Government of Himachal Pradesh
Irrigation & Public Health Department

No. IPH-B(F)5-6/2017 Dated Shimla-2, the

NOTIFICATION

The Governor, Himachal Pradesh is pleased to prescribe the Standard Operating Procedure (SOP) for operation and maintenance of Sewage treatment plants to be adhered by Process Engineers as per Annexure "A".

2. The above order will come into force with immediate effect.

3. This has also been uploaded on e-Gazette of Himachal Pradesh Government.

BY ORDER

Devesh Kumar
Secretary(IPH) to the
Government of Himachal Pradesh.

Endst No. as above Dated Shimla-2 the 15-10-2018

Copy forwarded to the following for information and necessary action:-

1. The Chief Secretary to the Govt. of Himachal Pradesh.
2. The Addl. Chief Secretary(Environment, S&T) to the Govt. of HP.
3. The Principal Secretary (Urban Dev) to the Govt. of HP.
4. The Engineer-in-Chief, IPH Department, US Club, Shimla-1.
5. The Member Secretary, HP Pollution Control Board, Shimla-9.
6. The Commissioner, Municipal Corporation, Shimla-1.
7. Director (Urban Dev.), HP Shimla-2.
8. The Chief Engineer, IPH Department, Shimla/Dharamshala/Mandi/Hamirpur
9. Section Officer, IPH-A, HP Secretariat for circulation of the same with the orde of the additional charge of STPs.
10. Guard file.

Deputy Secretary(IPH) to the
Government of Himachal Pradesh.

Annex 6

Standard Operating Procedure (SOP) for Operation and maintenance of Sewage treatment plants; Role of Process Engineer

The following SOPs are for the general guidance of the Process Engineers and the Junior Engineers, incharge of the STP. They are advised to frequently refer to the Operations Manual available at the STPs for specific guidance on design assumptions and operation parameters. However the following Operation and Maintenance considerations must be fulfilled and strictly adhered.

The Process Engineer must visit the STP at least once in a month and shall submit guidance report to the Executive Engineer and the Superintending Engineer within one week of the visit. The Process Engineer's report must be as per the requirements of the Manual on Sewerage and Sewage Treatment Part B: Operation and Maintenance and Manual on Sewerage and Sewage Treatment Part C(available at website of MoHUA, mohua.gov.in/publication)

The Executive Engineer will immediately respond to the guidance report of the Process Engineer. The Superintending Engineer will ensure that the advice and guidance of the Process Engineer are properly responded by the Executive Engineer.

The overall responsibility for the performance of the STP will rest with the Executive Engineer incharge of the STP.

The Executive Engineer incharge of the STP will provide complete support to the process engineer for the visit to the STP. The Assistant Engineer and Junior Engineer incharge of the STP will accompany the Process Engineer on every visit.

1. Bar Screen Chamber

1.1 Function

The function of the bar screen is to prevent entry of solid particles/ articles above a certain size; such as plastic cups, paper dishes, polythene bags, sanitary napkins into the STP. (If these items are allowed to enter the STP, they clog and damage the STP pumps, and cause stoppage of the plant.) The screening is achieved by placing a screen made out of vertical bars, placed across the sewage flow.

If this unit is left unattended for long periods of time, it will generate a significant amount of odor: it will also result in backing of sewage in the incoming pipelines and chambers.

1.2 Operation and Maintenance Considerations

- Check and clean the bar screen at frequent intervals
- Do not allow solids to overflow/ escape from the screen
- Ensure no large gaps are formed due to corrosion of the screen
- Replace corroded/ unserviceable bar screen immediately
- Dispose of the screened materials as per the provisions of the Manual on Sewerage and Sewage Treatment

2. GRIT TRAP

2.1 Function

The solids and fats that are separated in this unit are disposed off along with other biodegradable waste. Separating solids (rice, vegetables, pulses) and grease from the wastewater at source ensures that the contact time between solids and wastewater is kept to a minimum, so that the wastewater does not absorb additional organic pollutant loads (starch, carbohydrates, proteins) due to leaching of these substances from the solids.

The trapped material (both floating film of grease/ fat and the grit settled at bottom) must be collected frequently; otherwise the trap will fail to serve its fundamental purpose. Therefore the trap must be engineered to facilitate frequent removal of these two layers.

2.2 Operation and Maintenance Considerations

- Check and clean trap at frequent intervals
- Remove both settled solids (at bottom) and the floating grease and dispose of the screened materials as per the provisions of the Manual on Sewerage and Sewage Treatment
- Do not allow solids to get washed out of the trap
- Do not allow oil and grease to escape the trap
- Redesign the trap if solids and grease escape on a regular basis, despite good cleaning practices

3. AERATION TANK

3.1 Function

The Aeration tank (together with the settling tank/ clarifier that follows) is at the heart of the treatment system. The bulk of the treatment is provided here, employing microbes/bacteria for the process. The main function of the Aeration tank is to maintain a high population level of microbes. This mixture is called MLSS (Mixed Liquor Suspended Solids). The mixed liquor is passed on to the clarifier tank, where the microbes are made to settle at the bottom. The settled microbes are recycled back to the aeration tank. Thus they are retained for a long period within the system.

3.2 Operation and Maintenance Considerations

- Operation considerations include maintaining the correct design level of MLSS (biomass concentration) in the aeration tank. Problems arise both in the case of excess or shortage of biomass, causing an imbalance, leading to failure of the process. The Operation Manual available at the STP shows how to maintain the correct design level of MLSS in the aeration tank. This also explains how MLSS ratio is measured and controlled.
- Visual observation will indicate if there is uniform aeration and mixing over the entire area of the tank. Local violent boiling/ bubbling is indicative of ruptured membranes or diffuser heads.
- Dead zones on the sewage surface indicate that membranes are blocked from the air side or the liquid side. Both conditions call for immediate attention, by cleaning or replacing the membranes. Cleaning of membranes is generally carried out by lifting out the defective units and scouring out the adhering materials by high-pressure hosing.
- Scrubbing with mild acid solution may also be resorted to in case of stubborn encrustation.
- Foaming in the aeration tank may be caused by excessive inflow of detergent-like substances: In a great majority of cases, the cause may be traced to an imbalance in the aeration tank recipe (Food: Microorganisms: Air: Nutrients), and corrective measures may be taken as indicated in the Operation Manual available at the STP.
- Aeration equipment should be operated continuously, non-stop.

- Measure Dissolved Oxygen (DO) concentration at different locations in the aeration tank as well as from top to bottom
- Maintain a DO concentration above around 2 mg/L throughout the aeration tank, maintain a portable DO probe or lab equipment to measure the DO concentration.

4. Secondary Clarifier/ Settling Tank

4.1 Function

The purpose and function of the secondary clarifier is threefold:

I. Allow settling of biomass solids in the Mixed Liquor (biomass slurry) coming out of the aeration tank, to the bottom of the clarifier

II. To thicken the settled biomass, in order to produce a thick underflow

III. To produce clear supernatant water, in the overflow from the clarifier.

The clarifier tank is only a passive device: All the above actions occur due to gravity. The thick biomass is recirculated back to the aeration tank.

4.2 Operation and Maintenance Considerations

If properly designed, engineered and constructed, clarifiers call for very little attention in terms of operation and maintenance. Some parts of the mechanical rake (such as the motor, gearbox etc.) call for only routine maintenance. The sacrificial rubber squeegees sweeping the floor of the clarifier need to be checked and replaced, possibly once in a years.

- The treated water flow should be uniform over the entire length of the launder. It would ensure good aeration also.
- There should be no scum over the surface of tank
- The bridge should be kept running.
- Sludge should be continuously removed
- Launder should be kept clean

5. SLUDGE RECIRCULATION

5.1 Function

The indivisible combination of the aeration tank, settling tank and sludge recirculation constitutes an "activated sludge biological treatment system". All three must be fine-tuned to act in unison to produce the desired high level of treatment. The optimum desired age of the microbes is between 25 to 30 days, confirm from the Operations Manual at STP. At the same time, an STP needs to maintain a high level of microbes in the aeration tank. Both these objectives are achieved by recirculating the sludge from the settling tank, and also wasting out of excess microbes from the system at regular intervals. Sludge recirculation rates are typically between 50 % to 100 % of the throughput rate of sewage in the STP, however the Operation Manual available at the STP should be referred to decide the rate of recirculation.

Sludge wasting into sludge drying beds should be done daily. This wasting of sludge being critical to the performance of STP should be regularly monitored and properly recorded. Enough space should always be available in the Secondary Clarifier for the aerated sewage to settle.

5.2 Operation and Maintenance Considerations

- Switch between the main and standby pump every 4 hours (approximately).
- Check motor-to-pump alignment after every dismantling operation
- Check condition of coupling and replace damaged parts immediately
- Check for vibrations and tighten the anchor bolts and other fasteners
- Check condition of bearings, oil seals, mechanical seal and replace if necessary
- The Pump and Motor manufacturer's O&M manual must be followed with diligence
- Ensure discharge of sludge recirculation into the aeration tank is visible and can be monitored
- Always keep safety guard in its proper position
- Maintain the flow rate at designed level (no tampering with the bypass valve)

6. PRESSURE SAND FILTER (PSF)

6.1 Function

The pressure sand filter (PSF) is used as a tertiary treatment unit to trap the trace amounts of solids which escape the clarifier, and can typically handle up to 50 mg/l of solids in an

economical manner. This unit is essentially a pressure vessel that is filled with graded media (sand and gravel). The water filtered with PSF is passed on to the next stage in the STP chain: the Activated Carbon Filter.

6.2 Operation and Maintenance Considerations

- The operations essentially consist of a long filtration run, followed by a short backwash sequence.
- The filter needs backwash when the pressure drop across the filter exceeds 0.5 kg/cm2 . However, it is a good practice to backwash once in a shift, irrespective of the actual amount of pressure loss.
- A five to ten minute backwash will typically rid the filter of all accumulated muck.

7. Activated Carbon Filter (ACF)

7.1 Function

An activated carbon filter, like the Pressure Sand Filter, is a tertiary treatment unit. It receives the water that is already filtered by the Pressure Sand Filter and improves multiple quality parameters of the water: BOD, COD, clarity (turbidity), color and odor.

7.2 Operation and Maintenance Considerations

- Just as the PSF, the ACF also needs to be backwashed, albeit at a lesser frequency to dislodge any solid particles trapped by simple filtration action.
- When the carbon gets exhausted (indicated by no improvement in water quality across the ACF), fresh carbon needs to be filled into the filter.

8. Disinfection of Treated Water

8.1 Function:

The treated water is disinfected to destroy and render harmless disease-causing organisms, such as bacteria, viruses, etc. The most common methods of disinfection include Chlorination. The primary action of the chlorine involves damaging the cell wall, resulting in cell lysis and death. In most STPs, the common form of Chlorine used is Bleaching Powder available commercially at 25-30 % strength, being safe, easy to handle and having a reasonable shelf life.

The other disinfectants like Sodium Hypo chlorite, Chlorine gas, UV Treatment can also be used for disinfection.

8.2 Operation and Maintenance Considerations

- The chlorine solution is best injected into the effluent via a diffuser or, preferably, a flash mixer
- Some of the chlorine gas could come out of solution un-dissolved (stratification), This would reduce the efficiency of disinfection and increase its costs
- Chlorine detention time/ contact period should be minimum 60 minutes.
- The Chlorine solution must be applied continuously.

9. EXCESS SLUDGE HANDLING

9.1 Function

Biological treatment of wastewater perforce produces excess biological solids due to the growth and multiplication of bacteria and other microorganisms in the system. The excess biomass thus produced needs to be bled out of the system, and disposed off efficiently. This is a five-step process: sludge removal, storage, conditioning, dewatering and disposal. Sludge is removed ("bled") from the system from the sludge recirculation pipeline (through a branch). The sludge is in the form of a thick slurry. It is taken into a sludge-holding tank, and kept under aeration (to prevent the living organisms from putrefying) until dewatering operations can be carried out. Before dewatering, polymer or other chemicals may be added for conditioning the sludge, to facilitate the process. Sludge is then dewatered in a filter press and/ or Sludge drying beds.

9.2 Operation and Maintenance Considerations

Typically, the filter press may be sized for a single batch operation per day. Refer Operation Manual available at the STP. Fresh sludge (not more than a day old), kept fully aerated and mixed (agitated), dewaters easily in the filter press. Hence, sludge must not be stored in the holding tank for longer durations. The desired quantity of polymer needs to be added 15 - 30 minutes before the dewatering operation. Filter press operation is carried out over 3 - 4 hours, or when filtration ceases.

After every dewatering operation, the filter cloths must be thoroughly cleaned, so that clogging in the pores of the woven polypropylene filter fabric is avoided.

Periodic cleaning of filter cloth with Hypo solution will also prolong the life of cloth.
When the filtration process becomes excessively slow, it is time to replace the filter cloth with a fresh set.

Normal maintenance as prescribed by the manufacturer may be practiced for the high pressure helical screw pump. Care must be taken not to damage the rubber stator of the screw pump by dry running of the pump. It is generally preferable to locate the pumps such that positive suction is enabled.

10. Sludge Drying Beds

10.1 Operation and Maintenance Considerations

- The sludge in drying beds should be covered with lime layer to avoid foul smell, if any.
- To enhance the drying of sludge should be regularly flipped and scrapped.
- The dried sludge should be regularly removed from sludge beds and stored in bags.
- Proper record of sludge collection be maintained at the plant.

11. MISCELLANEOUS CONSIDERATIONS

- Maintain Genset/ Diesel Generator backup to run the entire STP in case the mains electricity line fails
- Provide Protective Gear at the STP for the operator's/ worker's safety, health and hygiene. They must not be allowed to work without protective gear.
- Ensure adequate illumination in STP at night
- Provide safe and comfortable access to all units in STP for monitoring, operation, and maintenance
- Ensure proper record (at appropriate intervals) of sewage Inflow, effluent flow and the disposal of sludge
- Prepare and maintain an operating log book for all activities in the STP
- Prepare and maintain a mechanical checklist for routine preventive maintenance
- Prepare and maintain a History Sheet for each critical equipment in the STP
- Prepare and maintain a chemicals/ consumables stock register at the labs
- Periodically check and validate all log books, checklists etc.