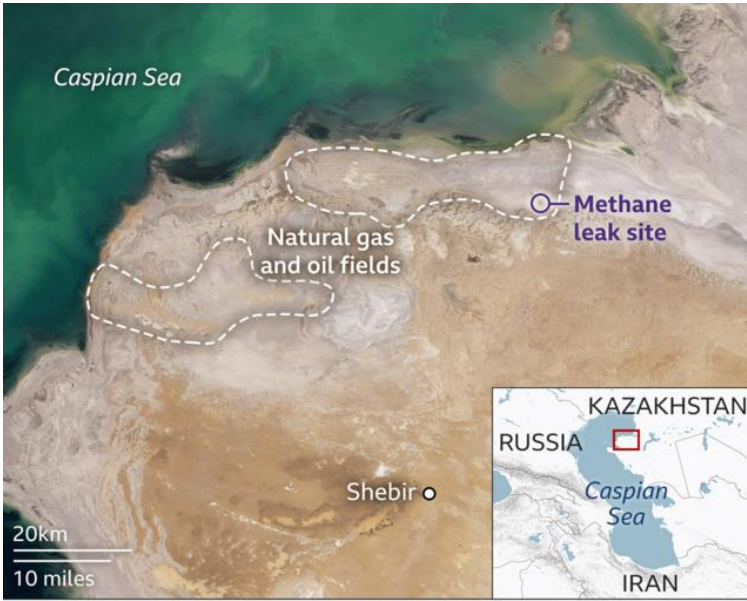
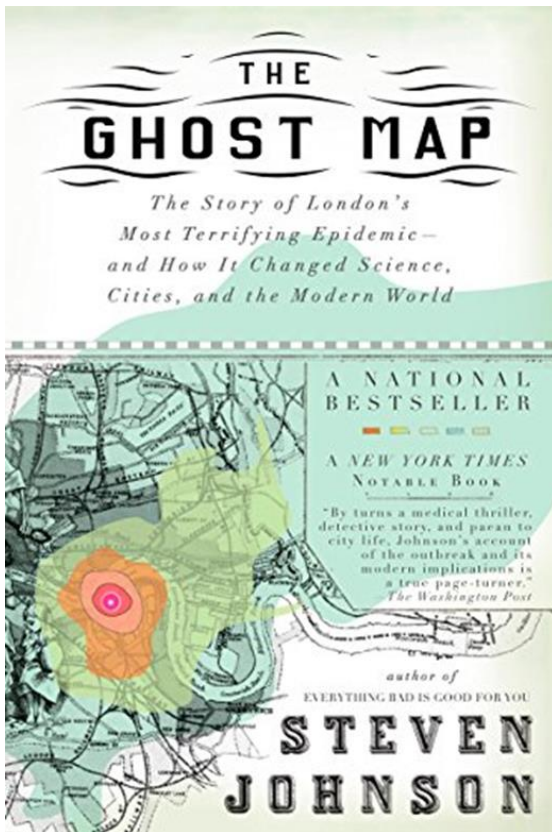


**SUPER EMITTER EVENTS**

**UPDATE ON CHHETAH MITRAS OF KUNO**



Source: Copernicus Sentinel-2, 2 October 2023



**EUROPEAN UNION 'S NEW ENVIRONMENTAL LAW**

**STORY OF THE EVENT THAT SHAPED OUR CENTURY & CIVILIZATION**

### **Message from the editor**

Dear friends, with our first issue up and running we are now gathering an increase in patronage from the water & wastewater industry, we call our community members not only to provide us articles but also their insights developed during the years of experience they had in our field.

I remember yet again about the importance of environmental preservation because it is the temple which is the foundation of our civilization, the temples described by Lord Macaulay in his poem Horatius on the Milvian Bridge where he stood along against an army of barbarians to protect Rome. In the same way all of us should strive for the protection of environment.

“To every man upon this earth, Death cometh soon or late. And how can man die better Than facing fearful odds, For the ashes of his fathers, And the temples of his gods.”

## **NEWS IN SPOTLIGHT**

### **EU Parliament passes nature law despite political backlash**

**BRUSSELS, Feb 27 (Reuters)** - The European Parliament approved a flagship law to restore nature on Tuesday, salvaging at least part of EU plans to protect the environment after farmers' protests ignited a backlash.

The vote took place after weeks of farmers' protests across Europe, including a violent demonstration on Monday outside the European Union's headquarters in Brussels. Among the protesters' complaints are EU green policies that they say impose excessive bureaucracy on farmers.

EU lawmakers adopted the law with 329 votes in favour, 275 against and 24 abstentions.

It passed despite the European People's Party lawmaker group deciding at the last minute to oppose the law, arguing it would subject farmers to more red tape.

The nature law is one of the EU's biggest pieces of environmental legislation, requiring countries to introduce measures restoring nature on a fifth of their land and sea by 2030. EU Environment Commissioner Virginijus Sinkevicius said the policy



contribution to preserve biodiversity, precious ecosystems, healthy soils and waters - first and foremost, for our farmers".

It aims to reverse the decline of Europe's natural habitats - 81% of which are classed as being in poor health - and includes specific targets, for example to restore peatlands so they can absorb CO2 emissions.

Still, the final policy is far weaker than originally planned.

The nature law has faced fierce political backlash since the European Commission proposed it in 2022.

### **Union Minister Bhupender Yadav bats for inclusive development for Cheetah Conservation and Eco-Tourism Hub**

Project Cheetah which has mobilized more than 350 individuals, a part of community engagement as Cheetah Mitras in the remote village of Kuno. The union minister Mr Yadav batted for inclusive development for the local society and the development of the Cheetah reserve. The Kuno reserve was inaugurated by PM Narendra Modi last year in 2023 which marked the beginning of the Cheetah reserve in India where they were extinct since many years. This with a greater vision to develop eco tourism



# Super Emitter Event!

**A methane leak which went for around 6 months released around 1,27,000 tonnes of Methane in atmosphere (Reproduced form Down to Earth article)**

'Super emitter' events refer to instances where a site gushes significant amounts of methane into the atmosphere, primarily detected by satellite data analysis.

The latest addition to this is the Kazakhstan blowout, igniting a fire that burned for over six months. During this period, an estimated 127,000 tonnes of methane was emitted into the atmosphere. This is estimated to be one of the worst methane leaks ever recorded. In Kazakhstan, the environmental impact of the leak is equivalent to the emissions of over 717,000 petrol cars driven for a year, according to the US Environmental Protection Agency's Greenhouse Gas Equivalency Calculator. However, the company that owns the well — Buzachi Neft — has disputed the claim.

Methane emissions are more impactful than carbon dioxide in terms of its effect on global warming. Methane is responsible for about 30 per cent of the rise in global temperatures since the Industrial Revolution, according to the International Energy Agency. It has more than 80 times the global warming potential of carbon dioxide during its first 20 years in the atmosphere and around 28 times the warming potential over 100 years. (Continue reading on following link <https://www.downtoearth.org.in/video/climate-change/what-are-human-caused-methane-super-emitter-events--94643> )

## What can we do about it?

Yes, this is a direct conversation with our reader! Again!

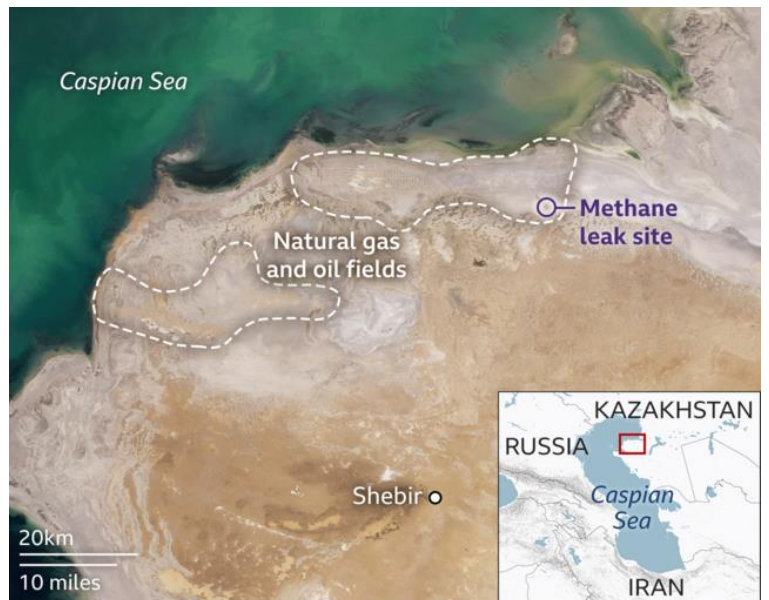
Have you thought about changes in your lifestyle (small and big) to solve this problem?

Let's start small! Let's use less fossil fuels!

#EAAcares

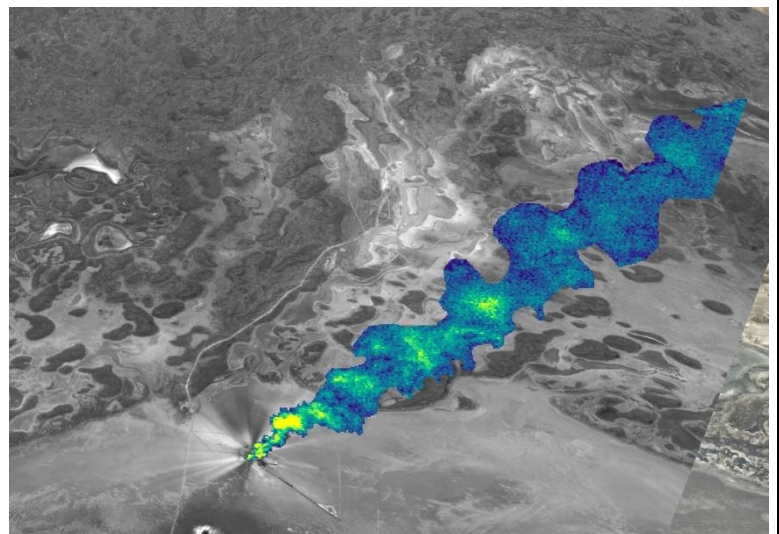
Small steps we can

1. Take a walk.
2. Use as much solar or renewable energy.
3. Compost your kitchen waste
4. Eat less meat (Cattle farming contributes 40% of total methane emission globally)



Source: Copernicus Sentinel-2, 2 October 2023

BBC



Satellite imagery from a MethaneSAT showing the methane plume (Source <https://www.geospatialworld.net/> )



Photograph for the actual oil spill (Source Google Images)

# LATEST NOTIFICATIONS

## **Ministry of Environment, Forest & Climate Change**

1. **FEBRUARY 13, 2024 | S.O.414(E) 29-1-2024:** Draft Certified Environmental Audit for audit of projects, activities and processes, approved under the Environmental Protection Act, 1986
2. **FEBRUARY 13, 2024 | S.O. No. 5409(E) [21.12.2023]** Draft Amendment in the Notification of Eco-sensitive Area around Doon Valley, in the state of Uttarakhand
3. **FEBRUARY 22, 2024 | S.O. 884(E), dated February 22, 2024,** in furtherance of the Green Credit Rules, 2023, formulated under sections 3, 6, and 25 of the Environment (Protection) Act, 1986.

## **National Green Tribunal- Order, reports and publications**

1. **JULY 2023 | Bird's eye view of NGT performance in the last five years (July, 2018 – July, 2023)**

Refer following link:

[https://greentribunal.gov.in/sites/default/files/important\\_orders\\_NGT\\_Initiatives%20final-1.pdf](https://greentribunal.gov.in/sites/default/files/important_orders_NGT_Initiatives%20final-1.pdf)

2. **DECEMBER 2023 | Direction to all ULBs to new treated sewage effluent standards for new & existing sewage treatment plants** (pH 5.5-9; BOD 10 mg/l, TSS 20 mg/l, COD 50 mg/l, Total N 10 mg/l, Total Phosphorous 1, Faecal Coliform (count/100 ml), Desirable 100, permissible-230)

## **NABL important notifications & updates related to testing laboratories**

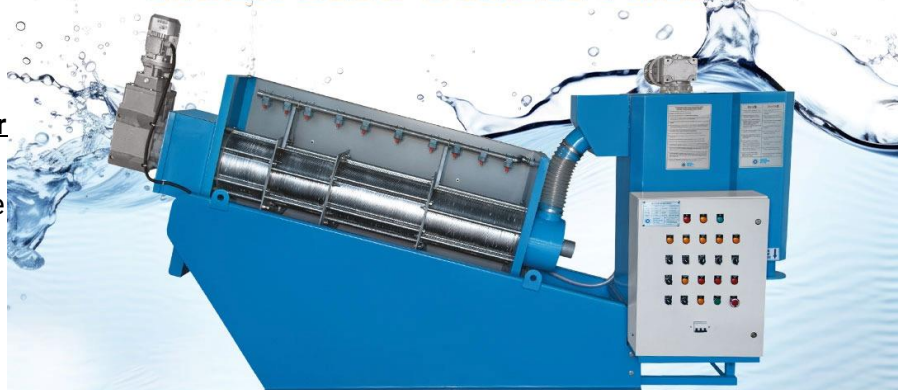
1. NABL 160 " **Guide for Preparing Management System Document / Quality Manual** ", Issue No. 07, Issue Date 11-Sep-2018, Amendment No. 03, Amendment Date: 22-Feb-2024
2. NABL 161 " **Guide for Internal Audit and Management Review for Conformity Assessment Bodies (Laboratories / PTP / RMP)** ", Issue No. 06, Issue Date 05-Feb-2022, Amendment No. 01 Amendment Date: 22-Feb-2024
3. NABL 218 " **Desktop Surveillance** ", Issue No. 03, Issue Date 09-Apr-2016, Amendment No. 06 Amendment Date: 21-Feb-2024
4. NABL 160 " **Guide for Preparing Management System Document / Quality Manual** ", Issue No. 07, Issue Date 11-Sep-2018, Amendment No. 03, Amendment Date: 22-Feb-2024
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6. NABL 218 " **Desktop Surveillance** ", Issue No. 03, Issue Date 09-Apr-2016, Amendment No. 06 Amendment Date: 21-Feb-2024



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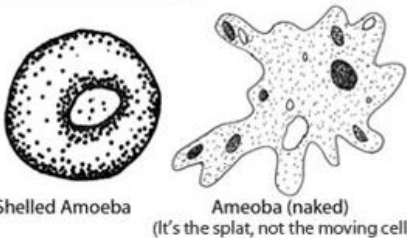
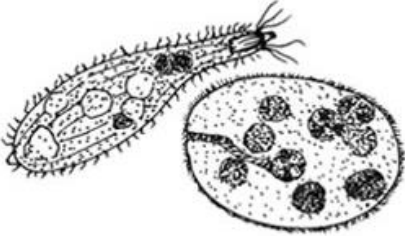


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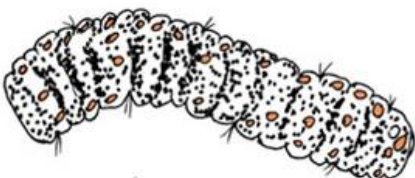
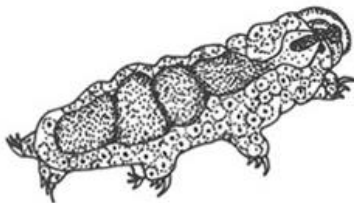
Bacteria is in all the video in the background FLOC. It doesn't move. You can click here to see a photo.



Shelled Amoeba

Amoeba (naked)  
(It's the splat, not the moving cell)

No flagellate video



**Bacteria:** Our wastewater treatment plant works like a river. Our aeration basins have two kinds of water:

- Gently flowing water that does not have a lot of oxygen
- White water that has lots of oxygen

We pump lots of compressed air into some of our aeration basins to make them frothy, like white water.

Some bacteria like white water better. Some prefer gently flowing water better. We need both kinds of bacteria to clean the water.

**Swimming Ciliates:** These one-celled microorganisms are covered with cilia, or hair-like projections. The cilia are used to move the ciliate around and to capture food. Food vacuoles are formed which are like little membrane sacks that store food as well as digesting it.

The swimming ciliates reproduce by dividing, but can also share DNA with another cell before dividing.

**Crawling Ciliates:** Crawling ciliates are like swimming ciliates except that their cilia are found on the lower surface of their body. The cilia has also fused together to form what is called "cirri" or thicker cilia. These cirri look like legs and they are used for crawling. The crawling ciliates are not very good at swimming.

**Stalked Ciliates:** Stalked ciliates are single-celled organisms that grow a stalk or filament that can rapidly coil up like a spring to avoid danger.

These cells reproduce by division into two daughter cells. One of the cells will keep the stalk, but the other will become a free-swimming cell until it finds a place to attach. It will then grow a stalk and stay there. Like other ciliates, these cells can share DNA with another cell before division.

To find food, stalked ciliates use the cilia which are located around the top of the cell.

**Amoebas:** When amoebas sense food nearby they extend a pseudopod (false foot) and surround the food, bringing into their cell.

Shelled amoebas make a shell either by secreting chemicals or by collecting particles to build the shell. Spaces are left in the shell so pseudopods can move past the shell and into the water to reach the food.

Amoebas eat bacteria, algae, and other single-celled organisms.

**Flagellates:** These single-celled organisms move by whipping around their flagella, a threadlike projection from the front of the cell.

**Rotifers:** The most common animals in the wastewater are rotifers. These microscopic animals feed on bacteria or algae or even microbes.

The body of a rotifer consists of three parts, the head (with cilia to bring in food) a trunk, and a tail or foot that it uses to attach itself.

Rotifers can reproduce sexually and lay eggs.

Except for their eyespot, rotifers are colorless.

**Water Bears:** Although difficult, it might be possible to see a water bear without a microscope. These little animals can be as large as 1 mm or about one thirtieth of an inch. They do not swim and prefer to crawl. They suck the juices of plants or small animals.

Water bears are amazing animals and worth study. Under extreme conditions, the animals can reduce body moisture from 85% down to 3%. They can survive in this state for years. In 2007, water bears survived a trip into space for 10 days and survived with no air, no water, and intense rays from the sun.

**Bristle Worms:** These long, segmented worms have bright orange or pink spots. They reproduce by budding at a particular segment. They use their bristle-like setae to move. These animals are the largest animals in wastewater and can be as large as one quarter of an inch long.

## MICROBIAL FLORA & FAUNA CONSTITUING THE ACTIVATED SLUDGE FLORA & FAUNA

Source:

[http://www.havasuwatersavers.org/wastewater\\_treatment](http://www.havasuwatersavers.org/wastewater_treatment)

.php

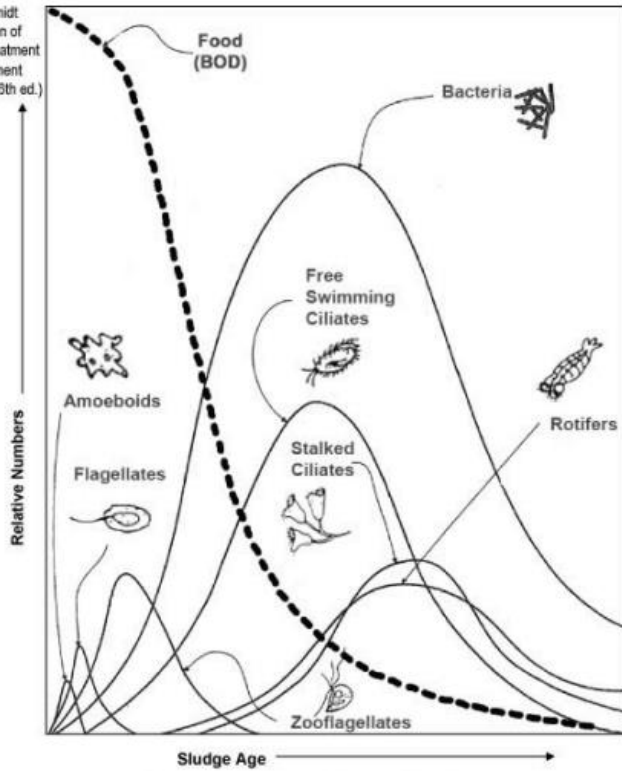
&

Process control of activated sludge process by microscopic investigation

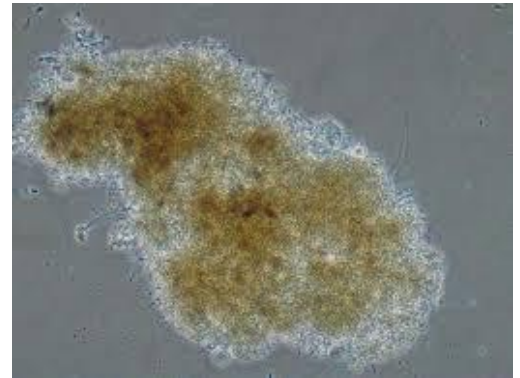
By David Eikenboom

# IDEAL OPERATING CONDITIONS- ACTIVATED SLUDGE PROCESS

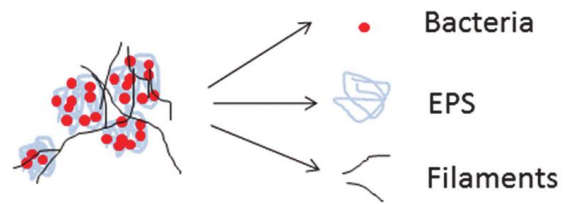
Courtesy of Amy Schmidt (WIDNR) and Operation of Municipal Wastewater Treatment Plants, Water Environment Federation (WEF) (Vol. II, 6th ed.)



The growth of microorganisms over time (sludge age) due to the presence of food (BOD) in the

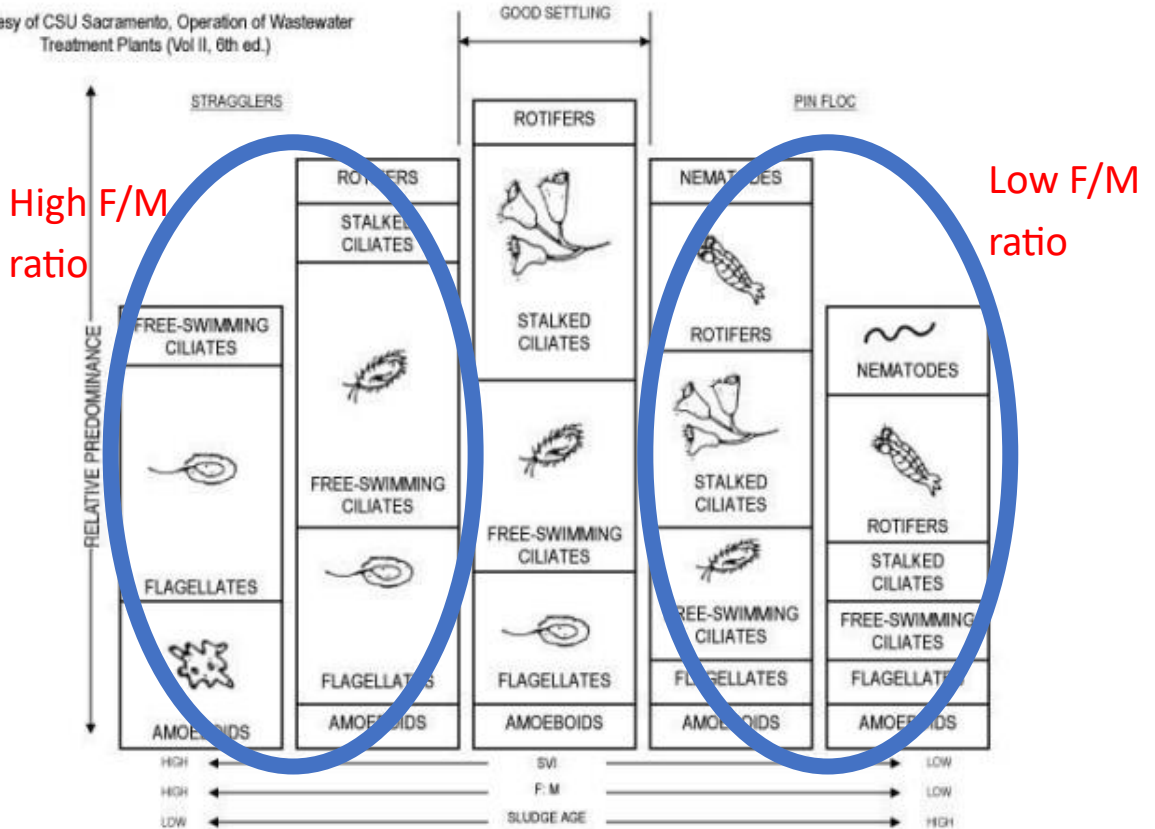


GOOD FLOC- Activated Sludge Floc (under microscope)



Composition of activated sludge floc

Courtesy of CSU Sacramento, Operation of Wastewater Treatment Plants (Vol II, 6th ed.)



It can be observed that in the activated sludge microbiology it is very important to maintain the Food to Microorganism ratio to provide good settling properties and maximum BOD removal. An ideal condition with respect to microbial morphology is provided, although a F/M ration can be calculated, microscopic investigation of activated sludge gives a greeter insights as to why is the settling disturbed ? or why is the there BOD reduction ? and several other issues. Typically, ideal F/M ratio is different for different ASP configurations like SBR, MBBR, Extended Aeration, MLE, A2O, Oxidation Ditch etc. one is recommended to refer Metcalf and Eddy for the same.

## TOUBLESHOOTING STRATEGIES

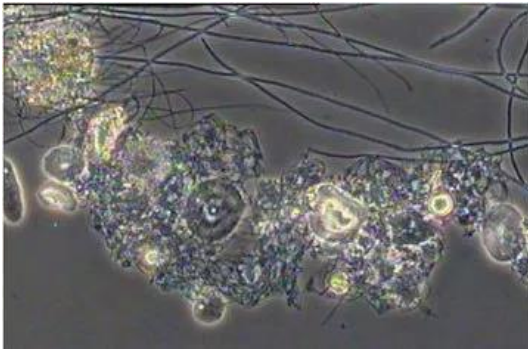
### 1. High Pin Floc/ Very Low SVI despite high MLSS

**CAUSE-** Very high SRT but not optimal to cause granulation.

**IMPACT-** Effluent is turbid, COD/BOD removal hampered.

#### REMEDIES-

- Waste Sludge!! But optimal (Run calcs as per standard equations to maintain an optimal SRT). It sound counter intuitive as the sludge volume as seen in the SVI test is very low, however, this is due to granulation of sludge and can only be controlled by reducing the SRT
- Increase organic load.
- SHOCK the aeration with a slug load. Jaggery/ Methanol is cheapest (Make sure no hydraulic load in permitted for no less than 12 hours)
- Micrograph show high flagellates and low F/M



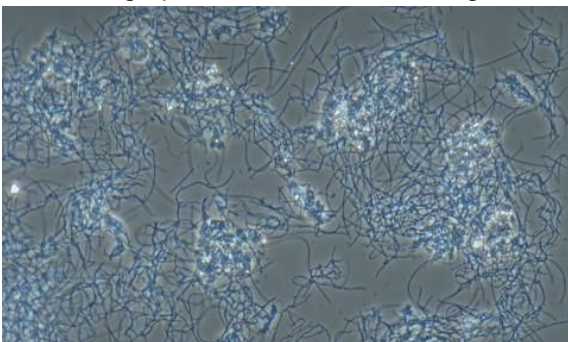
### 2. Filamentous growth / High SVI (Bulking sludge)

**CAUSE-** Very high SRT but not optimal to cause granulation.

**IMPACT-** Effluent with highly turbid due to poor settling

#### REMEDIES-

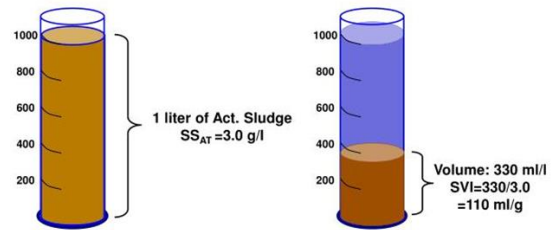
- Reduce the organic load – Starve out the filaments.
- SHUT THE BLOWERS!!! (for max 8 hours)
- SWING STRATEGY (FAST & FEAST)- This enhances granulation. In this strategy, to grow an optimized sludge the aeration tank is feed with pulse organic load of 30% of its daily capacity in form of solid carbon source like jaggery or methanol, stopping the service flow for the day and keep aeration On for next 6-8 hours, this will create a swing between fast and feast conditions. Repeat this process 2-3 times on the same day
- Micrograph of the filamentous sludge



## Sludge Volume Index

Start of Test

After 30 min



#### → In this Example

- Sludge Volume Index SVI = 110 ml/g or l/kg
- (Diluted) Sludge Volume SV = 330 ml/l or l/m<sup>3</sup>

13

Note: It is a common misconception that sludge volume is mistaken as sludge volume index, both are different and shall be understood properly to understand the settling properties of the sludge

Various conditions represented herewith in schematic

#### Ideal, Non-Bulking Activated Sludge Floc

- Filamentous organisms and floc forming organisms in balance
- Strong, large floc
- Filaments do not interfere
- Clear supernatant
- Low SVI

#### Filamentous Bulking Activated Sludge Floc

- Filamentous organisms predominant
- Strong, large floc
- Filaments interfere with settling, compaction
- Clear supernatant
- High SVI

#### Pin Point Floc

- Low filamentous organisms
- Weak, small floc
- Turbid supernatant
- High SVI

8

### 3. Rising sludge

Sometimes sludge that has good settling properties will be observed to rise or float to the surface after a relatively short settling time in small islands of sludge mass floating on top of clarifier.

**CAUSE-** Denitrification in secondary clarifier in which nitrates and nitrites and converted to the nitrogen gas and which gets entrained in the sludge making it buoyant, light and making it rise to top

**IMPACT-** Effluent with highly turbid due to poor settling

#### REMEDIES-

- Increasing RAS and reducing detention time in the secondary clarifier which reduces the anoxic conditions in the secondary clarifier
- Reducing the SRT by more sludge withdrawal if all other matters are stable
- If possible, increase the speed of sludge scrapper

There are numerous issues from which we were able to discuss 3 major and most common, however the inquisitive reader is encouraged to read more of the Process control of activated sludge process by microscopic investigation By David Eikenboom and Metcalf & Eddy for more detailed understanding.



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## BOOK REVIEW

### *The Ghost Map— by Steven Johnson*

Reprinted from

<https://www.blinkist.com/en/books/the-ghost-map-en>

#### The Cholera Outbreak in London

In *The Ghost Map* by Steven Johnson, we are transported to London in 1854, a city grappling with a deadly cholera outbreak. The disease, which causes severe diarrhoea and dehydration, is spreading rapidly, and the medical community is at a loss to explain its cause or find a cure. The prevailing theory at the time is that cholera is transmitted through miasma, or foul air, and this belief has led to misguided public health policies.

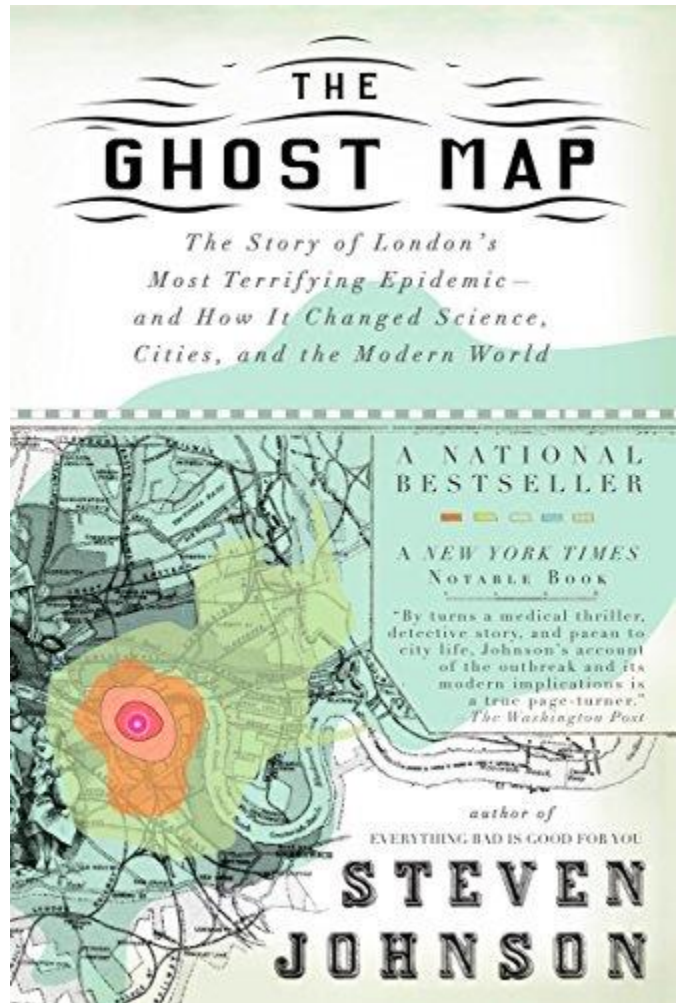
Johnson introduces us to Dr. John Snow, a pioneering anaesthetist who suspects that cholera is not airborne but waterborne. He begins mapping the locations of cholera cases in Soho, a particularly hard-hit neighbourhood, and discovers a cluster of cases around a public water pump on Broad Street. Snow's findings challenge the miasma theory and suggest that contaminated water is the source of the outbreak.

#### The Birth of Epidemiology

As Snow continues his investigation, we are introduced to Reverend Henry Whitehead, a local clergyman. Initially sceptical of Snow's theory, Whitehead becomes convinced of its validity after conducting his own interviews with the affected families. The collaboration between the scientifically trained Snow and the community-connected Whitehead is a testament to the power of interdisciplinary approaches in solving complex problems.

Together, Snow and Whitehead's work marks the birth of modern epidemiology. They identify the contaminated Broad Street pump as the source of the outbreak and convince local authorities to remove its handle, effectively halting the spread of cholera in the area. Their efforts provide compelling evidence for the waterborne transmission of the disease and lay the groundwork for future public health interventions.

#### Urbanization and Public Health



Johnson uses the Soho cholera outbreak as a lens to explore broader themes of urbanization and public health. London, like many other cities during the Industrial Revolution, was experiencing rapid population growth and inadequate infrastructure. The lack of proper sanitation and clean water made urban dwellers particularly vulnerable to infectious diseases like cholera.

However, the Soho outbreak also serves as a turning point. Snow and Whitehead's investigation prompts a re-evaluation of public health policies, leading to improvements in urban sanitation and the establishment of water filtration systems. Their work demonstrates the potential for scientific inquiry to drive positive social change and highlights the importance of evidence-based decision-making in public health.

(The complete review can be accessed at [https://www.environmentandsociety.org/sites/default/files/rachelcarson\\_silentspring\\_version2\\_1.pdf](https://www.environmentandsociety.org/sites/default/files/rachelcarson_silentspring_version2_1.pdf))



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# TECHNOLOGY REVIEW

## **AIR BLOWERS, the gold mine of our ETPs and STPs?**

**(Author- Urv Patel, SWA Environmental Consultants & Engineers)**

Yes, it is indeed a gold mine, only that the effort must be put in design, installation, and proper equipment selection to mine gold out of our air blowers we use in the ETPs and STPs.

Anybody who has design and executed a biological based wastewater treatment plant, must know that the 80% of power consumption in a biological treatment process is from the air blowers. Air blower serve the most fundamental and critical function of the supplying oxygen to the aerobic oxidising bacteria (AOBs) responsible for BOD removal. However, it is often overlooked aspect in terms of design optimization and the deployment so that the power consumption is minimal.

In this article we aim to discuss, on how we can use sound engineering principles, design strategies, configurations, and technology to optimize our power consumption. Let us look for the aspects in logical order or progression from most fundamental to the more tertiary:

1. Design of oxygen requirement/ air flow
2. Selection of tank depth / discharge pressure
3. Selection of diffusers
4. Selection of blower typology

### **Aspects 1: Design of oxygen requirement**

The most optimal way to design is the equation provided in the Metcalf & Eddy Edition 5 Page no 429 Section 5-11

$$AOTR = SOTR \left( \frac{\beta C_{s,1,H} - C_L}{C_{s,20}} \right) (1.024^{T-20}) (\alpha) (F)$$

This takes into account not only the temperature of the wastewater which has profound effect on the solubility of oxygen but also the barometric pressure, tank depth and the various correction factor.

A good free resource for the calculation based on the aforementioned principle can be referred to in the following link:

<https://swaenviro.com/calculate-blower-size/>

It provides an online calculator for the BOD removal design as well as nitrification demand.



### **WASTEWATER TREATMENT PROCESS DESIGN CALCULATOR | NO 2**

Activated sludge process – Blower sizing  
(Blower sizing for BOD removal only excluding nitrification demand)

### **Aspect 2: Selection of tank depth**

Tank depth is another very critical parameter for optimization of the blower power consumption. The depth has a direct proportional effect on the transfer efficiency of the air bubbles released by from the diffusers, generally in cases of a typical fine bubble diffusers, it is 5-6% per meter of water depth above the diffuser surface. Example, if the tank water depth is 5 meter then the pressure above diffuser is 4.8 m in water column, after subtracting the 200 mm depth below the diffusers.

As a generally rule of thumb it is always more optimal for the tank depth to be more than 3 m and up to 5.5 meter for optimal air flow requirement. As the water depth above diffusers increase although the transfer efficiency increases, the discharge pressure also increases which also increases the kW of blower. So, it is a fine balance which needs to be worked out.

Typically for larger installation beyond 250-500 KLD and above a tank water depth of 5-5.5 m is preferred. For lower capacity plants <100 KLD a tank depth of 3.3-3.5 meter is preferable for economy.

Generally, below 2.8 meters, it becomes exponentially uneconomical as higher air flows compared to the head required more no of diffusers, and thus lower than 2.8 m water depth is not preferable.

Moreover, having a more than 6 meter of water depth results into higher discharge pressure requirement which also results into creating a requirement for liquid cooled blowers instead of air cooled. This additional utility itself not only increases the capex of the blower, but also results into more power consumption.

Thus, a range of 3-5.5-meter water depth is preferred in terms of tank depth selection.

**Aspect 3: Selection of diffusers**

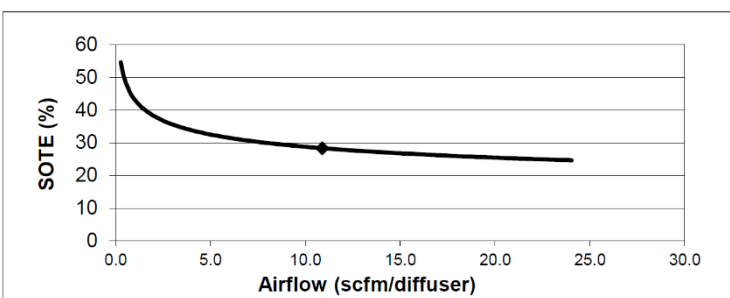
It is now a general industry standard practice to use fine bubble diffusers which are of primarily 2 configurations tube type and disc type. It has been found that generally disc type is slightly better about 2-5% compared to tube type diffusers in term of SOTE or the standard Oxygen Transfer Efficiency.

It should also be noted that following are the sized for the tube and disc type diffusers and their recommended air flow rate per diffuser-

Sr No	Type	Recommended design flow per diffuser (Ncum/hr)*
<b>Tube type</b>		
1	1000 mm long x 63 mm Dia	6-7
2	1000 mm long x 90 mm Dia	11-13
3	500 mm long x 63 mm Dia	4
<b>Disc type</b>		
1	12-inch Dia	11-13
2	9-inch Dia	6-7

\*verify with vendor, this is for guidance only

It can be observed from the below mentioned SOTE versus air flow per diffuser that the as the air flow rate reduces the SOTE increases and reaches an optimal point, ask your vendor regarding this SOTE curve and then select the number of diffusers which gives you the



Courtesy EDI diffusers datasheet for 1000 mm long 90 mm Dia

most optimal results in terms of lowest blower capacity and optimal number of diffusers. This cost benefit analysis is very critical especially in terms of larger plants.

**Aspect 4: Selection of aeration/ blower technology**

After optimizing the above 3 aspects the last but not the least point which remains critical for reducing blower energy consumption is the type of blower technology.

There are 3-4 major types of blower technology which has its own benefits and drawbacks:

- Roots blower** – This is most prevalent and widely used blower technology since last 50 years, which is normally used in conjunction with fine bubble diffuser technology. In this you can select 2 sub types depending on the size of blower, i.e. twin lobe and tri-lobe. If the blower size to be used is not more than 1000 cum/hr, the twin lobe technology is at par with tri lobe which an advantage of lower speed compared to the same size tri lobe blowers. Moreover, tri lobe blowers are better at higher flows (5% higher efficiency) and more dynamically stable and reduced ear and tear
- Surface aerators- these are much less efficient compared to fine bubble diffusers and also mechanically high maintenance equipment, thus we will not discuss them in more details
- Screw blowers – These blowers are recommended for more than 25-30% energy saving compared to the conventional roots blower, however they are entirely imported and are more than 3-4 times as expensive compared to the roots blower. The energy saving is more profound at higher pressure 0.6-1 bar
- Turbo blowers—Thees blower work on the principle of turbo centrifugal blowers and are mostly suitable for very high flowrate application and more than 40% energy efficient compared to the roots blower, the only drawback being more than 6 times expensive and require and ultra clear environment to operate
- Lastly, diaphragm blower of small size of upto 7 cum/hr per blower are also being used now a days for very small application like <10-20 KLD STP. This are much more economical in terms of capex as well as low in maintenance.

A typical use case scenario of return-on-investment calculation for replacement with screw blower

## RETURN ON INVESTMENT CALCULATION/R1

Project – Blower Upgradation to Screw Type Hybrid blowers

Client- Confidential

Calculation- Urv Patel | [urvpatel@swaenviro.com](mailto:urvpatel@swaenviro.com) | +91-8828186901

Proposal

Option 1 : Change 2 working blowers from twin lobe to 2 nos tri lobe

Option 2: Change 2 working blower from twin lobe to 1 nos screw blower

Scope considered – Blower, Acoustic hood, Motor, VFD considered for both option

Parameters	Units	OPTION - 1 ( 2 X 2500 CUM/HR )		OPTION - 2 ( 1 X 5000 CUM/HR )	
		Screw Blower	Lobe Blower	Screw Blower	Lobe Blower
Qty.	nos.	2	2	1	2
Type of blower		Screw Blower	Lobe Blower	Screw Blower	Lobe Blower
Flow at inlet of the blower	Nm3/hr	2300	2300	4600	4600
Flow at inlet of the blower @ 40 deg	cum/hr	2500	2500	5000	5000
Operating pressure	bar(g)	0.6	0.6	0.6	0.6
Shaft Power	KW	44.8	64**	82	64**
Specific Power Consumption	KW hr/Nm3	0.019	0.027826087	0.018	0.013913043
Total Shaft Power for working blowers	bKw	89.6	128.0	82.0	128.0
Total Power savings	KW	38.4		46.0	
Savings in power cost @ 8400 operating hr/350 day @ Rs 9.3 per unit	Rs	29,99,808		35,93,520	
Cost per unit of screw blower	Rs.	35,50,000		67,00,000	
Initial investment (Per Unit) - Ex-Works, Pune	Rs	71,00,000		67,00,000	
ROI for extra investment	Year	2.37		1.86	

**\*\*Based on the present ampere rating of 108 Amp for the motor of 100 hp and PF of 0.8, the bKW = 64**

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