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Controlling Sludge Age in a Wastewater Treatment Plant

Case History

Controlling Sludge Age in a Wastewater Treatment Plant

One of the most cost and labor intensive operations in a wastewater treatment plant is the wasting of activated sludge. Each day the operator should take a sample of the mixed liquor, and weigh, bake and calculate the amount of sludge that needs to be wasted in order to maintain a proper sludge age, or sludge retention time (SRT). In the extended aeration process, the normal range of SRT is between 20 to 25 days.

This 0.75-mgd wastewater treatment plant in Lewes, DE, operates two aeration basins with dual SAC™ Bio-Control Units.

However, in lieu of daily sampling, calculations, and wasting, many facilities use sludge wasting procedures that are detrimental to plant performance. In some cases, wasting operations are only performed on a weekly basis. This will drive the SRT to high levels, sometimes three to four times the desired value of 25 days. When the sludge is eventually wasted from the biosystem, the volume that is removed is so large that the SRT is lowered to a value of one-fourth to one-half of the normal range. Although such a sludge wasting program is sometimes perceived as keeping the "average" SRT within the acceptable range, it can lead to serious consequences—that ultimately result in poor facility performance. Proper sludge wasting allows for the growth of a healthy biological colony which induces a good settling sludge, an important factor in maintaining a high quality discharge, especially under adverse flow conditions.

Problem

Failure to keep a proper SRT usually results in the generation of poor settling sludge. Inconsistent sludge wasting procedures can enable the growth of bacteria, such as filamentous bacteria, which hinder sludge settlement and reduce the overall effectiveness of the treatment facility. This is the kind of problem experienced at a 0.75-mgd wastewater treatment plant in Lewes, DE, owned and operated by the city of Lewes. The plant operates two aeration basins and sludge was manually wasted to an anaerobic digester.

The problem also involved the large volume of water that the Lewes facility had to waste. "Because of the size of our digester, we have to waste a large volume of water—and it was thin mixed liquor," says Walter Baumer, assistant supervisor for the Lewes facility. Because the plant had difficulty controlling its sludge wasting process and the biological conditions in the aeration basins, there were large fluctuations in effluent quality—and large amounts of manpower were continuously being devoted to sludge handling. Even though the plant uses high efficiency, dual clarification units, the poor settling sludge was affecting the sludge blanket level in the clarifiers, and, therefore, clarification performance. The efficiency of the clarifiers are based on hydraulic flows and sludge settleability. For any given flow rate, if the sludge does not settle quickly enough, higher sludge blanket levels would result. Poor settling sludge can be defined as a biomass with a Sludge Volume Index (SVI) of greater than 100 ml/gr. A higher than normal SRT can cause a poor settling sludge. One visible

indicator is the development of a brown foam in the aeration basin, a sign that was evident in the Lewes facility.

Solution

The city sought an efficient and automatic means of wasting thickened sludge and maintaining an SRT of 20 to 25 days, even under fluctuating flows and biological loads. They found a system offered by United Industries Inc., in Baton Rouge, LA, that automatically and continuously wastes a specified amount of mixed liquor from the aeration basin without the manpower normally needed for the job. This continuous sludge wasting unit, the **SAC™** bio-control system, displaced the intermittent, manual process, thereby lowering the plant's manpower requirements and allowing for the creation of a consistent sludge age. The system was designed to maintain sludge age at any desired level, regardless of influent conditions and flows. "Sludge age is the means of determining how young the bugs are that you are culturing, in order to maintain them in a good, healthy state. The unit will do that automatically once you reach the point of equilibrium," says George Siegfried, president of Siegfried Machine & Supply, which installed the system. "The operator can establish the sludge age by setting the electronic controls within the unit. After a few weeks of operation, the sludge age should reach equilibrium and should be stabilized at the proper level to maximize plant performance."

The stable sludge age allowed for maximum settleability and a greater amount of clear water above the sludge blanket in the clarifiers. Increasing the distance of the sludge blanket from the effluent weir of the clarifier allows the plant to handle higher flows and provides for a better effluent. "Once you've reached the point of equilibrium, you'll get the proper [water] level of the top of the sludge blanket," says Siegfried.

The unit also thickens the sludge before it is transmitted to the digester. "The digester is able to handle twice the amount," says Baumer. The maximized sludge concentration also led to a reduction in downstream costs—the thicker the sludge, the less expensive it is to handle, because the necessary amount of dewatering is reduced.

At the Lewes facility, the bio-control unit transmits the thickened sludge to an existing 320,000-gallon digester/storage tank. The pumping rate of thickened sludge from the unit to the digester is electronically controlled. Thickened digested sludge is hauled to a landfill twice a year. The clear supernatant from the bio-control unit is returned to the aeration basin by gravity.

Results

Since the unit was installed, less decanted water is returned to the headworks. Baumer says the plant can handle a greater volume of incoming raw sewage. "Now we're not recycling clean water through the plant over and over again," he says. Digester efficiency and productivity also has increased. "Before, we were sending 100,000 gallons through the digester every day, now it's only 10,000." Efficiency has increased in the use of manpower as well. Baumer says they are saving two to three hours per day. Decanting the clear supernatant from the digester previously was performed every other day—now, it's just once a week.

Effluent quality also has improved. Total suspended solids now average 5.7 mg/L with a maximum level of 8.5 mg/L, which is approximately 43 percent lower than maximum levels prior to installation. "It's made the plant a lot easier to maintain and operate," says Baumer. "A lot of the headaches have been eliminated."

For more information, contact, Gary Beard, United Industries Inc., P.O. Box 3838, Baton Rouge, LA 70821; (504) 292-5527.

The wastewater and reclamation facilities for the Chino Basin Municipal Water Distric in California will incorporate the SAC™ bio-control system to maintain a constant sludge age. This plant will ultimately hansle a flow rate of 28 mgd of both domestic and industrial wastes. The system also utilizes other innovative treatment processes such as the NITROX® ORP denitrification process, the BOAT® intra-channel clarifiers, and the BULLSEYE® nutrient removal process.

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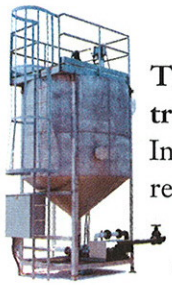

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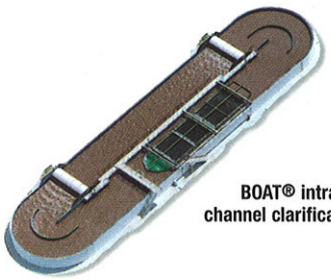

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