STP

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PCB/T4/115/97 Date:07.11.2016

Design Criteria & Guidelines for STP for Flats and Commercial Establishments

The following design criteria and guidelines are evolved to provide a reference for processing the application and assessing the STP proposal.

Design Criteria

Sl. No.	Item	Design Criteria		
1	Water consumption for residential building	For a population of 20,000-1,00,000 — 100-150litre/capita/day For a population above1,00,000 — 150-200 litre/capita/day		
2	Water consumption for other buildings*#	**Sl. No.**	**Type of Building**	**Consumption (litre/day)**
		1	Factories	
			i. Factories with Bathrooms	45 per head
			ii. Factories without Bathrooms	30 per head
		2	Hospital (Including Laundry)	
			i. No. of beds not exceeding 100	340 per head
			ii. No. of beds exceeding 100	450 per head
			iii. Nurses' homes & Medical quarters	135 per head
		3	Hotels	
			i. Hotel (up to 4 star)	180 per head
			ii. Hotel (5 star and above)	320 per head
		4	Schools	
			i. Day Schools	45 per head
			ii. Boarding schools	135 per head
		5	Hostels	135 per head
		6	Offices	45 per head
		7	Cinemas, Concert halls and Theaters	15 per seat
In addition, water demand of visitors to these building is considered as 15 LPCD				

		8	Railway/Bus Stations & Airports		
			Nature of station	Where bathing facilities are provided (litres/capita)	Where bathing facilities are not provided (litres/capita)
			Railway /Bus Stations		
			i. Intermediate stations (excluding mail and express stops)	45	25
			ii) Junction stations and intermediate stations where mail or express stoppage is provided.	70	45
			iii)Terminal stations	45	45
			Airports		
			International and domestic airports	70	70

Notes

1. The number of persons shall be determined by average number of passengers handled by the station daily: due consideration may be given to the staff and vendors likely to use facilities.
2. Consideration should be given for seasonal average peak requirements.

3	Oil and grease/Grit trap**	1. Shallow trap (to allow quick rise of oils and fats to the surface) 2. The length of trap should be approximately 2 times its depth 3. Residence time in the trap is optimally 5-20 minutes at peak flow. 4. Surface area of the trap in m^2 should be approximately 1.5 to 2 times the depth of trap in metre. Alternately, Accelerated gravity separators(ref. Metcalf and Eddy, Fig.5.30) for grit removal can be provided.
4	Septic tank	Septic tank shall be designed as per IS2470-PartI
5	Equalization tank**	1. Capacity to hold 4-6 hours of average hourly flow for residential buildings. 2. Air flow –1.2-1.5 times the volume of equalization tank per hour. Or 2.5-3m^3/m^2/hour of tank floor area (whichever is greater). 3. Tank is to be covered and vented to odour control biofilter. Suction for blower capacity is 10 times volume of tank per hour

		to be used in larger equalization tank. The size of biofilter is one sixth volume of equalization tank.
6	Secondary settling for extended aeration**	1. Surface overflow rate– 12-18$m^3/hr/m^2$ 2. Depth-2.5 to 3m 3. Detention period-2.5to3hours
7	Moving Bed Bio Reactor## (Kaldnes Process)	1. Retention time for aerobic: 2.5 to 4.5 hours 2. Retention time for anoixic: 1 to 1.2 hours 3. Area of biofilm: 200-250 m^2/m^3 4. BOD loading rate – 1-1.4$kg/m^2/day$
8	Raw sewage pump**	1. Capacity of the raw sewage lift pump is selected based on daily average rated capacity of the STP, on the premise that the pumps shall be operated for 20 Hours in a day. 2. Bypass line to equalization tank to limit pump rate to average sewage flow to be provided.
9	Aeration tank(Extended aeration)**	1. F/M – 0.1-0.12 2. MLSS – 3500-4500 3. Aeration time: 16 Hrs minimum (desirable: 18 hrs) 4. 50-60 m3/hr of air for every kg of BOD removed Diffusers : Flux rate 8 – 12 m^3/ Running meter /hr (for 90 OD diffuser)
10	Secondary clarifier**	1. Overflow rate : 12-18 $m^3/m^2/Day$ throughout flow of sewage. 2. Depth- 2.5-3 m 3. Detention time : 2.5-3hours
11	Pressure sand filter**	Loading rate : Less than 12 $m^3/m^2/hr$
12	Chlorination **	Retention time-20-30 minutes Dose rate 3-5ppm chlorine
13	Activated carbon filter**	Loading rate : Less than 10 $m^3/m^2/hr$

*BIS 1172:1993; #National Building Code 2005 ** Kodavasal(2011);
##CPHEEO,2013: *** APA(2003)
*# BIS 1172: 1993 & National Building Code:2005

B. STP Proposal

STP design shall include the following:

1. ***Plan*** showing the location of project, STP, nearby residences and water bodies, and effluent discharge location. STP and outlet location shall be fixed with respect to two fixed points.

2. ***Plan and section* of STP** units.
3. ***Hydraulic profile*** together with supporting calculations
4. ***Detailed process design calculation*** in which important design parameters like retention time, Sludge loading rate, Mixed Liquor Suspended Solids, organic loading in the biological processes, contact time of disinfection, quantity of sludge generated and disposal method etc., with supporting calculations, dimensions of the tank etc., are to be included.
5. ***Detailed drawing with plan and elevation*** showing plant room layout including pipe work and equipments
6. ***Route of access to the plant room*** and access within the STP.
7. ***Ventilation and lighting*** details
8. ***Equipment schedule*** showing number of duty and standby units, make, model number, capacity etc. The schedule should be shown on the drawing.
9. ***Equipment catalogues and operation/maintenance manual*** shall be available at the plant.
10. The ***access to the effluent treatment plant, head room*** above tank for maintenance purpose and ventilation arrangements for odour control are to be specified.
11. ***Distance from the source of pollution to the nearest residence*** as well as the location of pollution sources namely STP, outlet, DG sets are to be marked with respect to fixed points.

A reasonable estimate of population, and a detailed breakdown of the total flow rate in the calculation shall be specified.

STP installation/operation

a. General

1. The installation of ***small sewage treatment plants*** shall be avoided as far as possible for a population less than 50. The possibility of primary treatment (septic tank as per IS 2470-Part I) followed by soak pit, which results in no open discharge of waste water shall be examined. Additional facilities to achieve the prescribed standards are to be attained.
2. The ***entrance to the STP*** shall be by a proper door without the use of steps or ladders and accessible by a vehicle. A second pedestrian entrance/exist shall be provided as far as possible for emergency purposes at the opposite end of the plant room.
3. All elements of the ***STP shall be open to view*** as far as possible for easy operation and maintenance.
4. If any part of the STP has been covered, open mesh flooring shall be used to allow ***easy visual interpretation***. Concrete covers shall be avoided as far as possible.

5. The STP shall be kept in a tidy state by ***good housekeeping***. This includes regular hosing down and scraping the walkways, white washing the walls, cleaning and painting metal works, maintaining adequate lighting and ventilation etc.
6. There shall be ***easy access*** to each and every effluent treatment unit and the recycling facility for inspection.
7. ***Access walkways*** of minimum 0.75m clear width shall be maintained within the STP for access to all areas requiring maintenance and operation. Walkways shall have safety rails. Staircases shall be provided where levels vary. No ladders and step irons shall be provided.
8. A ***general head room of 3m*** shall be maintained for enclosed or cellar STP with artificial ventilation.
9. Proper ***lighting arrangements*** shall be provided in the STP. Lights shall be located where they are accessible for maintenance and replacement.
10. For enclosed STP, ***minimum air volume of 14 cubic metre per cubic metre of room per hour*** shall be provided. Ventilation exhaust pipes shall be carried up to a height not less than 1m above the roof of the building at which the STP is located.
11. To ***minimize noise problem from STP***, the designer shall consider the use of silencers, sound barriers, anti-vibration mounting and blowers with motors of low rpm. Provision of an air blower is discouraged. Alternatively, the use of submersible ejectors shall be considered which would result in quieter operation. The intake and exhaust grills of the ventilation system shall also be designed t properly to reduce the whistling noise and shall not point towards nearby buildings.
12. Mechanical equipment which is critical to the functioning of the STP, shall be provided with ***standby units like pumps***.
13. ***Spare parts*** sufficient for two years operation as per manufacturer's recommendation shall be provided with the equipment supply.
14. Hours run meters shall be provided for all major equipments to record the total hours of operation. They shall be of resettlable type.
15. ***Time of day type meter*** shall be installed exclusively for the effluent treatment and reuse system and shall be maintained properly.
16. An ***automatic flow measuring device*** with non-resettable type totalizer shall be provided at suitable location for measuring the flow for STP serving a population more than 50
17. An ***easily accessible sampling point*** shall be provided for taking samples of the treated effluent.
18. ***Inbuilt facility*** shall be provided for reuse of treated effluent for flushing, gardening, vehicle and floor wash, cooling water make up etc. Water meter shall be provided for measuring the quantity of treated water recycled.

19. STP shall be designed to minimize visual impact. ***Landscaping with bushes and trees*** is encouraged, but not in places where the leaves may fall into the tanks.

b. Specific

1. ***Screening*** shall be removed daily and therefore screen locations shall be so designed to enable easy screenings removal.
2. ***Coarse screen*** shall be provided to precede pumps. Fine screens shall be placed downstream of equalization tanks equipped with air ejectors so as to minimize organic solids content in the screenings.
3. A properly designed ***grease trap*** shall be provided where restaurants or garages are to be served by the STP.
4. ***Upward flow sedimentation tanks*** shall be provided with minimum 60 degree hopper wall slopes to facilitate easy sludge collection and removal.
5. ***V-notch weirs*** shall be used where wide flow variation occurs. The side wall height shall not be less than 1m in order to avoid sludge carryover. The layout shall be such that the inlet arrangement never becomes submerged in sludge.
6. ***Back wash*** from the filters shall be taken for treatment.
7. ***Sludge*** in sedimentation tanks shall be removed as frequently as possible, at least once per day by suitable sludge withdrawal device such as submersible sludge pumps, airlifts or valves. A scum removal device shall also be provided. The sludge and scum removal device shall have independent adjustable control.
8. ***Disinfection unit*** shall be introduced between Pressure Sand filter and Activated carbon filter.
9. The effluent after ***pressure sand filter*** shall be collected in a tank and chlorinated to provide sufficient contact time. The effluent from there is to be passed through activated carbon filter to remove odour and excess chlorine.
10. ***Chlorination facility*** shall include a flash mixing device followed by a plug flow contact tank. Baffles shall be provided in chlorination tanks to prevent short circuiting. Lateral baffling shall be used for shallow tanks and up and over baffling shall be used for deep tanks. Dechlorination facility may be required in situations where the residual chlorine poses hazard to fisheries and shell fisheries.
11. ***Sludge pumps*** shall be designed with positive suction head to minimize the possibility of clogging.
12. All valves, penstocks, pumps etc., shall be ***labeled***.
13. ***Electrical voltage*** for level sensors in pump sumps shall not exceed 24 V to avoid electrical hazard.
14. ***High-level alarms*** shall be provided in all pump sumps. They shall be in the form of visual and audio alarms connected to a suitable constantly manned location.

Others

1. In the case of flats, the ***builder has the responsibility*** to hand over the valid consent to the society of registered owners of the respective apartments and to edify them regarding the necessity of obtaining a valid consent. Agreement with the registered owners/society in this regard is to be submitted before applying for the consent to operate.
2. The latest manual on sewerage and sewage treatment systems of Central Public health and Environmental Engineering Organization (CPHEEO) under the Ministry of Urban Development shall be followed for the design, operation and maintenance.

CHAIRMAN

To

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