

# TECHNICAL VISIT TO KLIA WASTE WATER TREATMENT PLANT

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On 20th of September 2003, a technical visit was organised by the Environmental Engineering Technical Division to Kuala Lumpur International Airport (KLIA) Waste Water Treatment Plant (WTP). 35 IEM members participated on this half-day visit to the plant.

The KLIA WTP is a Sequential Batch Reactor (SBR) system which is designed to treat 17,250 ml/day [approximately 75,000 population equivalent (PE)] to meet the requirements of Standard B of Environmental Quality Act (EQA). The plant comprises two streams of inlet. Stream 1 receives wastewater from major public and administration area of the airport, while stream 2 takes waste load from domestic and industrial wastewater including output from hanger facilities. Wastewater from the first stream normally consists of biodegradable substance while wastewater from the second stream may contain inorganic compounds in the form of heavy metals like cyanide and arsenic from the maintenance activity. There is a pre-treatment facility at the engineering area before discharging into the sewer.

The SBR system is another type of an activated treatment process designed to operate under non-steady state conditions. It operates with aeration and sludge sedimentation process taking place in the same tank. The major advantage of the SBR system as compared to the conventional system is that, it operates in a unique time sequence process. In other words, the aeration and sedimentation process takes place



Ir. Hooi Kam Seng presenting a token to the representative of KLIA (WTP)

independently in different compartments thereby providing more treatment capacity than conventional system (extended aeration system). Moreover, SBR system is capable of accepting any variations in the hydraulic loads.

The SBR system has four operation phases; filling and mixing, aeration, settle & decant and de-sludge. Alum and lime are added during aeration stage for phosphorus removal. During settling stage, liquid and solids are separated. Effluent from stream 1 is pumped to tertiary treatment compartment while stream 2 is disinfected before final discharge.

By adjusting the timings for aeration, settling and chemical dosing, good effluent can be achieved both for discharge and reuse. SBR system's effluent has better Biochemical Oxygen Demand (BOD) and nutrient removals (ammonia and phosphorus) and also the control of bulking effect.

Plant monitoring, alarming and reporting functions is controlled by a PLC located in the administration

building control room. Window software is used with object oriented, graphical man-machine-interface (MMI) application generator for process control, supervisory, monitoring and reporting in the form of mimic screen display. Colour graphical presentation and simulation for equipment status, alarms, raw sewage flow into SBR can be captured during the whole process.

There are two processes consist of the following sequential operation on each tank:

- For 6-hour mode of process, the following sequential timing is followed :-
  - Filling and mixing – 2 hours
  - Aeration – 3 hours (Over lap of 1 hour with filling)
  - Settle – 1 hour
  - Decant and de-sludge – 1 hour
- For 8-hour mode of process, the following sequential timing is followed:-
  - Filling and mixing – 2 hours
  - Aeration – 3.5 hours
  - Settle – 1.5 hours
  - Decant and de-sludge – 1 hour

Each reactor is capable of handling 740 m<sup>3</sup> of wastewater in each cycle of treatment. After the wastewater has under gone oxidation and sedimentation, it is decanted from the reactor by means of decanter at a rate of 740 m<sup>3</sup>/hour. The decanter draws clarified treated wastewater from the top of the reactor while the sludge settles at the bottom of the reactor.

The SBR process is intended to nitrify (convert ammonia to nitrate) during the anoxic phase and denitrify (convert nitrate into nitrogen gas) mainly during settle and decant phases. Biological treatment may help in removing phosphorus removal.

Rotary blowers controlled by a set of motorized valves deliver air required to generate aerobic condition required in each process. The three service-reactors share two blowers while the third blower serves as a standby. Each blower is capable of delivering 65m<sup>3</sup>/hour of air at 0.4kg/cm<sup>2</sup> pressure. At any given point of time at least one blower would be operating with a second blower cutting in when demand peaks. Submersible mixers are provided for mixing of pH and dissolved oxygen has been provided.

Excess sludge from the SBR reactors is pumped into the sludge holding tank during decants option phase. The de-sludge pumps are controlled by a set of motorized control valves. The sludge timing is freely adjustable from the PLC to maintain the right level of microorganisms in the reactor.

Tertiary treatment plant is designed to produce high quality effluent for landscaping, toilet flushing and other non-potable water requirements of the airport. The treatment capacity of the tertiary treatment plant is approximately 4200 m<sup>3</sup> per day. Tertiary treatment plant consists of lamella plate separators, 'dynasand' backwash sand filters, cascade aerators and reuse water-chlorinating systems.

The sludge house consists of rotary drum thickeners and membrane filters press. Sludge from the SBR tanks and the residual from the lamella plate separators, which is stored in the holding tank, is pumped by using feed pumps. The retaining period for the sludge in the



The IEM group at the visit

holding tank is two and the half days and the sludge is aerated in the holding tank by using coarse bubble air diffusers. Polymer solution is added to aid the process of thickening. Thickened sludge from the drum thickener is discharged in to the sludge pit. The sludge contents after drum thickener is maintain around 4%. Thickened sludge is then pumped into filter press to achieve 30% dry solids content. Polymer is injected in the suction side of the filter press feed pump to achieve good flocculation of the sludge. Upon unclamping of the plates, de-watered sludge cakes drops into a screw conveyor and transferred to a bin for final disposal. The filtrate from the filter press is recycled back to stream 2 SBR transfer pump sump for further treatment.

Both inlet area and the sludge house are equipped with odour removal systems. It consists of the FRP scrubber units, a set of circulation pumps, chemical dosing metering pumps and a radial extraction fan. The process of removing contaminated air is accomplished in three stages. Stage 1 consists of treatment with water for dust removal and other physical matters. In stage 2, sulfuric acid is

used to remove alkaline compounds like ammonia and amines. Sodium hypo chlorite is injected in the third stage for the removal of acidic components like hydrogen sulphide. Caustic soda is used to break down and oxidize components which are neither acidic nor alkaline in nature.

The members benefited from the site visit and the site visit ended at 12.30pm. ■

## REMINDER

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