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PIPELINE PERSPECTIVE

Getting into rehab and installation

Water conditioner reduces polymer and leads to drier cake in a New Hampshire centrifuge

Problem: Seasonal nutrient limits led to high polymer doses to ensure proper centrifuge dewatering.
Solution: Adding a water conditioner led to less polymer use and drier cake.

In Somersworth, N.H., citywide collection systems deliver wastewater from local industry as well as 11,800 citizens to a 9 ML/d (2.4 mgd) water resource recovery facility. The facility has to meet an effluent limit of 7 mg/L of ammonia–nitrogen. During the summer, the facility faces a 0.75-mg/L phosphorus limit to protect downstream waters.

The facility uses a modified University of Cape Town biological nutrient removal process to control nitrogen. It also uses a GEA (Düsseldorf, Germany) Westfalia centrifuge in its solids dewatering process. In 2015, HydroFLOW USA (Redmond, Wash.) approached facility managers with a proposal to evaluate a technology for the ability to reduce polymer use.

"We chose Somersworth because of centrifuge operations were using a large dose … of polymer and we wanted to see if we could reduce it. We focused on polymer reduction in a planned, step-wise fashion," said Douglas Miller, president of Douglas L. Miller Consulting (Cape Elizabeth, Maine).

The facility's management team agreed to evaluate the HydroFLOW USA Hydropath Technology. Installations of the technology at other facilities showed a significant reduction of struvite buildup and a 20% reduction in polymer use.

"We wanted to study this phenomenon," Miller said.

The facility would consider the new technology a success if it could reduce polymer use and produce drier cake. But the centrate quality needed to remain mostly unchanged. Somersworth's centrate averages 500 mg/L for total suspended solids (TSS). Passing a threshold of more than 1000 mg/L TSS could affect the facility's treatment capacity.

Installing electric induction units

In November 2015, HydroFLOW USA staff installed two 160i HydroFLOW units on a 152-mm (6-in.) pipe feeding the centrifuge. Unit 1 was placed about 23 m (75 ft) upstream of the centrifuge, just after the thickened waste activated sludge pump. Unit 2 was placed 1.5 m (5 ft) upstream of the feed tube, just before the centrifuge. The installations caused no process downtime, fit around existing piping, and did not require plumbing modifications. The units' energy requirement are similar to that consumed by a 60-watt light bulb, estimated at $10/year.

The units induce an electric signal in the liquid inside a pipe. A specialized transducer connected to a ring of ferrites performs the electric induction. The technology, developed for calcium carbonate scale removal and scale prevention in domestic water heating applications, also can be applied for various uses in the wastewater sector.

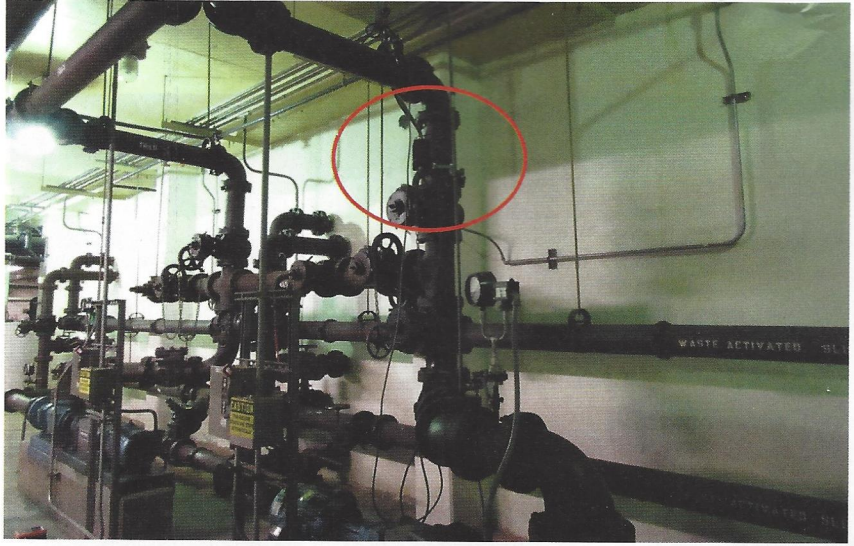
"Somersworth is a wastewater treatment site that we were very familiar with from various historical working relationships," Miller said. "This made studying polymer use very simple. The ability to quickly change the dosing on a centrifuge with a rapid response to our adjustments helped obtain results without delay."

The Somersworth, N.H., water resource recovery facility treats wastewater for 11,800 residents. City of Somersworth, New Hampshire

Collecting baseline data

For the trial installation, facility staff gathered baseline data by operating the centrifuge normally at a feed solids flow rate of 662 to 700 L/min (175 to 185 gal/min) with the HydroFLOW units turned off. On Dec. 14, 2015, staff recorded about 12 kg (27 lb) of polymer per dry 0.9 Mg (1 ton) of solids to produce a cake of about 21% to 22% total solids (TS).

Staff also were instructed to reduce polymer addition incrementally and allow the centrifuge to stabilize after each adjustment. The facility lowered polymer feed to 10 kg (22 lb) per 0.9 Mg (1 ton) at which point the dewatering process became ineffective and the cake became wet. Thus, the baseline



One water conditioning unit treated flows just after the discharge of the thickened waste activated sludge pump, which is about 23 m (75 ft) upstream of the centrifuge. Chuck Glessner

HydroFLOW staff installed a pair of water conditioning units. The one pictured about 1.5 m (5 ft) upstream of the solids entrance to the facility's centrifuge. Douglas Lee Miller

lower limit for polymer use was determined to be 11 kg (24 lb) of polymer per 0.9 Mg (1 ton) of dry solids.

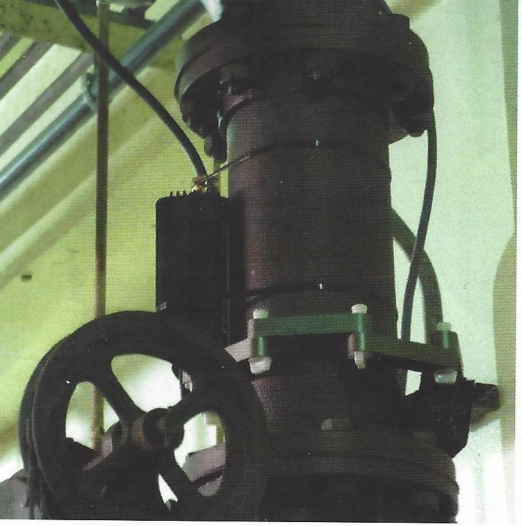
Conducting a series of trials

After collecting baseline information, a series of six testing sequences measured polymer reduction by each unit separately and from both units together.

On Dec. 16, 2015, the trial began by testing Unit 1. The first test sequence achieved a polymer reduction of 26.7%. On Jan. 4, the trial with Unit 1 continued, achieving successful dewatering with about 9 kg (20 lb) of polymer per dry 0.9 Mg (1 ton). Both trials, conducted under normal centrifuge operations, maintained the quality of water leaving the centrifuge at between 100 and 200 mg TSS/L and maintained the cake solids of 22.7% TS for the first trial and 21.5% TS for the second trial.

A polymer reduction of more than 20% was achieved during the second testing sequence.

On Jan. 6, the trials began on Unit 2, the unit closest to the centrifuge. This test decreased polymer dose to 8 kg (17 lb)



These water conditioning units induce an electric signal into the liquid inside a pipe. This treatment has been shown to help reduce polymer use and produce drier cake in the facility. Chuck Glessner

Douglas Miller installs a water conditioning unit on the centrifuge feed piping. Chuck Glessner

per 0.9 Mg (1 ton), producing a 23.9% TS cake and 672 mg/L TSS in the centrate. A total 22.8% polymer reduction was achieved with improvement to cake solids. On Feb. 2, another trial confirmed the first results; the system was able to reduce polymer dose to 10 kg (23 lb) per 0.9 Mg (1 ton) while producing a cake of 24.8% TS and a centrate with 718 mg/L TSS. A total polymer reduction of 15% with greatly improved quality of cake and water leaving the centrifuge was achieved during this testing sequence.

On Jan. 11, both units were tested together. This test achieved a polymer dose of 8 kg (18 lb) per dry 0.9 Mg (1 ton);

Staff perform a signal check on the water conditioning units. Chuck Glessner

it produced cake of 20.5% TS and centrate of 732 mg/L TSS. However, some biological scum was added to the sludge holding tank. This adversely affected the results, causing the centrate in one sample to exceed 1000 mg/L TSS. This trial achieved a 28% polymer reduction.

Another test of both units was conducted on Jan. 20, with a jumper wire inserted within the ferrites of the units. This was done to boost the Hydropath signal throughout the piping network and liquid feeding the centrifuge in an attempt to increase performance. But the trial did not produce noticeable improvement. In addition, scum also was added on this day. The centrate TSS reached 1036 mg/L. A total of 26% polymer reduction was achieved.

Units work together to improve system performance

During six testing sequences, the units reduced polymer use from an average of 12 kg (25.5 lb) per 0.9 Mg (1 ton) to 9 kg (19.1 lb) per 0.9 Mg (1 ton) for a 25.1% reduction. This increased cake solids by up to 3% TS and kept centrate quality within testing limits of less than 1000 mg/L TSS.

"The results suggested a 1 to 1.5 year payback on the investment," Miller said. "The Somersworth team was willing to make improvements to their system and we were able to show promising results."

"Somersworth is in the process of upgrading its dewatering system and will consider including a HydroFLOW unit in their design. HydroFLOW USA is currently in collaboration testing with other wastewater treatment facilities to confirm long-term performance of this technology." ■