

## Frequently asked Questions on Restarting ETPs after shutdown 2

### Questions & answers

The following list contains frequent queries as well as the replies received from the expert group.

| Sl. No. | Question  | Answer  |
|---------|---|---|
| 1.      | Is H <sub>2</sub> S risk occurs only for closed type ETPs?  | No. Though Hydrogen sulphide generation occurs more in closed type ETPs, it can also occur in all areas of the conventional ETPs where there is anaerobic condition. Any deep pits, tanks and unit with sludge can generate Hydrogen sulphide.  |
| 2.      | If all the tanks are open, then also this type of gas can be found?   | Even if a tank is open, if it is not a completely aerated tank, the bottom portion of the tank can be in anaerobic condition, causing H <sub>2</sub> S generation. Any sludge deposited in bottom too can generate H <sub>2</sub> S.  |
| 3.      | Is there any hazardous gas produced when biological ETP is running?   | In a running biological ETP too units such as settling tank bottom, sludge collection tank(s) and dewatering units etc. can be the source of H <sub>2</sub> S.  |
| 4.      | Where there is no need to restart ETP like Biological one that creates any risk? If any, please explain what type of risk arises? | Generally running ETPs have lower risk of H <sub>2</sub> S generation, except in areas mentioned above. Accidents mostly occur when the tanks are cleaned or de-sludged.  |
| 5.      | What concentration of hydrogen sulphide will be lethal or fatal?  | The severity of H <sub>2</sub> S gas depends on both concentration of gas and period of exposure. Detailed table summarising this factor is given the Standard Operating Guideline attached.  |
| 6.      | Is particle size the only factor for using coagulant?   | <p>No. Particle size has been indicated as a measure to check the quantum of colloidal solids.</p> <p>It is a general advice that coagulants need to be used only if the colloidal solids are high. The percentage of colloidal solids can easily be found through filtering the effluent through filter papers of size indicated or it can be identified easily through a particle size distribution (PSD) analysis in a good lab. A coagulant need to be used only if the colloidal solids level exceeds 80-100 mg/l. If colloidal solids are low, only flocculants are needed.</p> <p>Sometimes ferrous sulphate is used as a colour removal agent for reactive dyes. Otherwise, ferrous sulphates does not give any particular advantage over other coagulants.</p> |

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| 7.      | After starting the clarifier sludge become to float from there. What is the impact of this?           | <p>We presume that the reference is about secondary clarifier.</p> <p>During the re-start, MLSS level in the aeration tank would be low and sludge will be less mineralized. Till the MLSS level picks up, it is unlikely that the sludge form granular bio-floc which would settle in the clarifier as a blanket, entrapping all sludge particles. This condition may result in some sludge rising to the top instead of settling. There are other reasons like sludge bulking too.</p> <p>The impact on this would be (a) loss of bio-mass which we need in the aeration system, (b) higher TSS and turbidity in the treated effluent and (c) less operational control.</p> <p>The remedy could be to (a) increase the rate of return of sludge to aeration tank, RAS (b) increase the nutrient levels and (c) if the settling is still not good, adding mild (say 100-150 ppm) dosage of poly aluminum chloride or 1-2 ppm of cationic polyelectrolyte at the inlet of the secondary clarifier.</p> <p>The estimation of SVI also would help. If SVI is more than 150, it indicates sludge bulking. How to estimate SVI and control of sludge bulking is described in the attached Standard Operating Guidelines.</p> |
| 8.      | Isnt it good idea to use organic coagulant instead? So that sludge produced is also organic in nature | <p>It is a good idea to use organic coagulants, if the total cost of chemical treatment (Tk/m<sup>3</sup>) is comparable to common coagulants.</p> <p>Generally such replacement products tends to be flocculants than coagulants (as organic chemicals, except polyelectrolytes, are not very effective in neutralizing zeta potential in colloidal solids thus effecting coagulation).</p> <p>Having higher organic content in the sludge would help in cases where the sludge is further processed to reduce the quantity (aerobic or anaerobic digestion of sludge).</p>   |
| 9.      | What is filamentous organisms and it's effects on biological tank                                     | <p>Filamentous organisms are micro-organisms found in aeration tanks that grow in a thread or filamentous form. They form bigger flocs compared to normal mixed liquor micro-organisms, but whereas normal micro-organisms forms a granulated sludge structure, facilitating settling of the sludge as a blanket in the secondary settling tank, the filamentous organisms disturbs its settling. Common filamentous organisms present in aeration tank of a textile ETP are Nocardia, Thiobrix, Sphaerotilus natans, Haliscomenobacter hydrossis and Actinomycetes. Detailed suggestions to manage issues due to filamentous organisms has been given in the Standard Operating Guidelines attached.</p>  |

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| 10.     | Would like to have more information about maintenance of F/M ratio balance in the biological treatment | F/M ratio, typically the proportion of quantity of organics in the feed to the quantity of micro-organisms present in the aeration tank. It is clear that too much or too less F/M value will result in overfeeding or underfeeding of the micro-organisms and affect the efficiency. How to maintain the F/M ratio in the desired level has been explained in detail in the Standard Operating Guidelines attached.   |
| 11.     | What type of meter will be used to know the detection concentration of hydrogen sulphide?              | There are portable H <sub>2</sub> S meter available in the market. It is possible to get a cheaper meter at about Tk 5000-7000 whereas a good branded portable meter may cost about Tk. 50,000-60,000.   |
| 12.     | What will be % of HCl to clean the diffusers?  | 10-15% may be the concentration of the acid to clean the diffusers. When hydrochloric acid is used, the diffuser sheaths need to be removed from the diffuser discs/tubes and then soaked in the acid for 30 minutes. Thereafter, it need to be washed thoroughly with water. However, if the acid injection is done through the air line (as spray mist), hydrochloric acid should not be used to prevent damage of pipes and destruction of micro-organisms when it enters aeration tank, instead, formic acid may be used which, being an organic acid, would eventually get digested in the aeration tank. |
| 13.     | Please describe the outcome of broken lamella of clarifier   | A broken lamella sheet or a mis-aligned block in a lamella clarifier may seriously affect the performance of the unit and any broken unit may need to be replaced immediately.   |
| 14.     | Why sulphuric acid is used for neutralization of wastewater in Biological ETP?                         | For the biological treatment to function normally, the pH of the tank contents should be close to the neutral range, in any case not more than 9.0. It is therefore required to neutralize the effluent before the same is admitted to aeration tank. Sulphuric acid or hydrochloric acid may be used as a neutralizing agent.   |
| 15.     | What are the suitable sampling point to test C:N:P ratio in biological ETP?                            | For a complete mixed tank, samples for checking nutrients can be taken from anywhere of the aeration tank.<br><br>For optimum efficiency the dosage of nutrients should be calculated based on the inlet organics and then dose the urea and DAP. Methods to calculate the dosage is described in the Standard Operating Guideline.  |

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| 16.     | How can we remove the extra nutrients if any in the in-fluent?   | <p>For most type of textile effluents, the influent seldom contain excess nutrients and in most cases need supplementing.</p> <p>Where the nutrients are high and discharge limit of Nitrogen and Phosphorous is implemented strictly, the excess nutrients may be removed through special treatment such as nitrification-denitrification or treatment through hydrophobic membranes for nitrogen and/or chemical precipitation of phosphates.</p>  |
| 17.     | How can decrease heavy metal like Pb in the sludge.  | <p>For chemical ETPs, lead will precipitate in the primary treatment and find its way to sludge. In most cases, the presence of Lead would be within the limit of Category B of DoE norms and if so does not need any serious intervention. In cases where the concentration of Lead goes more than 840 mg/kg, categorizing the same as Category C of DOE norms, the best course of action could be to switch over to low lead containing chemicals in the manufacturing process.</p>  |
| 18.     | For disinfection in the RAS line, we will be adding the NaOCl for how many days?   | <p>The hypochlorite dosing should be made for only 5-10 ppm of chlorine in the return activated sludge. The dosage may be applied for 8 hours continuously in the RAS line, repeating the same after 48 hours, if needed.</p>  |
| 19.     | What are the advantages & disadvantages of de-coring agent to use before secondary sedimentation tank of biological tank. Is there any impact on MLSS level in aeration tank as well as bacteria in aeration tank? | <p>Dosage of de-colouring agents done the outlet of aeration tank (inlet to secondary settling tank) usually results in clearer and lighter overflow from the clarifier. This is because the de-colouring agents helps the granulated secondary sludge to entrap colour forming organics and facilitate its return to the aeration tank for further degradation.</p> <p>At the moment, most of the suppliers of de-colouring agents are not willing to divulge information of its composition. Yet it is observed that most of them (may be also due to the low dosages commonly used) does not have significant impact on the MLSS levels or bacteria in aeration tank.</p> <p>The additional cost of treatment is also a disadvantage. Hence the need for the chemical and optimum dosage may be assessed by the plant manager through jar tests as well as trial and error.</p> |

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| 20.     | Sometimes we face return tank SV is less than from biological tank, what's the reason behind this. | <p>Theoretically the concentration of SS in the return line should be much more (normally double) that of the MLSS in aeration tank. This is when the solids are measured in weight basis (mg/l). It may not necessarily follow the same ratio in case of the volume (ml/l). Still, in most cases the SV of return line would be higher than the aeration tank.</p> <p>In certain cases where the retention time of secondary settling is high and sludge return is not continuous it was observed that the SV-30 of RAS is actually lower than aeration tank. This is because of the additional compaction of bio-flocs during settling phase (thickening) and bulk loss of biomass due to the loss of dissolved oxygen.</p> <p>This can also happen in situations of sludge bulking.</p> <p>Typically such situations are addressed through increased RAS.</p>  |
| 21.     | How to empty equalization and primary clarifier tank? who or where we can discharge this water?    | <p>The equalization tank contents can be fully pumped out to the primary treatment before stoppage. If the equalization tank is not fully mixed, it is possible that some sludge may be found in the bottom.</p> <p>In case of primary ETP, it is possible to water flush this sludge and pump the same to primary treatment for settling in primary clarifier.</p> <p>If the ETP is all biological treatment, it is not advisable to admit the sludge to aeration tank and in such cases, the residual sludge need to be scooped off and dewatered in sludge drying beds.</p> <p>For emptying the primary clarifier, after stoppage of feeding keep the tank for fine-settling for about 3 hours. Thereafter take out the sludge from the clarifier underflow till the sludge becomes watery. Once the majority of sludge is taken out, the clear supernatant may be pumped or siphoned off to the next treatment level (to the aeration tank in case of combined ETP or disposal in case of primary ETP).</p> |

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| 22.     | Give some solutions of color problem of outlet water for MBR ETP without dosing decoloring agent. Mostly all color removed, but treated water seems like light brown. | <p>The light brown or light red colour in the biologically treated effluent is mostly due to the red dye which is very difficult to get synthesized in the biological treatment. Though an MBR is generally more efficient than normal biological treatment to entrap colour forming organics, the degree of removal also depends on the separation medium (micro filter Vs Ultra filter) and type of MBR (submerged, side stream or airlift, submerged being more efficient)</p> <p>In most cases, apart from the aesthetic issue this colour does not create any serious environmental consequences. Nevertheless the colour could be removed through tertiary treatment such as chemical precipitation or through adsorption in activated carbon filter.</p>  |
| 23.     | We want to remove color from discharge water give some suggestion without using decoloring agent  | <p>It is also possible to use a multi-grade &amp; activated carbon filter, though the carbon may get exhausted faster if the colour is too high.</p>   |
| 24.     | How to recover energy from blower air line here most of the time line temperature is 85-90 degree we want to reduce.  | <p>Unless the ETP is big (say above 50 MLD), the possibility of any energy recovery is limited for twin/tri lobe blowers. In case of turbo-blowers with more than 1 bar pressure in air supply, there are some options but again this depends on the size and not recommended for ETPs smaller than 30 MLD.</p> <p>The increase in temperature is natural in compression of air and the degree of increase depends on a number of factors including type of blower, cfm/cm dia of piping and design of air header. However, normally this increase is not high enough to consider any energy recovery and such attempts often interfere with blower efficiency.</p> <p>The high air temperature quickly dissipates once the air reaches the aeration tank. It does increase the tank temperature to some extent, but not high enough to create any issue in the treatment for a pre-cooled effluent.</p> <p>Reduction of temperature in the effluent (through cooling tower etc.) before biological treatment is necessary, irrespective of the type of aeration.</p> <p>One way of reducing the energy consumption by blowers is to install on-line DO meter, value of which may be used to control the VFD of the blower(s) using a micro PLC. Assuming that the blowers are already provided with VFDs, the arrangement of automatic DO control may cost only about 2-3 Lakh Taka, which can be recovered from the savings of energy in few months.</p> |

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| 25.     | Sometimes we find diffuser blocked. why diffusers pores are blocked & how can we recover? | <p>Blockage of diffuser pores is mostly due to deposits of sludge over the same. The issue is more if the operation of the system is intermittent and not continuous. Blockages of diffusers create low treatment efficiency, promote further deposit of sludge and blockage. The blocked diffusers also create higher back-pressure resulting in lesser air flow and air pressure (unlike water lines, if air lines are blocked it will actually reduce the air pressure). It may also results in other, non-blocked diffusers, getting torn.</p> <p>The preventive measure to avoid blockages are (a) run the system continuously without intermittent stoppages, (b) in case of aeration tank, do periodical sludge wasting (WAS) to maintain MLSS and MLVSS levels in designed range and (c) prevent entry of any chemical sludge into aeration tanks.</p> <p>Periodic cleaning of the diffusers with acid shall remove the blockages in most cases. The methodology and procedure of cleaning has been explained in detail in the Standard Operating Guidelines.</p>   |
| 26.     | Which bacteria are good for biological treatment?   | <p>Of the thousands of microbial species in aeration tanks, less than hundred are actually efficient in rapid degradation of organic matter whereas some other may be useful (say in floc formation) and most may be inert.</p> <p>Bacillus and pseudomonas are the most effective species for treatment. Bacillus groups are very good for treating fats, oils, greases, and proteins. The best bacteria for breaking down organics such as sugars and carbohydrates are Pseudomonas. The most effective strains of Pseudomonas are Pseudomonas fluorescens and Pseudomonas putida. Besides the degradation of organics Putida has the added benefit of converting nitrates to nitrites. We would need Nitrosomonas and Nitrobacter to treat organic and ammoniacal nitrogen.</p> <p>Besides bacteria, many other micro-organisms are present and needed in the aeration system. They include fungi, protozoa, rotifiers and nematodes.</p> <p>Generally, all these microorganisms grow naturally in the aeration system as long as we maintain favourable conditions such as steady rate of feed, dissolved oxygen, nutrients, biomass level etc.</p> |

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| 27.     | What is the way to control DO of a Biological process in shut down period?? | During shutdown, we may need to provide just enough oxygen for the bacterial inventory to survive. Too much aeration may result in proliferation of MLSS which, in the absence of sufficient feed, will die out and digest themselves. It is recommended to keep aeration power at around 20-30 W per m <sup>3</sup> of aeration tank volume, for both mixing and sustenance of bacteria.  |
| 28.     | How to reduce SVI?  | Though the level of SVI in the range of 70-150 is considered as acceptable, the range 80-110 is considered good. Above 150 is considered as bulking sludge. To reduce SVI from >150 to around 100 it is necessary to increase the rate of return sludge (RAS), increase dissolved oxygen level in the aeration tank, increase dosing of nutrients and also the methods described here to control filamentous organisms, if needed. |