Sewerage Treatment Plants, Rampur

Ghatampur STP (14 MLD)

2.2 Process Flow Scheme & Design

- **Approach**

The process design of the 14 MLD Sewage Treatment Plant (STP) based on UASB technology at Rampur presented here is based on the general concepts of UASB Technology and the experience of the firm (SM Engineers) related to the design, construction, start-up, commissioning and operation & maintenance of the UASB STPs in India.

2.2.1 Process Flow Scheme

The 14 MLD UASB Sewage Treatment Plant at Rampur will receive sewage from Sewage Pumping Station through 500mm DI pipe rising main into the inlet chamber of the 14 MLD UASB Sewage Treatment Plan at Rampur.

The sewage undergoes screening in the screen chamber, which is provided after the inlet chamber. There will be two mechanical and one manual screen chambers with 100% standby arrangement. Under normal operations, one mechanical screen shall be able to handle 50% of peak flow of 23.25 MLD. Both the mechanical screens shall be operational during 100% peak flow. However, if due to some operational reason, mechanical screens are not functional, manual screen can be used. All the screens are independent and can be operated with the help of sluice gates provided in the inlet chamber. A mesh screen of 1 inch square shall be provided in all the three screen chambers downstream side. After the screening sewage is treated for grit removal in the grit chamber which will consist of two mechanically operated mechanical detritor type de-gritting unit and one manual channels for peak flow each as standby. The liquid from grits shall be conveyed to the filtrate sump from where it will be pumped to the outlet chamber of the inlet system. Ultra sonic flow meter shall be placed in the Parshall flume after grit channel to keep the record of discharge.

From grit chamber, the sewage enters into the outlet chamber. From outlet chamber, it falls into the division box from where it will be divided into 4 streams via 400 dia CI pipe and this flow of 4-streams is connected to 4 nos. distribution boxes, two boxes in each side of the reactor.

There will be 2 reactors of equal capacity. From each distribution box, sewage is distributed further via 110 OD HDPE pipes to feeding boxes placed on top of the reactor. There will be 12 feeding boxes in each reactor, 12 nos. down take pipes of min. 110mm OD HDPE to distribute the sewage uniformly

over the bed of the reactor. One down take pipe distributes sewage over an area of 4 m2, which is the feed inlet density.

In the UASB reactor, the bio-degradation of sewage and settling of solids takes place. Each reactor is designed to handle an average flow of 7 MLD. After the treatment, the treated effluent flows upward through the GLSS to the effluent gutters placed over top of the reactor on either side of the gas domes. In one reactor of 7 MLD, there are 7 bays of gas domes each of 4m and 14 effluent gutters, one on either side of each gas dome. The treated effluent from UASB reactors is conveyed through common effluent channels provided on each long side of the UASB reactor. In a row of 2 reactors, common effluent channel is provided on one side of each reactor separately to carry the treated effluent which outfalls effluent into collection chamber in the middle of both the reactors facing polishing pond. From this collection chamber, effluent is further conveyed to the common collection sump from where it will be splitted into two parts. Splitter box will have sluice gates to control or divert the flow of UASB effluent as per the requirements.

After UASB reactor, treated effluent shall be conveyed to aeration tank having detention period of 30 minutes. Rectangular type aeration tank has been provided with two surface aerators each of 7.5 HP. By-pass arrangement is also provided to diver the flow directly into ponds, in case aerators are not working. After aeration, polishing pond is provided which is designed for one day retention. This shallow basin shall polish the effluent from UASB reactors to being to permissible levels for discharge. The liquid depth of polishing pond is 1.50 m. For accumulation of solids in these ponds, 0.25 m depth is provided. De-sludging of ponds after every three years is recommended. After the treatment of residual BOD and SS in the ponds, the flow will enter into a common chlorine contact tank (CCT) for disinfection of treated effluent. After disinfection, the final treated effluent will be disposed through a channel into a natural drain flowing across the road.

The excess sludge produced in the reactor is removed on a regular basis. The quantity of sludge to be removed is withdrawn with the help of the 2 sludge withdrawal pits. Pits are provided on longer side of the reactors. Each sludge pit has two tapping points for sludge withdrawal and one tapping point for water to flush the sludge pipelines. The specified quantity of sludge is withdrawn equally from all four-sludge pits. The sludge from the reactor to the sludge sump flows by gravity. From the sump the sludge is pumped to the sludge drying beds. The sludge on the sludge drying beds undergoes dewatering and gets dried in 10 days cycle. The beds can be subsequently used for drying of sludge again in another cycle. The filtrate from these SDB's will flow to the filtrate sump by gravity and then pumped to the outlet chamber of the inlet system.

The biogas produced in the reactors is separated with the help of the Gas Liquid Solids Separators (GLSS), which is placed in the upper part of the reactor. The biogas collected in the gas domes is taken through gas pipes placed along the longer side of the reactor. Each gas hood is connected to a common header of 75 OD HPDE pipe running parallel to the shorter side of the reactor and carries the gas to 140 OD FRP gas pipe running along the longer side of UASB reactor. The connection of the gas hood with a 75 OD pipe is through a ½" dia flexible reinforced PVC pipe. These gas pipes will convey the gas to the biogas holder which has been provided based on 6 hours retention capacity for storage of the gas. Moisture trap and gas flow meters have been provided before gas holder.

The office and laboratory building is provided for the administration of the plant operation and for the analysis of wastewater and sludge in order to monitor the plant performance. Main Electrical Room has been proposed which would house control panels of all the units of STP.

Pahadi Gate STP (15 MLD)

University Road STP (5 MLD)