ANAEROBIC/ANOXIC TANKS

PROCESS DESCRIPTION

In the anaerobic/anoxic tanks, wastewater is prepared for further treatment in the biological reactors. Denitrification and luxury uptake of phosphorus take place by mixing a food source (primary clarifier effluent, raw sewage, or mixtures of both) with microorganisms (return activated sludge). Biochemical reactions take place in the presence of combined oxygen (in the nitrate form - NO₃), or in anaerobic conditions (no oxygen.) Reactions are adjusted by directing the biological reactor return sludge to either the anaerobic or anoxic cells of the anaerobic/anoxic tanks. After this processing, the effluent flows to the biological reactors.

MECHANICAL DESCRIPTION

The concrete tanks are arranged in two parallel anaerobic/anoxic or anoxic-only trains. The four initial (anaerobic in the a/a mode) tanks in each train are plug-flow, 16.5’ X 16.5’ each with a Chemineer 2GTP-3, 3 hp vertical mixer in each tank. The following two anoxic tanks in each train are 22’ X 35’ each with a Chemineer 3GTP-3, 3 hp vertical mixer in each tank. All tanks are 17.5’ deep.

In the anaerobic/anoxic mode, primary clarifier effluent flows into the anaerobic tanks and return activated sludge (RAS) is pumped to the anoxic tanks where it mixes with the effluent coming in from the anaerobic tanks. Submersible Flygt NP3171 25 hp, 3,500 gpm recycle pumps at the end of the anoxic zone pump the resulting low nitrate mixed liquor to the influent A/A tank splitter box where it mixes with settled primary effluent before entering the anaerobic tanks for phosphorus removal.

In the anoxic mode, RAS is pumped directly into the influent splitter box where it mixes with primary clarifier effluent before passing through each of the tanks in a train in a simple plug-flow mode. There is no recirculation in this mode and phosphorus removal may not be as complete.

The anaerobic/anoxic tanks are covered and odorous air is treated at the plant odor control facility.

A/A tanks may be dewatered using the submersible Flygt CP3127, 7.5 hp, 350 gpm dewatering pump.
FLOW SEQUENCE

Normal (Anaerobic/Anoxic)
Full plant flow is normally split into both trains. Return sludge is discharged into center gate structure (with gates G5 and G6 closed) and discharged through gates G7 and G8. Anoxic recycle pumps are on. All other gates are open except primary clarifier bypass valve and RAS valve 2. All mixers are on.

Alternate (Anoxic)
Full plant flow and return sludge are mixed and discharge through both trains. Anoxic recycle pumps are off. RAS valve 1 is closed and 2 is open. Primary clarifier bypass valve is closed; all tank gates are open.

Alternate
If a train is taken out of operation, all gates in that train are closed. If the primary clarifiers are being bypassed, the primary clarifier bypass valve is opened and primary effluent valve is closed. Stop logs are available for all gates except 3, 4, 9, and 10. Scum may be pumped into the A/A influent splitter box from the primary clarifier scum concentrator.

FLOW SCHEMATIC
PROCESS CONTROL

The normal mode of treatment uses the aerobic/anoxic treatment mode because it allows enhanced removal of phosphorus by luxury uptake in an anaerobic environment along with removal of nitrogen by stripping off and using the oxygen molecule from nitrates (NO$_3$) and releasing the remaining free nitrogen (N) into the atmosphere.

Depending on plant nitrogen and phosphorus loading, it may be more efficient to use only one of the two treatment trains, vary the recycle pumping rate, and/or vary the tank mixers speed settings. If desired, the anoxic recycle pumps may be set up to be flow-paced using a signal from the effluent flowmeter. Effluent or in-plant process control nitrogen and phosphorus testing will provide information for the plant supervisor to make the decision.

COMMON OPERATING PROBLEMS

Access panels should be opened to inspect the tanks regularly. Scum or foam may form on the liquid surface or biological build-ups may occur.

SAFETY

1. CCWA lockout-tagout procedures must be used before maintenance activities that expose the operator or maintenance personnel to moving or energized parts.
2. Guards and other safety equipment must always be in place when the equipment is operating.
3. Steps and walkways may ice in winter. Spreading of sand or salt may minimize slip hazards.
4. All maintenance activities below grade must conform to CCWA’s Confined Space entry procedures.

SAMPLE LOCATIONS

Samples are not normally taken at this tank. On occasion, it may be appropriate to check the flow distribution by running suspended solids or centrifuge spins on each process train. Grab samples are then taken from the marked covers at the effluent end of the tanks.
USE OF MANUFACTURER’S SERVICE MANUAL

Scheduled maintenance: some maintenance is operator staff level and some should be reserved for designated maintenance staff. Safety procedures must be followed. Equipment manual information and resources are extracted and incorporated into the facility computerized maintenance program.

- Valves and gates should be exercised at least once every 3 months. Periodic lubrication is not required for Dezurik manual butterfly and plug valves.

MECHANICAL MIXERS

Tab 3 – Oil change frequency and troubleshooting.

SUBMERSIBLE PUMPS (Anoxic Recycle Pumps and Dewatering Pump)

Flygt Manual, tabs 3 through 8 are dedicated to all plant Flygt pumps and contain maintenance information; none is operator level.

Tab 9 contains troubleshooting information for maintenance personnel only.

WEIR GATES, SLUICE GATES, AND STOP LOGS

A single manual covers all Fontaine Gates and Stop Logs.

Tab 2 – Maintenance summaries

SECTION REFERENCES

1. Pumps – *Operation and Maintenance Instructions* by ITT Flygt Corp.
5. Clayton County Water Authority General and Plant Safety Rules.
Note: The ANAEROBIC/ANOXIC TANKS maintenance section was written for a system that uses computerized maintenance and needed minimal maintenance information. The following is an extract from a maintenance section for a smaller system that wanted more detail.

USE OF MANUFACTURER’S SERVICE MANUAL

Scheduled maintenance: some maintenance is operator staff level and some should be reserved for designated maintenance staff. Safety procedures must be followed. Equipment manual information and resources are extracted and incorporated into the facility computerized maintenance program. (See appropriate manual section/page.)

- Valves and gates should be exercised at least once every 3 months.

Telescoping Valve (See Telescoping Valves manual.)

- Every 6 months – Lubricate grease fittings on manual operators.
- Every 6 months – Clean and lubricate operating stems.

Digester

- Daily – Check for foaming or alarm conditions.
- Daily – Visually check float switches for problems including debris or freezing.
- Monthly – Visually inspect electric winch for safe operation.
- Monthly – Oil winch bushings with medium weight oil.
- Every 3 months – Grease lubrication inside winch worm gear reservoir; lubricate other points of friction.
- Every 6 months – Lube mixers. (See section 5 for initial maintenance start schedule.)
- Every 6 months – Visually check submersible pumps.
- Every 6 months – Visually check level transducers.
- Every 6 months – Clean transducers in mild detergent – do not remove screens.
- Every 1500 operating hours – Inspect submersible pump seals for wear (See section 2 tab, page number 2.)
- Every 500 cycles or 18 months – Inspect electric valve actuators gear case lubricant.
- Yearly – Visually inspect calibration of limit switches and mechanical stops for electric valve actuators.
- Every 5 years – Rewind mixer motors.

This section was continued on a following page that included additional digester maintenance, blower maintenance, and references.