ITT

Water & Wastewater

Treatment – Sludge Collection

Case Story

The Impact of Continuous Sludge Collection in Potable Water Treatment Plants

In a conventional potable water treatment plant that uses surface water as its source, the treatment scheme usually consists of:

- Coagulant feed to the rapid mix
- Flocculation and sedimentation
- Filtration as the last step to remove insoluble material
- Disinfection
- Storage and distribution to the customers

Plant personnel usually attempt to remove as much of the raw water contaminant as possible in the clarification step. The contaminant removal is important to optimize the filter operation and achieve the longest filter runs between backwashes and highest effluent water quality. Invariably, operators focus on treating the water source with the right chemical options to oxidize soluble material, adjust pH, as well as coagulate and flocculate the solids so that they settle adequately in the sedimentation basins and do not carry over to the filters.

These typical surface water treatment plants also consist of a solids-handling scheme to process both solids that are settled out in the clarification step and solids removed from the filters during backwash. Since the focus is usually on achieving the highest water quality to supply the consumers, these solids handling schemes and their impact on plant operations can easily be overlooked. Solids handling can have a major impact on water quality and cost of operation. Some systems allow solids to accumulate in the sedimentation tank, periodically shut them down and then manually clean them. This approach has some drawbacks to consider. As solids accumulate in the basins, the residence time for settling is decreased and could cause additional solids to be sent to the filters. These additional solids are low density solids that will cause a quicker loss of head and require more frequent filter backwashes. In addition, the solids build-up on the bottom of the basins could easily allow anaerobic bacteria to grow beneath the sludge and create septic conditions within the tank. This condition could manifest itself as taste and odor problems, gas generation that could carry solids over to the filters, and may require additional disinfection for the finished water. When removing solids periodically, the operators would prefer to have the maintenance completed during times of low demand, so scheduling can become a problem. This basin cleaning maintenance often requires overtime for labor and a large amount of sludge to handle at one time. All of these issues increase operational cost. The raw water contaminant quantity and coagulant dosage will determine solids removed, amount of sludge build up, and the frequency of shut downs to manually clean the basins.

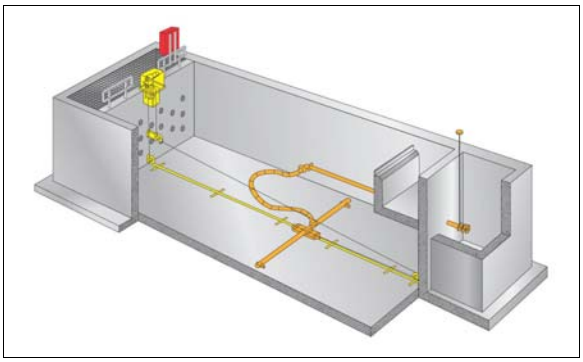
The alternative to this periodic shutdown and manual cleaning of sedimentation basins is to continuously remove sludge solids with a sludge collector. If the sludge collection system is designed properly and operated correctly, the solids are removed (every hour or every shift or every day) so that the basins maintain their settling capacity. The collection system also eliminates both the potential for anaerobic bacteria growth, and the need to schedule shutdowns involving added manpower cost and handling large amounts of sludge at one time.

The Aguas de Cartagena S.A. E.S.P plant in Colombia treats an average of 4,860 m^3/hr (30.8 MGD) through its conventional water

Visitors to the Cartagena plant are greeted by a beautifully landscaped sign marking the plant's location.

treatment plant. The treatment scheme consists of five trains with equal flow and each having hydraulic flocculation, a sedimentation basin, and dual media gravity filters. The source water is from the Magdalena River and stored in a reservoir prior to being pumped into the treatment plant. The water entering the plant contains turbidity from 2 to 5 NTU, color of 30 to 50 Pt-Co, and TOC of 7 to 8 mg/L. The plant uses alum as its coagulant and feeds it at a rate of 60 to 80 mg/L. The plant shuts down four times per year to clean each of the basins. The maintenance shut down requires the plant to take four days working 8 hours/day to clean one basin and put it back into operation. During this time 4,000 m^3 (10^6 gallons) of effluent water is diverted to clean each basin. The sludge is sent to a holding pond for processing through the solids handling dewatering facility.

In February 2008, the plant installed Leopold© CT2© submerged sludge collectors in Basin #2, one of its five rectangular sedimentation basins. The CT2 submerged sludge collector operates on the simple principle of gravity and removes sludge by taking advantage of a differential head. Water pressure in the main tank forces the sludge through the header collector into the outlet piping, and away to the sludge removal trough. Careful selection of smooth-bore piping for the suction header keeps headloss to a minimum, maintains efficient sludge removal, and low driving head requirements. A simple cable drive moves the suction header across the tank floor at a steady, controlled rate, removing sludge without disturbance.



The CT2® submerged sludge collector's cable drive pulls the header through the sludge with a positive motion and minimal sludge disturbance, removing the sludge without dilution.

The CT2 header is locked onto the guide rail and is controlled by a programmable operating system. The cable drive pulls the header through the sludge with a positive motion and minimal sludge disturbance, removing the sludge without dilution. This reduces the sludge volume, which in turn means lower thickening and dewatering costs.

Installation of the CT2 submerged sludge collector is completed in the basin in preparation for operation.

To evaluate the system, it was decided to compare the performance of Basin #1 and Basin #2. For the year prior to the CT2 installation, in 2007, Basin #1 effluent averaged 1.71 NTU while Basin #2 effluent turbidity averaged 1.86 NTU. Since installing the CT2 submerged sludge collector in the #2 Sedimentation Basin in 2008, Basin #2 now averages effluent turbidity that is 10% lower than Basin #1's effluent turbidity. The plant has operated Basin #2 for a year without shutting down for maintenance

cleaning, while still requiring the usual three-month shut downs for the other four basins. The filters have consistently operated for 30 hours between backwashing, and filter effluent turbidity readings are less than 0.3 NTU.

Cartagena service people along with the plant personnel are pleased with the performance of the CT2 sludge collector control system that was tailored to meet the plant's requirements and optimize the performance of the sludge collection system.

The installation of the CT2 submerged sludge collector has resulted in sedimentation and filter effluent water quality improvement, reduced operator attention to the solids handling portion of the plant, and reduced operating cost of producing water. In fact, it has worked out so well that the plant is installing CT2 submerged sludge collectors in two additional basins in 2009.

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