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SAF®

Case Study

Algae Removal & Water Reclamation

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Mobile Session: Small/Decentralized System Technologies and Management Approaches

California Title 22 Water Reclamation Project - CA State Prison WWTP Improvements

BACKGROUND

The existing 0.65 mgd wastewater treatment plant for the prison consisted of a headworks with bar screen and a series of four aerated ponds in series followed by sodium hypochlorite addition and a chlorine contact tank. The lined ponds utilize surface aerators and provide 30 days of detention time for secondary treatment. Flow through each pond is controlled by diversion structures which maintain water surface elevations and allowed for bypass of any individual pond. Effluent from the ponds flows by gravity through a chlorine contact tank and subsequently to a series of four lined effluent storage ponds, each with a storage capacity of 30 days at rated flow. Effluent is pumped to a nearby privately-owned land application site where it was used to irrigate forage crops in the Coalinga, CA area. A long-term contract with a local farmer for effluent disposal was nearing expiration at the time that the project was developed and the farmer was desirous of using his land and the water from the prison facility for the production of much higher value pistachios in lieu of forage. Especially after the prolonged severe California drought, a reliable source of irrigation water was extremely valuable for the investment in orchard crops. Recycled municipal wastewater requirements for pistachio irrigation have been increased to include tertiary treatment (flocculation, coagulation and filtration) with disinfection after salmonella contamination of pistachios was detected in 2009.

PROBLEM STATEMENT

The challenge was to upgrade the quality of the plant effluent to the disinfected tertiary level, and it was decided to proceed to Title 22 disinfected tertiary effluent with approval from the California SWRCB Division of Drinking Water. A complicating factor in the design of the upgrade was the presence of algae in the effluent of the aerated pond treatment system. In the Coalinga area, algal blooms are common from late spring to mid fall, with algae solids concentrations exceeding 80 ppm at times. Various treatment processes, including sand bed filtration and dissolved air flotation have been utilized to remove algae prior to filtration with varying degrees of success. Filtration alone is not able to withstand fouling from algae, except in the case of sand bed filtration, which is area and labor intensive.

SOLUTION STATEMENT

Based on promising earlier work at Graton, CA, it was decided to proceed with the use of suspended air flotation for algae removal followed by dual media gravity filtration. The Suspended Air® Flotation process is like dissolved air flotation, but creates small bubbles utilizing a froth generator with surfactant instead of dissolving air in water as the process utilized in a DAF pressurization system. The SAF® bubbles seem to be particularly effective at removing algae from suspension. The filter selected utilizes concurrent air scour and backwash to provide a particularly effective media cleaning process to minimize algae fouling.

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Sodium hypochlorite continues to be utilized for disinfection. A critical element of the system is the use of pre-chlorination to prevent algae growth in the filter and on the media, which can occur rapidly if the system is shut down for even a short time. Aeration pond effluent is pumped first into the SAF® unit for algae removal and then flows to the gravity filter for final polishing. Typical SAF® effluent turbidity is less than 2 NTU with final effluent typically less than 1 NTU. With relatively minor modifications of conditioning chemical feeds, the SAF® can produce 0.2NTU water from this system, easily meeting the CA Title 22 requirement of 2NTU and significantly reducing loading on the downstream filter. In addition, skimmed solids are 7-10% utilizing the SAF process; significantly higher solids than that achievable in competing approaches.

Collected algae float solids are pumped to geotextile dewatering bags in roll-off containers and can be landfilled or composted. Backwash flow from the filters is returned to the head of the wastewater treatment plant. Float solids may also be returned to the head of the plant for short periods of time. Equipment or process failures result in the shut down of the feed pump to the SAF unit, which terminates discharge and several days of storage in the aeration basin allow for time to correct problems. In the event of a long-term outage, one or more effluent storage ponds may be used to store secondary effluent prior to tertiary processing. There is no discharge to surface waters.

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