

# Optimized Dewatering

By Steve Hettinger

In-line polymer preparation & feed boosts dewatering performance at Colorado WWTP



Based on a three-week performance trial, Greeley, Colo., elected to install a polymer feed system resulting in a drier cake production and reduced polymer consumption.

## ARTICLE SUMMARY

**Challenge:** Dry solids recovery at the Greeley WWTP was poor, and polymer usage was as high as 80 lb per day.

**Solution:** A switch from conventional batch mixing to an in-line polymer preparation and feed system improved biosolids management.

**Conclusion:** Polymer expenditures at the Greeley WWTP were reduced by approximately \$12,000 per year.

Optimizing polymer preparation and feed through an enhanced mixing regime has significantly improved the biosolids management program at the city of Greeley, Colo., Water Pollution Control Facility. Switching from conventional batch mixing to an in-line polymer preparation and feed system also has reduced annual polymer expenditures by approximately \$12,000.

### Operations Overview

Processes for the 14.7-million-gal-per-day (mgd) advanced secondary wastewater treatment plant (WWTP) include primary clarification; activated sludge with fine-bubble diffused aeration and nitrification and denitrification capabilities; secondary clarification; anaerobic digesters with floating covers; thickening and dewatering centrifuges; full SCADA monitoring and control of treatment processes and equipment; and an ultraviolet disinfection system.

A portion of the sludge that settles out in the activated sludge process is returned to the aeration basins. The remaining waste-activated sludge is sent to a thickening centrifuge, where it is thickened to approximately 6% total solids and then pumped to the primary digesters for further processing into biosolids.

In the primary digesters, microorganisms consume about 60% of the sludge and also produce the methane gas that is used to heat the digesters to 98°F and generate heat for the facility's buildings. Primary digester solids are sent to two 500,000-gal holding tanks until processed through a dewatering centrifuge. Biosolids average 2% total dry solids prior to dewatering operations.

The plant dewaterers approximately 60,000 to 70,000 gal of sludge per day, four days a week, through a high-speed (about 6,000 rpm) centrifuge, then stores it in a large hopper until it is transported to agricultural sites for beneficial use.

In 2010, the plant's dry solids recovery suddenly dropped and polymer usage skyrocketed. At one point, the plant was using as much as 80 lb of polymer per dry ton while struggling to make 14% to 17% dry solids.

Plant personnel investigated all processes related to the dewatering and solids operation, including the polymer preparation unit. The plant had been using a conventional polymer makedown system comprising two 500-plus-gal tanks that would transfer in liquid coagulant polymer and water simultaneously. Once the required levels in the tanks were achieved, operators then would initiate mixing using a large high-speed mixer.

Using the plant's house-made batch system, one batch was made at a time and aged for a half-hour before being fed into the process with a progressive cavity pump. The plant had been using that system successfully until 2010.

### Optimizing Polymer Feed

In polymer preparation, the first moment of initial wetting of polymer with water is most critical because of the high tendency to form large aggregates of polymers ("fish eyes"). Employing high shear for a short time period is required to prevent fish eye formation at this stage.

Once successful initial wetting is achieved,

individual polymer molecules gradually dissolve into a homogeneous solution; however, the extended or fully dissolved polymer solution is susceptible to any high shear. Because the polymer chain consists of weak carbon-carbon bonds, a considerable amount of polymer chains may be broken easily during the activation process when the extended polymer molecules remain in the high-shear environment.

This was determined to be the likely reason for the poor dewatering performance at the Greeley facility. The original freestanding polymer batch mix tank equipped with impellers induced high shear that was fracturing the extending polymer chains, thereby resulting in inadequate flocculation and requiring excessive polymer use to dewater sludge.

### Performance Trials

To find a way to alleviate the problem, Greeley plant management decided to conduct performance trials for two different polymer blending designs and compare the results with the plant's original makedown system.

Based on the results of the performance trials, the city elected to install a ProMinent ProMix M system because of the drier cake produced and lower amount of polymer consumed during the three-week trial period. The ProMix M system arrived at the WWTP fully assembled; all that was needed to put it into service was a 10-AWG extension cord. A garden hose was used as a water source during the trial period. Once sufficient flow was determined based on the polymer percent makedown, the plant began dewatering sludge using the polymer prepared by the ProMinent unit. The unit was permanently mounted with hard piping in May 2012.

The new system provides a multi-zone mixing chamber that delivers a tapered energy profile for proper polymer activation. This engineered profile effectively hydrates and mixes the polymer to a homogenous and fully activated solution, providing gentle agitation in the mixing tank to allow for the full extension of polymer chain molecules.

The new system also provides an LCD (including primary and secondary flow display) with touchpad control, remote start/stop and programmable auto-flush, and the unit maintains desired concentration based on primary and secondary dilution water flow.

The plant is now back to using 30 to 35 lb of polymer per ton of sludge. Cake solids also are up and consistently average around 19%.

This calculates to approximately \$12,000 in annual savings in polymer use alone. Plus, the lower final sludge water content has greatly reduced the costs to transport biosolids to the field, where they are applied to local dry-land wheat farms by a private firm.

Because better activation results in less polymer needed to do an equal job, the ProMix M system has paid for itself by making full use of the chemical being fed. **WWD**

Steve Hettinger is plant supervisor for the Greeley (Colo.) Water Pollution Control Facility. Hettinger can be reached at [steve.hettinger@greeleygov.com](mailto:steve.hettinger@greeleygov.com).

For more information, write in 1111 on this issue's reader service form on page 102.