Third-Party Technology Verification of the Hydropath Technology at the J. B. Messerly Water Pollution Control Plant, Augusta, Georgia.

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DATE:	November 5, 2018

Scope and Purpose

The primary objective of this independent, third-party technology verification is to validate the effectiveness of the *Hydro*FLOW I Range product with respect to controlling struvite scaling at selected test sites. The verification is based on a review of visual observations and discussion with plant staff. It focuses on identifying changes to struvite scaling before and after installing *Hydro*FLOW units. This technical memorandum specifically discusses the verification testing completed at the J. B. Messerly Water Pollution Control Plant (WPCP), Augusta, Georgia, and the observed outcome.

Technology Description

The *Hydro*FLOW I Range is powered by the patented Hydropath technology. When properly installed on a pipe (see Figure 1), it induces a 150 kilohertz, oscillating sine wave, alternating current (AC) signal. The electric induction is performed by a special transducer connected to a ring of ferrites. The pipe and the flowing fluid act as a conduit, which allows the signal to propagate. The induced AC signal is believed to cause the mineral ions that make up struvite (magnesium, ammonium, and phosphate) to form loosely held together clusters. When certain conditions are created (e.g., pressure change, temperature change, and turbulence) the clusters precipitate out of solution and form stable crystals of struvite that remain in suspension. The crystals are not able to adhere to surfaces as hard scale and are carried away with the flow. Because hard scale no longer accumulates, the shear forces created by the flowing liquid erode and soften existing scale deposits over time. It is important to note that constant liquid flow is required to remove hard scale deposits from a system.

Figure 1: Installed *Hydro*FLOW unit (Model 160i) at a wastewater treatment plant

The J. B. Messerly Water Pollution Control Plant

The WPCP (see Figure 2) is one of four wastewater treatment plants that serve the City of Augusta's service population. It is managed, operated, and maintained by the City's Water and Sewer Department. The WPCP, designed for 46 mgd, currently treats an average flow of 20 mgd.

Figure 2: The J. B. Messerly Water Pollution Control Plant

The liquid treatment train includes screening, grit removal, in-line equalization, primary clarification, biological reactor (Modified Ludzack Ettinger process), final clarification, disinfection, and constructed wetland treatment prior to discharge to the Savannah River. The primary and waste activated sludges are anaerobically digested, dewatered, and hauled for land application.

The WPCP has been experiencing struvite scale buildup on the two belt filter presses (BFPs). Scale control has been accomplished with the application of an anti-scalant at an approximate cost of $4,000 per month.

Test Details

The Augusta WPCP and *Hydro*FLOW USA signed a memorandum of understanding to participate in a 90-day product evaluation testing to determine the effectiveness of the Hydropath technology in mitigating scale formation in the belt filter presses. A site-specific test protocol was also developed outlining details of the tests and providing a consistent framework and guidance for testing so that the results could be used for the third-party technology verification by Jacobs. Seminal information from the protocol is presented in the following sections.

Test Period

The test period began on 7th September 2017 and ended on 1st March 2018. While a 90-day trial period was originally planned, the actual testing lasted approximately six months. Concurrent with the operation of the *Hydro*FLOW unit, operators reduced the anti-scalant feed to zero. It should also be noted that during the test period, the drum in the test BFP broke resulting in the need to interrupt the trial. The BFP malfunction was mechanical and not related to the use of the *Hydro*FLOW device.

*Hydro*FLOW Unit Installation

A single *Hydro*FLOW unit (Model 160i) was installed on the six-inch diameter sludge feed line to one of the BFPs at a location less than 100 feet upstream of the evaluated BFP. Following the installation, an

oscilloscope measurement confirmed that the Hydropath signal was detected at both BFPs due to a pipe bypass (Figure 3) that allowed the signal to travel to the second BFP.

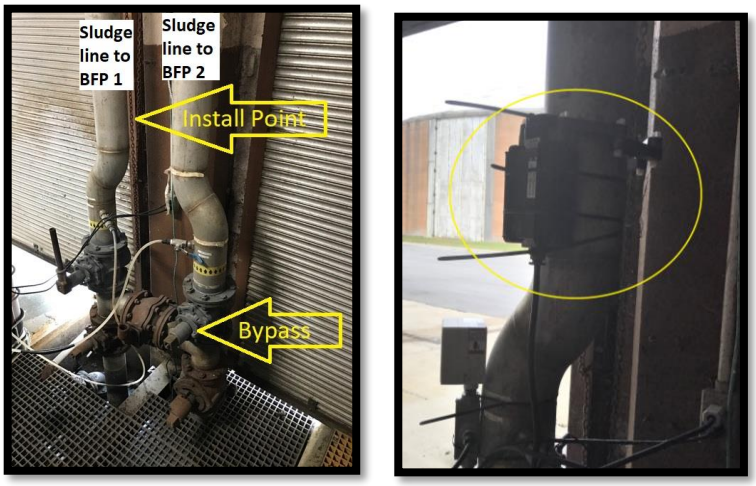

Figure 3: Location of the installation point and pipe bypass (left) and installed *Hydro*FLOW device (right)

Location of Visual Observations

The WPCP staff made visual observations of the drum surfaces and other parts of the BFP.

Baseline Condition

Before energizing the *Hydro*FLOW unit, several pictures were taken to establish baseline condition. As shown in the Figure 4 below, heavy struvite encrustation was evident on the drum surface. Other parts of the BFP also showed struvite scale accumulation.

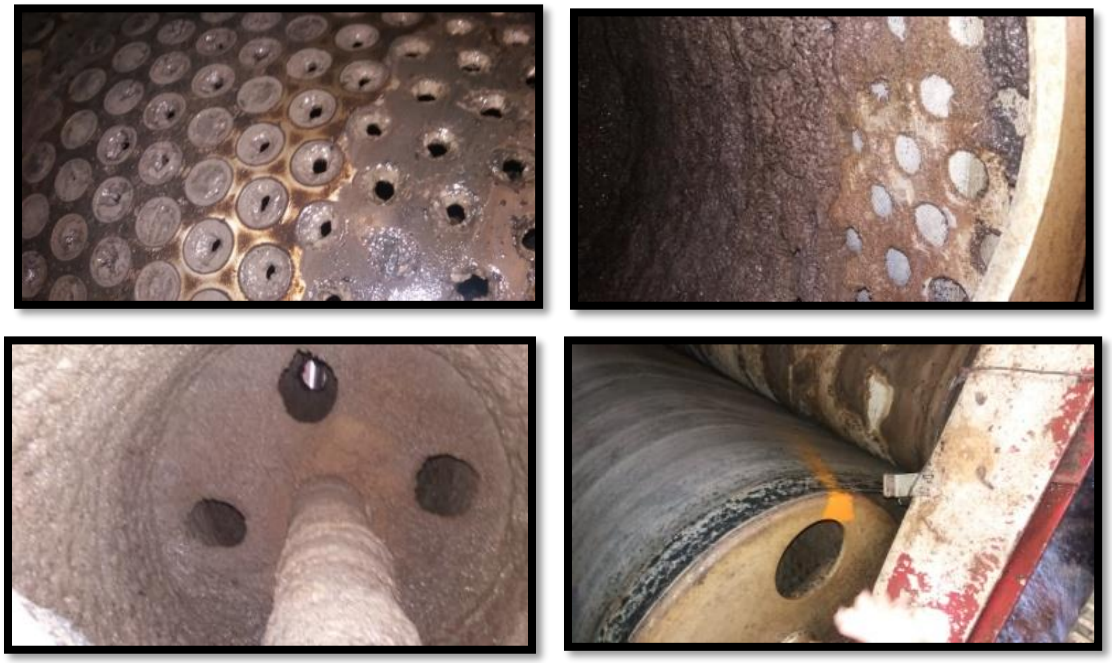

Figure 4: Baseline condition on 7th September 2017 before *Hydro*FLOW was activated

Test Results

Several pictures, taken on 1st March 2018, were made available for review. These pictures (Figure 5), taken at the end of the 6-month test period, appeared to show softened and reduced scaling.

Figure 5: Final condition on 1st March 2018

In addition to test observations, it is also important to note anecdotal information concerning the operators experience using *Hydro*FLOW:

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- The breakage of the 20-year-old drum was due to wear and tear and not caused by *Hydro*FLOW.
- Prior to the installation of *Hydro*FLOW, chisels and hammers had to be used to break loose the hard scale. With *Hydro*FLOW in operation and no addition of anti-scalant, when the drum was removed for repairs after it broke, it was possible to remove the scale by spraying with high pressure water. Since the only operational change was the use *Hydro*FLOW and reduction of anti-scalant, the operator believes the phenomenon is solely attributed to *Hydro*FLOW.
- The cost of repairing the drum was off-set by the savings in anti-scalant use without the need to dip into the plant's O&M budget. The plant's operating staff concluded that the trial was a resounding success.

Conclusion

The dewatering BFPs at the J. B. Messerly WPCP experience struvite scaling, which requires high-cost chemical application and labor-intensive removal of hard scale with chisels and hammers.

One *Hydro*FLOW I Range was installed on the sludge feed line to one of the BFPs to evaluate its effectiveness in controlling scaling. The available photographic information and data was insufficient and did not allow a direct comparison between baseline, intermediate, and final observations of scale accumulation. Consequently, it is not possible to solely rely on the provided photographs to make definitive conclusions.

However, following the installation of *Hydro*FLOW and discontinuation of anti-scalant, existing scale became soft and was easily removed by spraying with high pressure water. The observations of the plant operating staff at the WPCP are consistent with findings at other facilities where *Hydro*FLOW has been tested.

The most significant finding with respect to site-specific performance is that *Hydro*FLOW allowed the WPCP to eliminate the use of anti-scalant chemical and realize significant cost savings of approximately $4,000 per month. In the case of WPCP, the calculated Return On Investment (ROI) was under eight months, on chemical savings alone. This calculation does not include savings and benefits associated with the reduction in maintenance labor, minimization of process downtime, and longer useful life of equipment. In addition to the favorable ROI, the ability of *Hydro*FLOW to allow the WPCP to discontinue

the use of anti-scalant chemical thereby minimizing environmental pollution is expected to be viewed positively by the water sector.

Disclaimer

This Third-Party Technology Verification Report is not a global validation of *Hydro*FLOW units and/or Hydropath technology and provides no assurance that it will be successful in mitigating scaling at other water resource recovery facilities. Jacobs recommends that other facilities interested in using *Hydro*FLOW units to mitigate scale formation, conduct onsite testing to validate its effectiveness under plant-specific conditions. Such tests are valuable in demonstrating technical and financial feasibility of implementing *Hydro*FLOW. Jacobs understands that *Hydro*FLOW USA has a limited number of rental units that it uses for trials. The availability of the rental equipment should be discussed directly with *Hydro*FLOW USA.

Acknowledgment

This technology verification was made possible through the assistance of the J. B. Messerly WPCP staff, who were involved in data collection and overall coordination. Southeast Pump and Equipment (the regional *Hydro*FLOW USA representative) provided and installed the test units. This study was funded by *Hydro*FLOW USA and Hydropath Technology, Ltd.