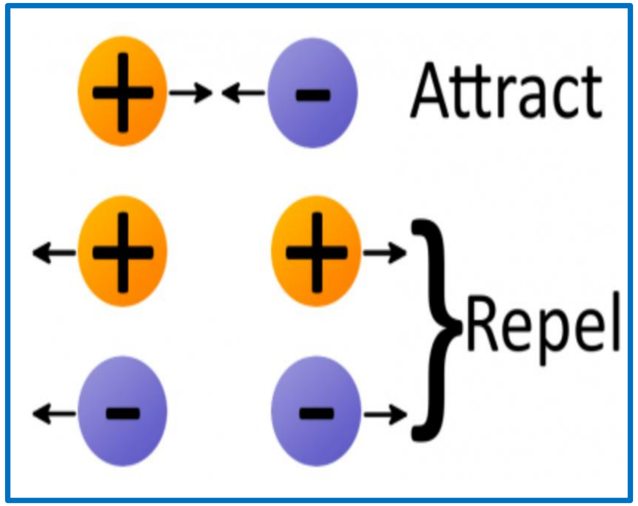
Step 2. A set amount of coagulant will be dosed with typical ranges from 300ppm to 600ppm.

A chemical reaction will cause the solids to separate, bunch together and form tiny flocs as it travels around the pipe flocculator.

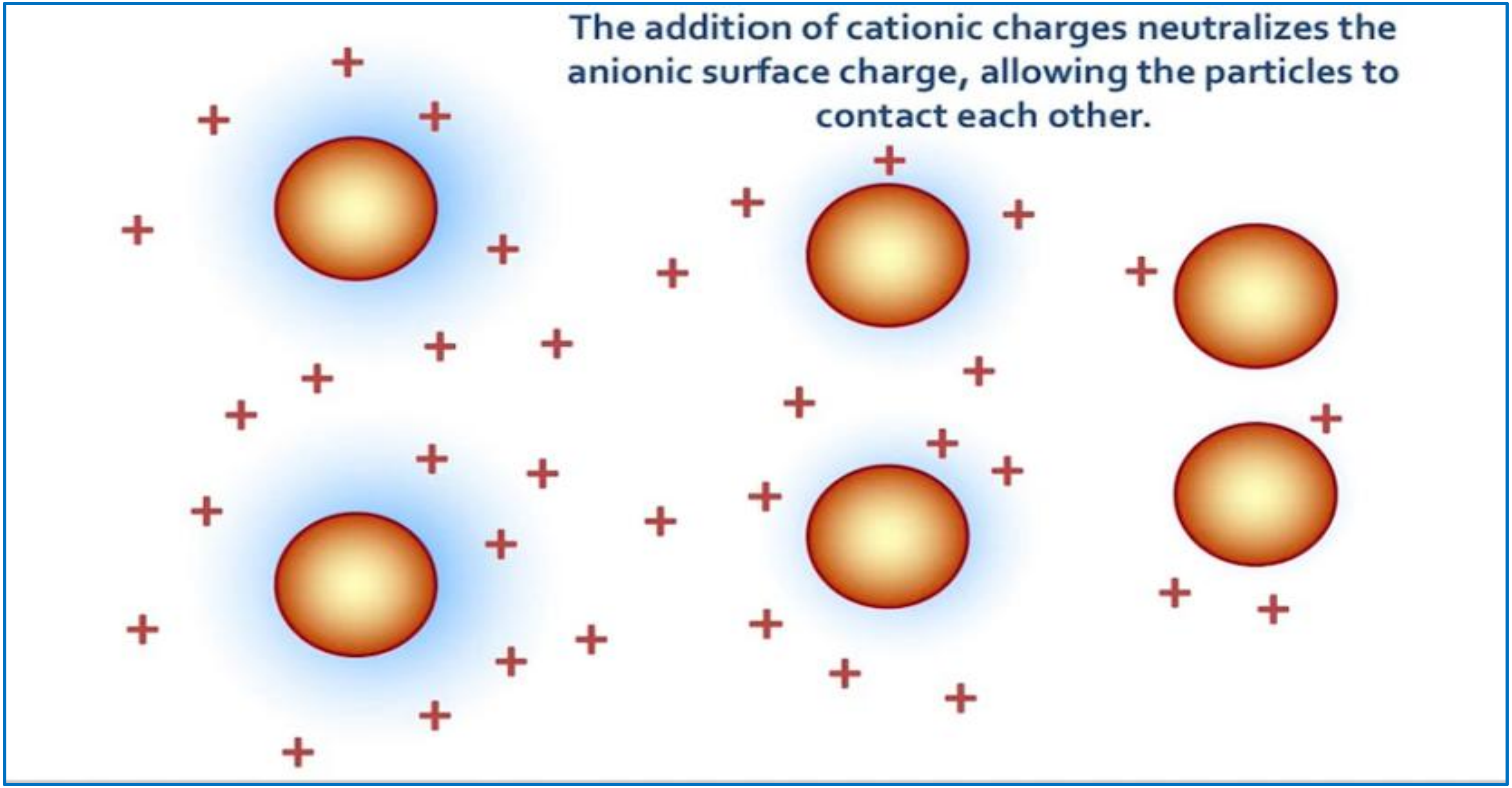
Step 3. Polymer will then be dosed into the flocculator, and the small flocks will start to stick together forming much larger floc’s that resembles large snowflakes. These larger flocs will become the building blocks of the sludge blanket once floated to the surface.

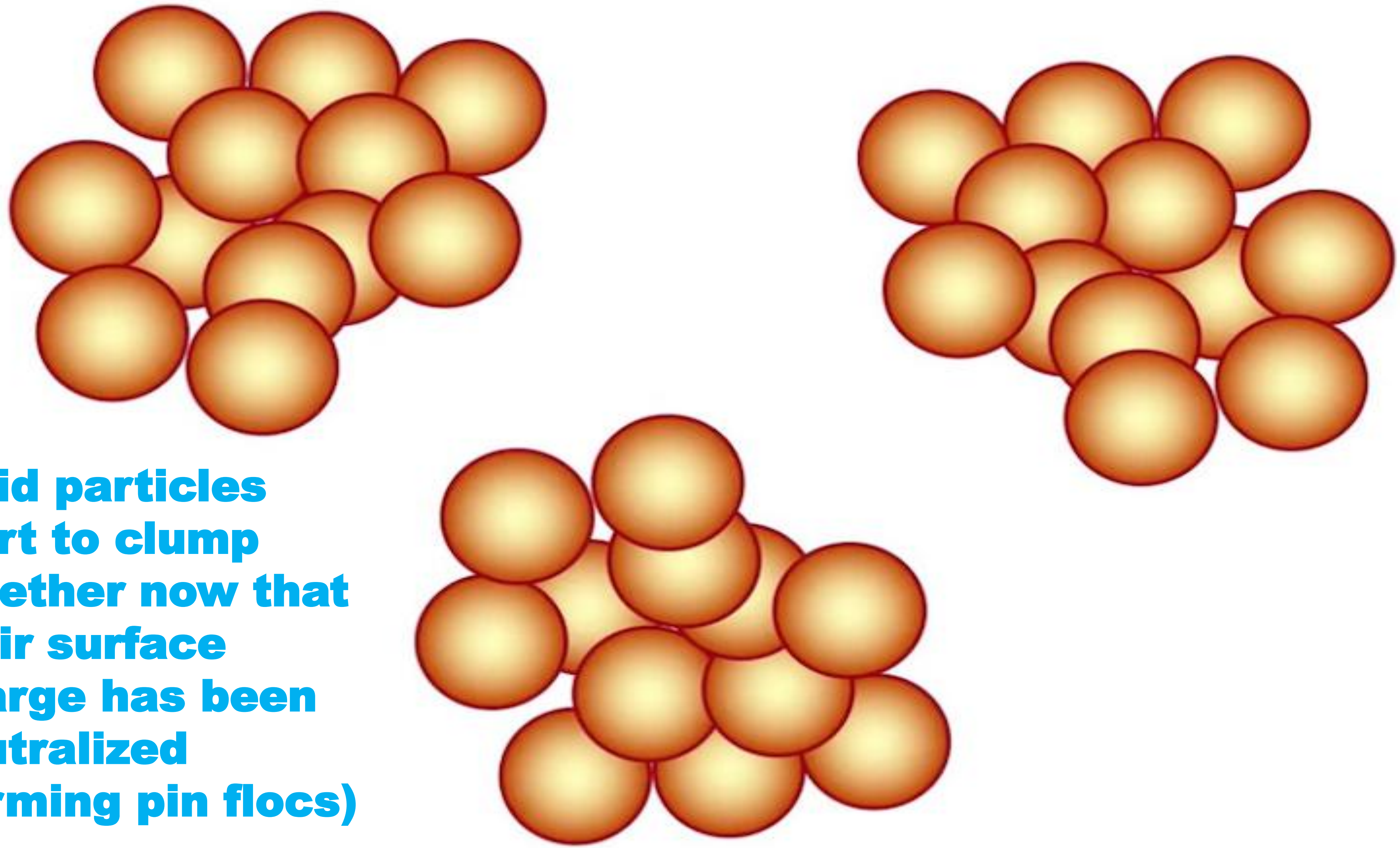


The brown circles represent the solid particles in the effluent; these could be organic or inorganic and fats oils and grease. These solids are all negatively charged and because same charges repel each other, they remain suspended in the effluent as individual particles.



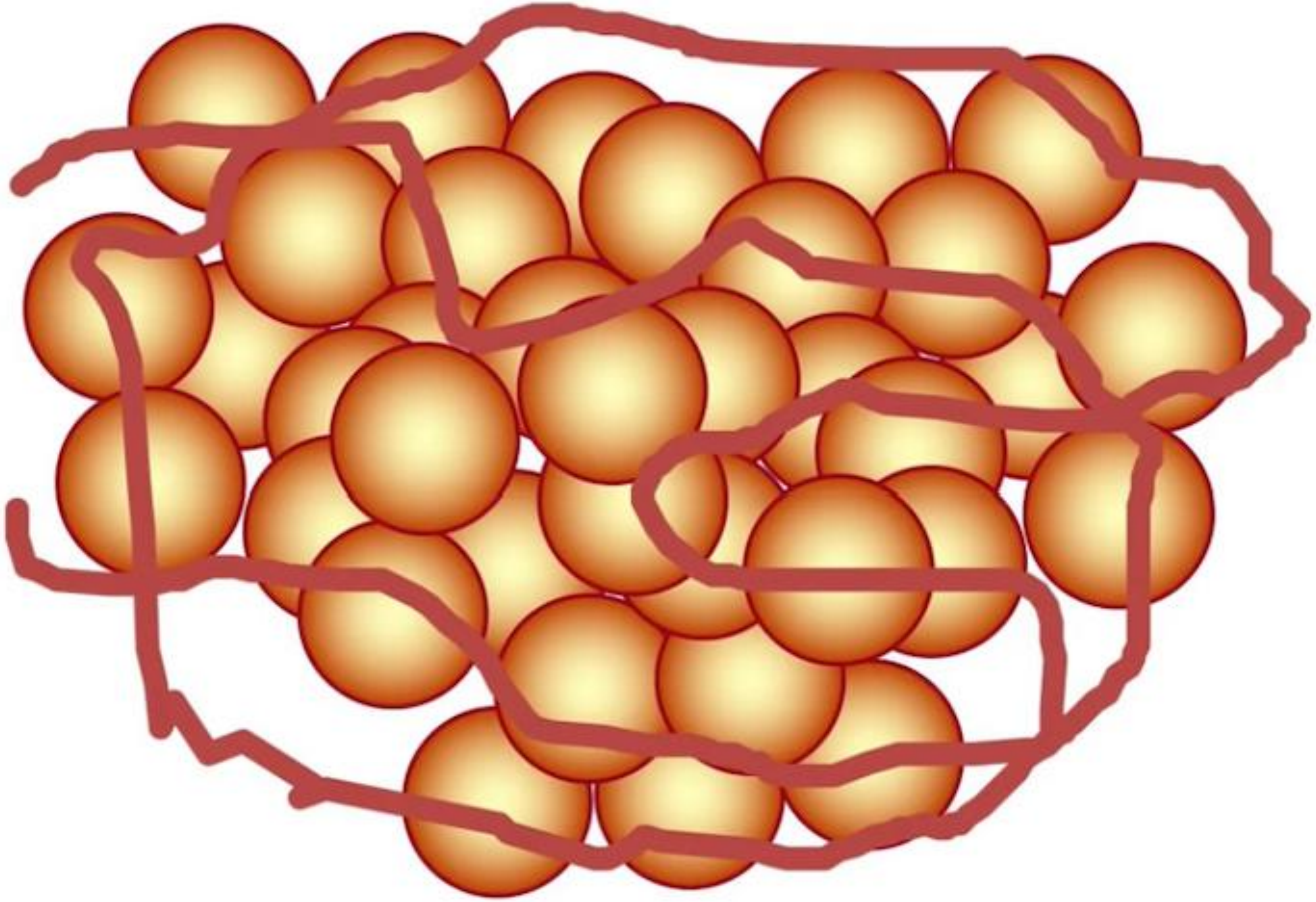
The blue haze represents the negative surface charge around the particle which keeps the flocs repelling each other.


The addition of cationic charges neutralizes the anionic surface charge, allowing the particles to contact each other.



Solid particles start to clump together now that their surface charge has been neutralized (forming pin flocs)

Once polymer is added its long strings collect the pin flocs to form larger flocs



Pin flocs forming in a mix tank after coagulant dosing

Larger flocs forming after polymer has been added in the second stage of the mix tank

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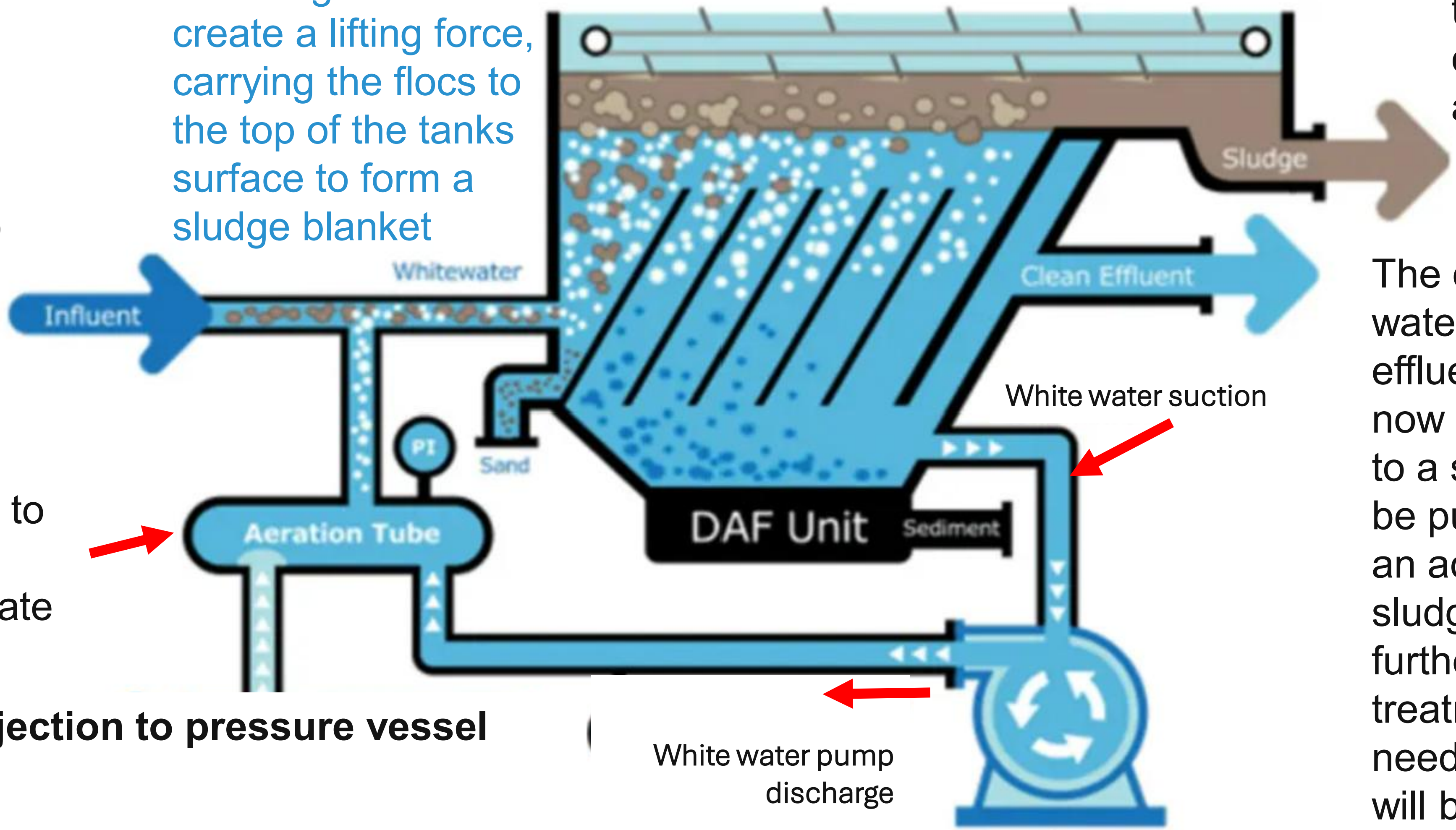
Incoming effluent via the flocculator – if the chemical reaction is efficient the flocs have fully formed on entry into the DAF

White water is added to the incoming effluent to create a lifting force, carrying the flocs to the top of the tanks surface to form a sludge blanket

The sludge is pumped to a holding tank to be collected by a tanker.



White water suction

6 bar minimum pressure is required to dissolve the oxygen into the water to create white water

Air injection to pressure vessel

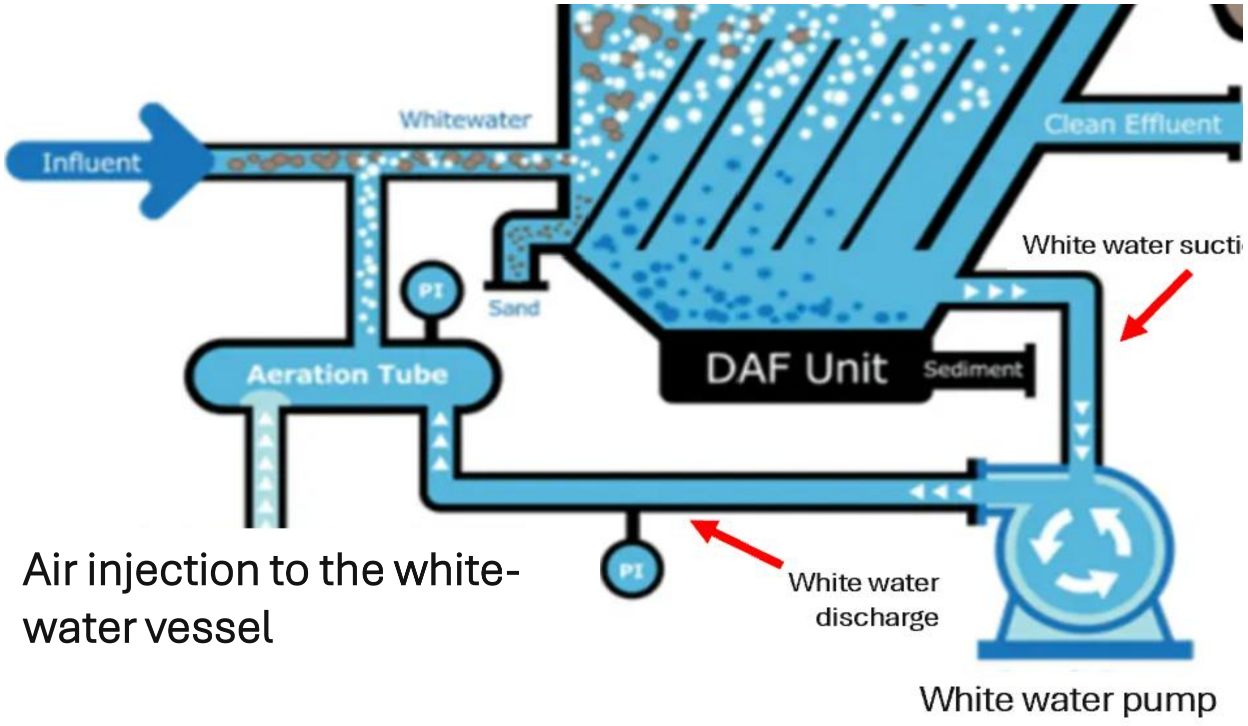
White water pump discharge

White water pump

The clean water (final effluent) will now discharge to a sewer or be pumped to an activated sludge plant if further treatment is needed as it will be discharged to a water course.

Whitewater system

The whitewater system is integral to a DAF's performance. It provides the force to float up the flocs formed and create a sludge blanket. If this system isn't running optimally then "Floc Carryover" will occur meaning flocs have left the DAF via the final effluent, and as the flocs contain suspended solids, fats oils and grease plus the metals from the coagulant used for flocculation, this could cause a failure and breach of consent when discharging to a sewer and will put extra stress on a biological system.



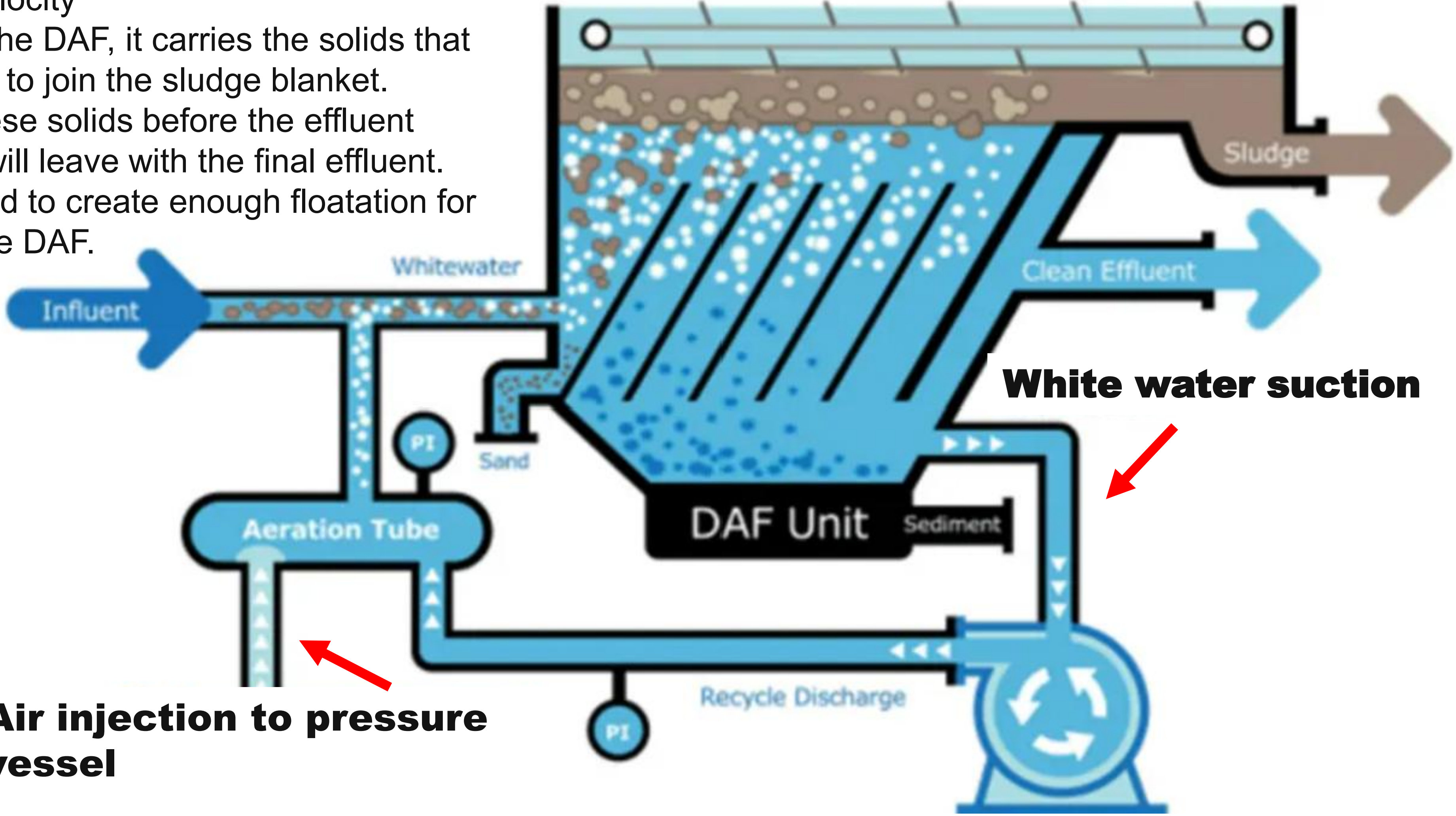
Air injection to the white-water vessel

Through flow velocity vs uplift velocity

- As the effluent flows through the DAF, it carries the solids that must be floated to the surface to join the sludge blanket.
- The white water must float these solids before the effluent leaves the DAF or the solids will leave with the final effluent.
- The whitewater system is sized to create enough floatation for the flow rate and loading of the DAF.

There are two 3 reasons why floc carry over can occur:

1. Inefficient chemical reaction due to inaccurate chemical dosing or inaccurate pH control
2. Too high flow rate through DAF overpowering the whitewater uplift rate.
3. Compromised white water system that cannot provide what it was designed to provide.



White water suction

Air injection to pressure vessel

White water pump

Poor flocculation sample

This is a sample taken from the flocculator sample point before the effluent enters the DAF to test the flocculation quality- this sample shows little flocculation happening and if it does happen it will be too slow causing floc carryover in the final effluent.

The cause of this poor sample was a blockage in the polymer dosing unit. Everything looked ok i.e., the dosing unit was running, there was polymer in the tank, there wasn't any alarms, but the reality was polymer wasn't being dosed and the result was very poor effluent treatment

Good flocculation sample

This sample was taken after the polymer blockage was cleared and straight away a good chemical reaction happened.

You can see that the flocs were quite large and naturally wanted to settle.

Good flocculation and flotation sample

This sample has had some white-water added to assist the flocs float.

The sample shows a fast chemical reaction time and the flocs floating to the top of the bottle.

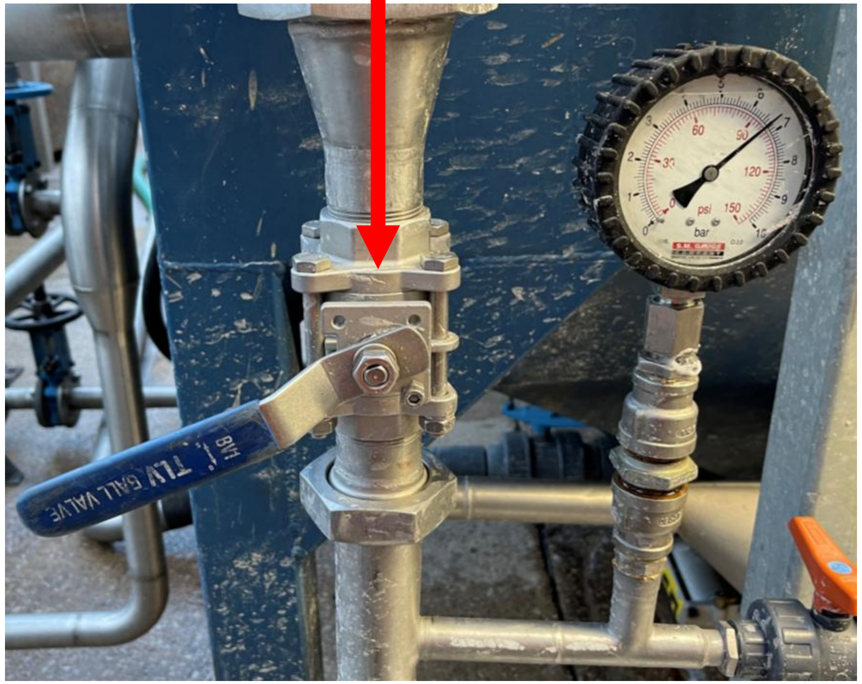
This is a snapshot of what is happening in the DAF and is what the operator should expect to see every time he takes a sample under normal operation.

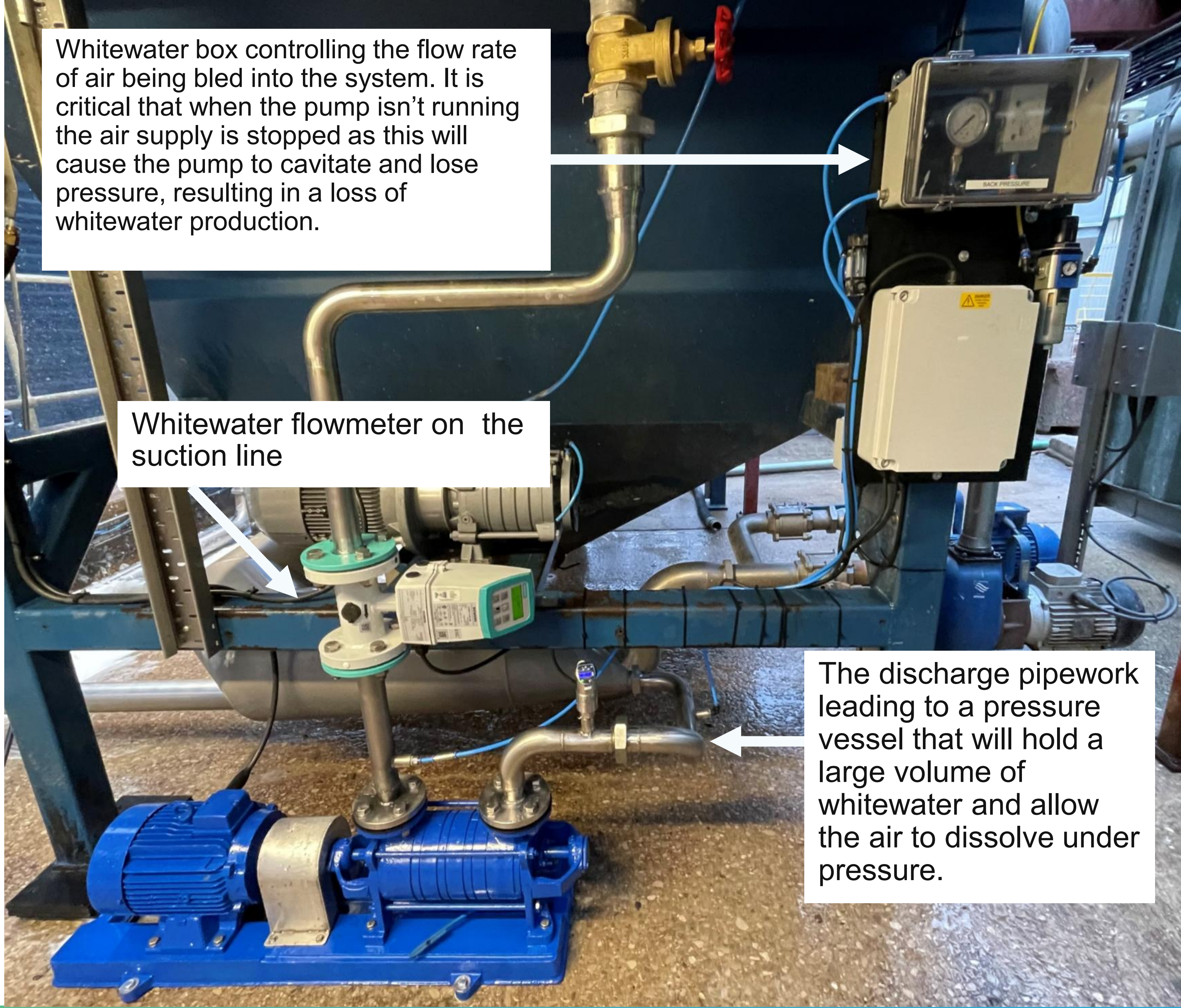
Good quality whitewater

This picture illustrates what good quality whitewater looks like and what too expect when a white-water sample is taken

The whitewater system

The final valve in front of the pressure vessel – this valve is throttled back towards the closed position until the required 6 bar pressure is achieved.





Whitewater box controlling the flow rate of air being bled into the system. It is critical that when the pump isn't running the air supply is stopped as this will cause the pump to cavitate and lose pressure, resulting in a loss of whitewater production.

Whitewater flowmeter on the suction line

The discharge pipework leading to a pressure vessel that will hold a large volume of whitewater and allow the air to dissolve under pressure.

Example: This DAF had been sized with a whitewater system to provide 4m3h min at 6 bar pressure (4 cubic meters per hour)

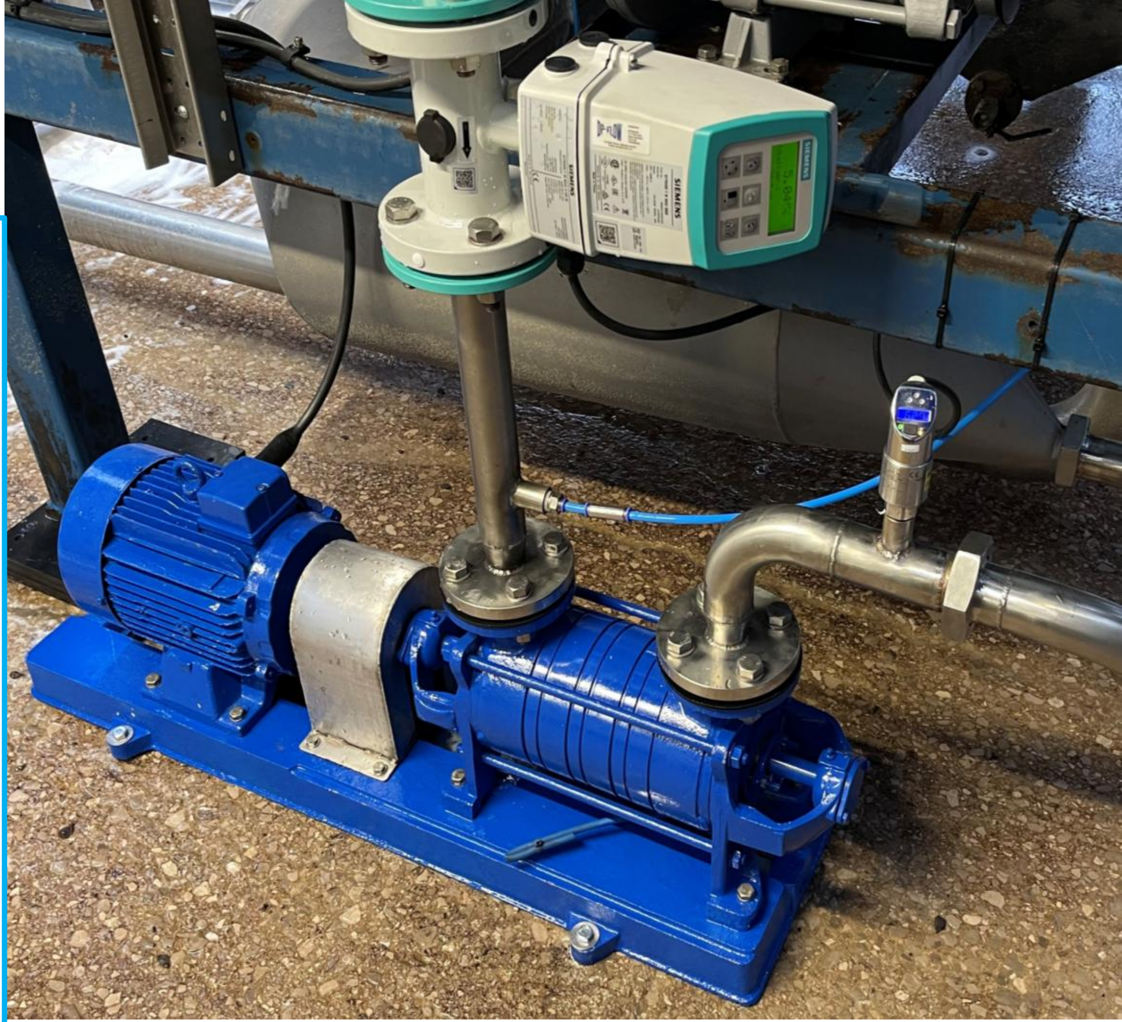
When the pump is new its performance provides
12bar pressure closed valve and12m3h max flow with a fully open valve, producing 1bar of pressure.
As the valve is closed ¼ of its closed position 6bar pressure is achieved with a flow of 10m3h

As the pumps running age increases the pump's performance will drop due to wear and the valve will need to be increasingly closed to achieve the 6bar pressure which will in turn drop the flow rate.

At some point the valve will be closed so much to reach 6bar pressure, the flow rate will drop below the 4m3h minimum flow required for the uplift needed. At this point, the pump should be replaced.

Point to note: the whitewater pump receives water from the final effluent end of the DAF which under normal circumstances should be relatively clean, but if the DAF does start to run poor, isn't cleaned regularly and the sludge settles to the bottom, the whitewater pump will suck in these solids and vastly increase the wear on the pumps and performance will drop faster.

Also, if the pressure vessel valve becomes blocked this will stop the flow of liquid through the pump and the pump will lose its cooling effect. This will eventually cook the pump to disrepair.



The natural degradation of the whitewater pump

The final effluent end of this DAF showing some floc carryover

The next video highlighting a DAF performing well

-The sludge is thick and has the consistency of cottage cheese

-The sludge blanket doesn’t form all the way down to the clean end

-The final effluent is very good quality and there isn’t any floc carryover.

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Sludge is the main waste product of the DAF process, and it can be costly to dispose of through tanker companies.

It is important that the sludge blanket on the DAF tank is produced in a way that it can mature and thicken before being scraped off and pumped to the sludge tanks.

Having a thick sludge blanket on the DAF will help pull other flocs to it and ensure that thick sludge is pumped to the sludge tanks. Filling sludge tanks with large amounts of liquid from foamy sludge and effluent is costly and avoidable.

Sludge also naturally separates whilst in the tanks as it cools and sometime large amount of water can be decanted back down the drain back into the system reducing tanker visits and saving money.

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Part 2:
Activated Sludge

Why is the Activated Sludge process needed?

DAF removal efficiency

Chemical Oxygen Demand (COD (insoluble) 60% to 90% removal)
Total Suspended Solids (TSS 85% to 95% removal)
Fats, Oils, and Grease (FOG 90% to 98% removal)

This level of treatment quality is normally to a good enough standard that the effluent can be discharged to a sewer, however when discharging to a water course such as a stream or a river, the acceptable levels of BOD, FOG, and TSS are much lower and Biological treatment is needed to achieve this.

When discharging into a water course other substances will need to be controlled such as nutrients like Ammonia and Phosphorus, Aswell as any metals present.

The activated sludge plant uses microorganisms to breakdown remaining BOD, Nutrients and Solids before being discharged to the watercourse.

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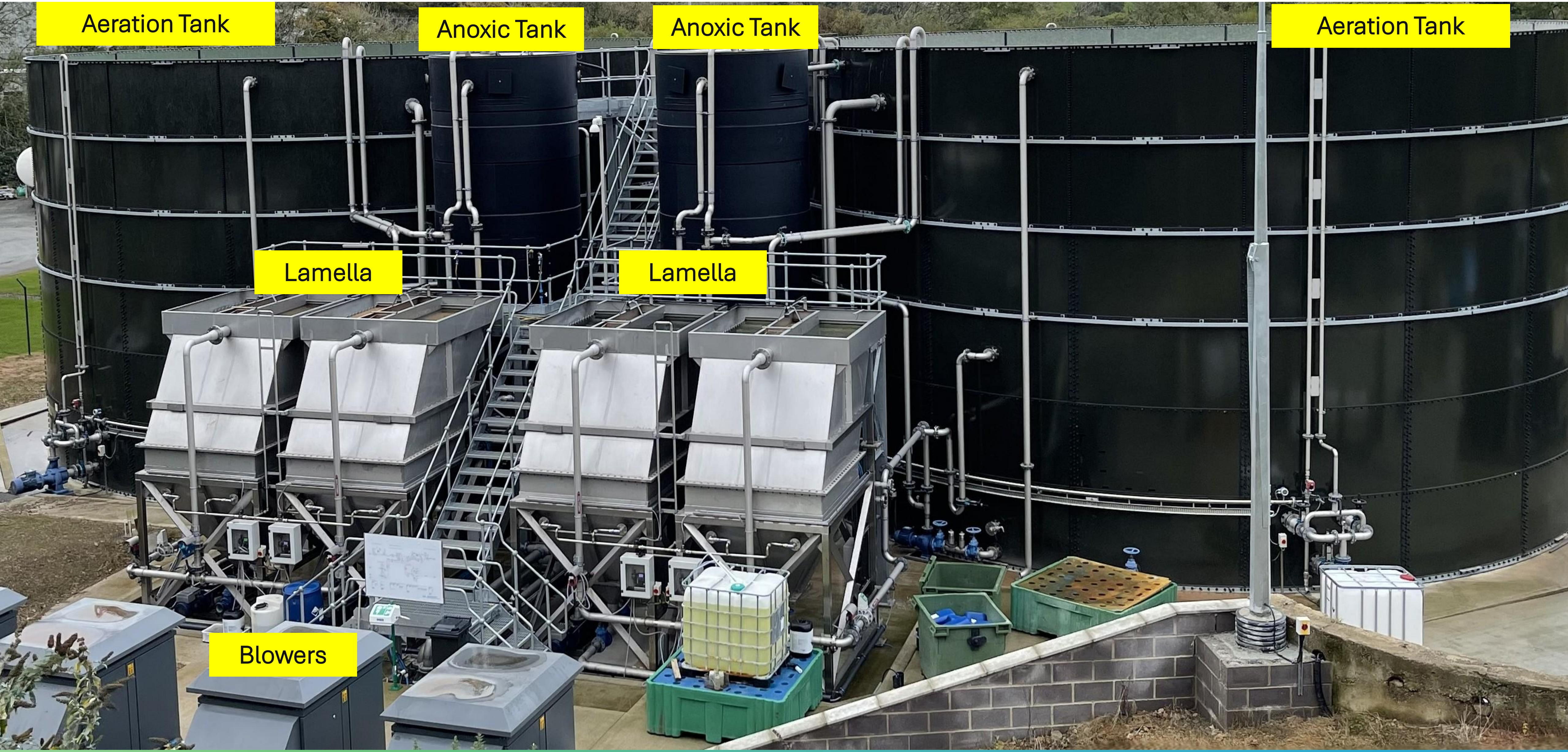

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Aeration Tank

Purpose: Aerobic (with oxygen) BOD removal & Nitrification
BOD removal: Biological Oxygen Demand is a measure of how much oxygen is needed to biologically break down the organic matter within the effluent and is a direct measure of how much organic waste is present.

Types of carbonaceous bacteria present to breakdown BOD:
Protozoa (Flagellates –Ciliates Amoebae)
Metazoa (Rotifers –Nematodes)
Filamentous (these can help form floc structure but if filamentous numbers are too high, they can cause poor settleability in clarifiers and Lamellas.

Ammonia removal (nitrification) Chemoautotrophic bacteria:
Ammonia Oxidizing bacteria **(AOB) –** Nitrosomonas europaea break down Ammonia into Nitrite.

Nitrite Oxidizing bacteria **(NOB)** – Nitrospira and Nitrobacter convert Nitrite into Nitrate.

Note: when measuring total nitrogen in final effluent Nitrate must be removed in an Anoxic process called **de-nitrification**

Incoming effluent from DAF must maintain a pH between 7ph and 8ph.
Below 5pH and above 10pH can cause potential sludge death

Key criteria and parameters within the aeration tank

1. pH – must be maintained between pH 7 and pH 8 (pH 7.5 optimal for nitrification)
2. DO (dissolved oxygen) The microorganisms need oxygen to breath and break down BOD, the more BOD present the more oxygen the organisms will consume. Ideally DO levels should be maintained around 2.0mg/L. Its is important to note that the DO measured is what is excess oxygen that the organisms are not using. Too high oxygen levels is a waste of power from running blowers and aerators. Some forms Filamentous bacteria favor high oxygen levels so it is important to not let filamentous organism populations get too large or settling problems will occur in Lamellas and clarifiers. If DO levels were to drop so low the tank would first become Anoxic whilst Nitrogen was present and then eventually become anaerobic. If this happens the microorganisms will be become dormant and eventually die, the liquor will become black and produce Hydrogen Sulfide. (smell like rotten eggs)
3. MLSS (mixed liquor suspended solids) – this is a measure of the size of the microorganism population. The organisms are constantly growing and dying, and it is important to maintain a certain sized population of around 2000mgl to 4000mg/L. MLSS must be calculated to the volume of liquor in the aeration tank.
4. HRT (hydraulic retention time) – this is the time the liquid stays in the system, this can range from 4 to 24hrs dependent on the effluent make up. HRT can be calculated by (the volume of the liquid in the aeration tank ÷ flow rate through the plant)
5. SRT (solids retention time) (sludge age) 2 to 8 days generally. This is important because sludge is constantly returned from lamellas and clarifiers back to the aeration tank but periodically sludge must be wasted and sent to a sludge tank. This is done for population control and as part of the Phosphorus removal system. If sludge is wasted to soon before its reproductive cycle, then the microorganisms won't have a chance to reproduce, and the population will go down. SRT can be calculated using the following formulae (the volume of the liquid in the aeration tank x MLSS) ÷(wasted activated sludge + sludge leaving the clarifier)

$$HRT = \theta = \frac{V_r}{Q}$$

V_r = Volume of Reactor (Activated Sludge basin)
Q = Flow rate

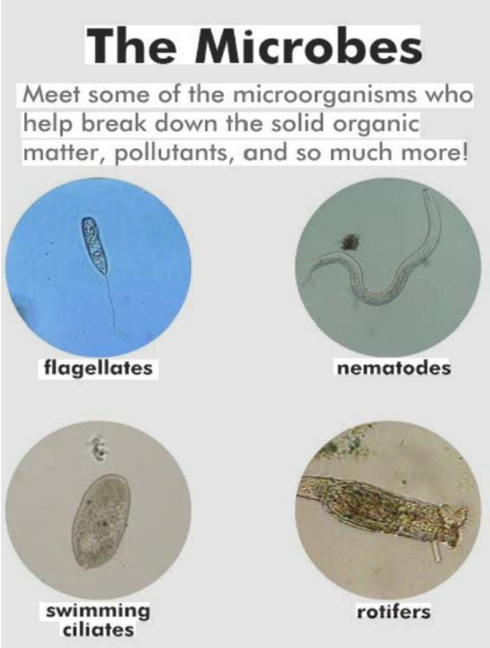
$$SRT = \theta_c = \frac{V_r X_{MLSS}}{Q_w X_w + Q_e X_e}$$

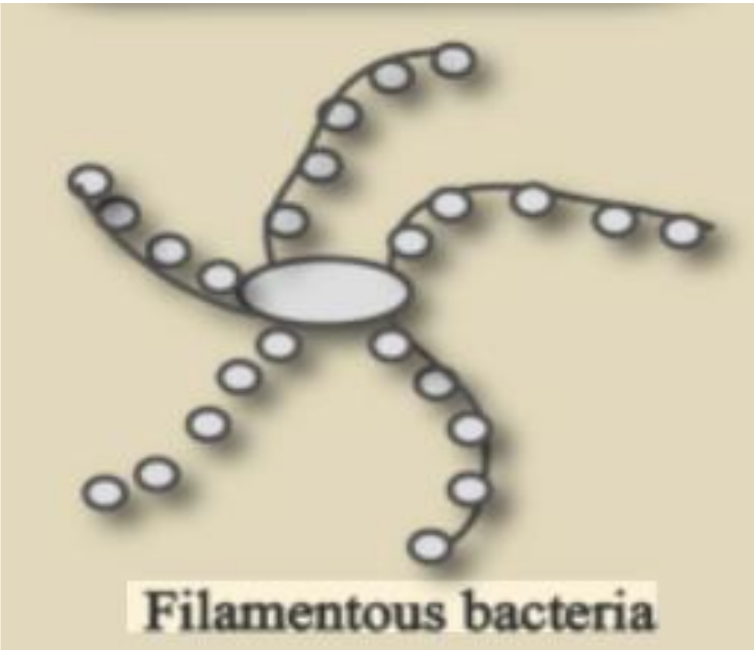
X_{MLSS} = Mixed Liquor Suspended Solids concentration
X_w = Suspended Solids concentration in wasted solids
X_e = Suspended Solids concentration in clarifier effluent

- F/M – Food to Mass Ratio
  - Ratio of influent BOD/day to mass of microorganisms
    - Lbs. BOD/day / lbs. biomass in reactor

Key criteria and parameters within the aeration tank

6. of the organisms present. The bigger the organism the more it can eat, but this must be controlled as if the food coming in is too high the organisms become fat or too big and they become buoyant and settling problems occur in the clarifier. Or they can't break all of the BOD down properly. If the food coming in is too low, then Filamentous bacteria favor these conditions. Normal range is FM Ration (food to mass ratio) how much food (BOD) is coming into the plant relative to the mass 0.2 to 0.5 FM ratio can be calculated using the following formula (BOD per day ÷ mass of microorganisms)





Nutrient removal (nitrogen and phosphorous) within the aeration tank

Nitrogen is a nutrient found in trade effluent and must be controlled when discharging effluent into a water course as it is Hazardous to aquatic life. It comes in forms of Urea (urine) – Ammonia and nitrate.

Ammonia exerts a biological oxygen demand on receiving waters.

Nitrate and Phosphorous both act as fertilizers to plant life and algae. Too much can cause an overgrowth of algae called eutrophication, blocking sunlight killing other plant life and when the algae dies it breaks down and consumes oxygen lowering levels for other aquatic life.

Eutrophication

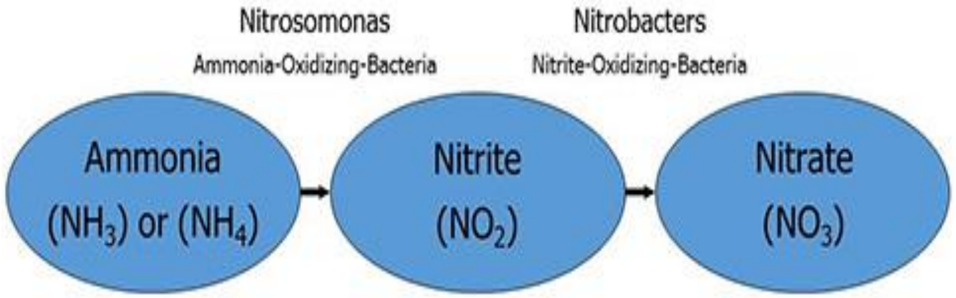
Ammonia breakdown

During the main BOD removal cycle ammonia is broken down through a process called nitrification, the nitrification process breaks down ammonia into Nitrite and then into Nitrate.

Nitrification bacteria are aerobic and require oxygen to respire.

Ammonia Oxidizing bacteria (AOB) – Nitrosomonas europaea break down Ammonia into Nitrite.

Nitrite Oxidizing bacteria (NOB) – NitroSpira and Nitrobacter convert Nitrite into Nitrate.



De-nitrification (Nitrite removal)

Total Nitrogen	mg/l	*20*
Total Phosporus	mg/l	*2*

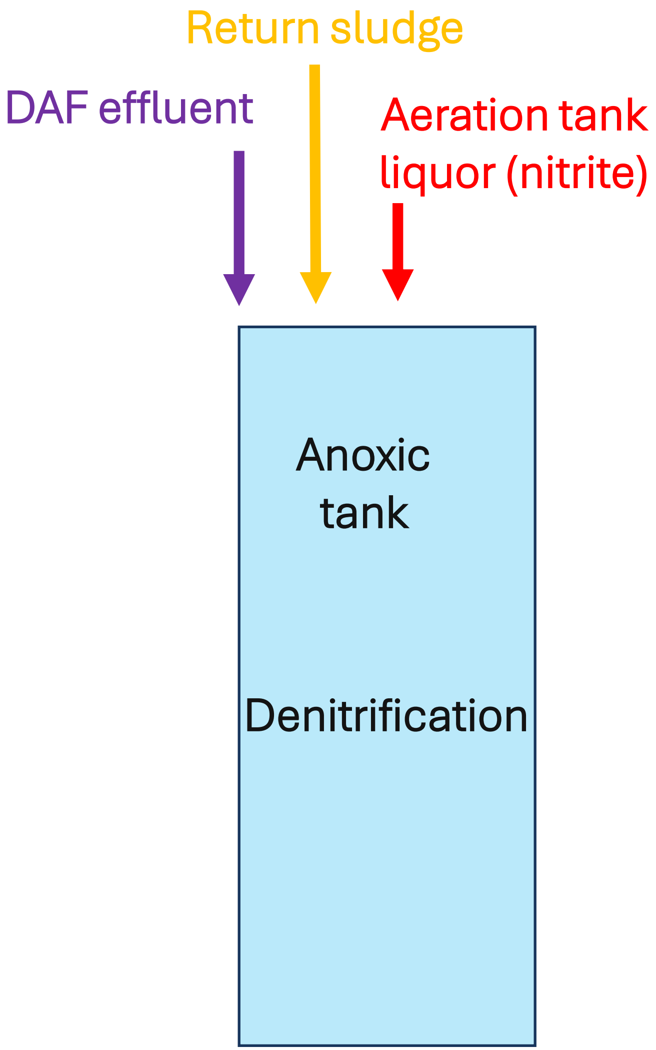
Total nitrogen must be below 20 mg/l
Total phosphorous must be below 2 mg/l

As seen above (total nitrogen) is measured in the permit to discharge and to be compliant Nitrite will need to be removed to be under 20 milligrams per litre.

Nitrite is removed in a process called denitrification. The organisms involved in this process are called Facultative Heterotrophs and they have the ability to switch from being aerobic respirators when dissolved oxygen is available to using carbon as their energy source in anoxic conditions.

When dissolved oxygen levels drop to around 0.2 to 0.5 mg/l the environment becomes what is known as anoxic (has no oxygen but nitrogen is present). In these conditions Heterotrophic bacteria use the nitrite as a carbon source and releases nitrogen gas to the atmosphere.

To create this environment, we use a separate tank at the front of the plant and don't add oxygen. We mix the returned activated sludge from the lamella clarifiers, incoming effluent from the DAF and liquor from the aeration tank into the anoxic tank and denitrification happens achieving levels of 5 to 10 mg/l.

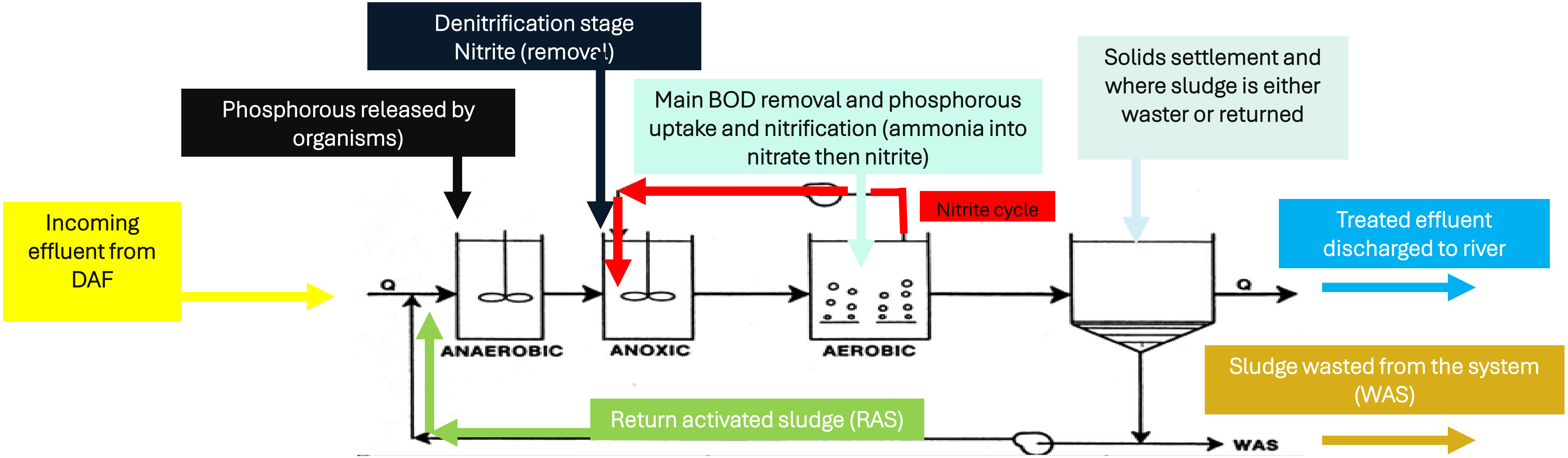


Biological Phosphorous Removal

Some species of bacteria can use a phosphorous compound called ATP (Adenosine triphosphate) as an energy source. These organisms are called Phosphorus accumulating organisms (PAO's)

PAO's absorb phosphorus into their cells whilst in an aerobic environment and release the phosphorous when in an anaerobic environmental (no oxygen or nitrogen).

By cycling the organisms through aerobic and anaerobic stages they over uptake large amounts of phosphorus during the aerobic stage and when the organisms are wasted the phosphorous contained within them is removed from the system also.



MLSS VS MLVSS

When measuring MLSS we are measuring all of the solids within the liquor contained in the aeration system. 60 -80% of those solids will be organisms of every variety

MLVSS test can be done to assess accurately how many organisms are in the solids.

The main BOD consuming bacteria (Heterotrophs) can outcompete nitrifying bacteria by competing for resources. Heterotrophs grow faster and reproduce in 10 to 15 minutes, whereas nitrifying bacteria can take 12 to 36 hours to reproduce.

If BOD is high, Heterotrophic bacteria use up the oxygen, starving the nitrifying bacteria

Wasting sludge is very important to keep the population size between 2000-4000mgl, slow the longer reproduction cycle of filamentous bacteria and remove phosphorous from the system.

It is also important to note that during the summer months encourage rapid sludge growth and metabolic activity, and during the colder month's activity will slow down also.

Difference Between MLSS and MLVSS

Samran Khalid

Parameter	MLSS (Mixed Liquor Suspended Solids)	MLVSS (Mixed Liquor Volattle Suspended Solids)
Definition	Total suspended solids in aeration tank	Organic (volatäle) portion of MLSS
Includes	Organic + Inorganic solids	Only organic (biomàs/ microorganismsn)
Indicates	Total solids concentration	Active microbiàl mass
Measure-ment Method	Drying at 105°C	igniting MLSS sample at 550°C
Typical Range	2,000–5,000 mg/L	60–80% of MLSS
Use in Operation	Monitors total solids loading	Used to evaluate biological activity
Importance	General process control	Critical for biological treatment performance
Test Equipment	Oven + balance	Muffle furnace + balance
Example Value	3,000 mg/L	2,100 mgL (≈ 70% of MLSS)

Factory installation services has over 10 years engineering experience in the building, commissioning and servicing of 15 effluent plants across the UK and provides its services from building and upgrading to the serving and supporting of existing effluent plants nation wide.

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