APPLICATION NOTE

AF7000 STREAMING CURRENT MONITOR

Pilot Study – The Detection of a Coagulant Feed Failure

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Introduction

An Accufloc streaming current monitor (SCM), now known as Hach AF7000 was placed at a local surface water treatment plant for field test. The facility was considering the evaluation of streaming current technology for monitoring and confirmation of coagulant feed.

With a production capacity of between 15 (winter) and 35 (summer) MGD, this drinking water facility practices conventional surface water treatment, including chemical injection to adjust pH and the addition of ferric chloride as the primary coagulant. After sedimentation, the water is filtered through dual media anthracite, followed by post-disinfection. The source water, primarily from snow melt, originates in the central Rocky Mountains. This surface water flows approximately 60 miles before being captured in an impoundment of approx. 1000 surface acres located in an urban area about three miles from the plant. The reservoir is considered to be a very stable raw water source, but is susceptible to flashing from rare, strong thunderstorms.

An SCM was installed in the plant to continuously sample the flash mixer effluent. The SCM signals were logged directly into the plant SCADA system, without being wired to any alarms. The trends were displayed and updated every minute. At a glance, the operators could determine whether the SCM readings were stable and in their expected range. Because of the typical stability of the raw water, the displayed value was expected to remain close to zero after setting it at the assumed optimal coagulation conditions. If the readings deviate strongly negative, it is a signal that the coagulant feed may be lower than the previous optimum; if it deviates positively, the coagulant feed is higher than optimum. Similarly, changes in the raw water quality or pH control may be interpreted by the direction and magnitude of the SCM reading deviations.

Initial Operation

When integrating any new on-line monitor into plant operations, the operators must first understand what the measurement is and how it can be used in their day-to-day operations. Operators will then learn the critical functions, operational protocols, and maintenance requirements of the instrument to ensure the generated data is reliable. Once the data is proven reliable, the operators will focus on how different changes in the raw water and chemical dosages in the treatment processes can impact the response of these instruments. Once they study these impacts the operators can also learn how to use the SCM information to

- Better monitor their treatment processes
- Optimize these processes
- Troubleshoot unexpected events.

Case Study - Detection of Chemical Feed Failure

Overall, the integration of the streaming current monitoring went well. However, it was not until the staff had an unexpected chemical feed failure that the plant fully embraced the use of SCM technology in plant operation.

One evening at approximately 7 PM, there was an abrupt increase in flash mix pH, as shown in Figure 1. There was no change in the raw water conditions (turbidity or pH) at this time. An over-feed of lime was initially suspected due to the increased sample pH (Figure 1). Only after the operator examined the SCM data trend, a coagulant feed problem became a suspect.

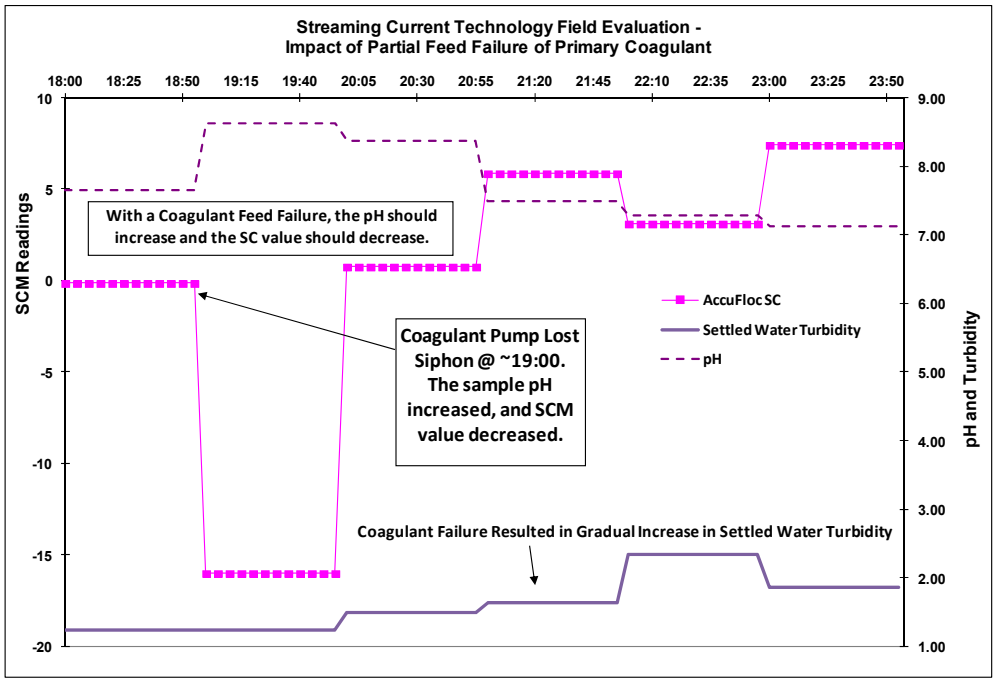

Figure 1: SCM, pH, and settled water turbidity trends during coagulant feed pump failure

The SCM data clearly show that the reduced coagulant feed lasted for about one hour. It was a subtle enough under-feed that it went undetected by other means. Once the operators examined the SCM measurements' trend, they diagnosed the root cause of the problem. The coagulant feed pumps were checked, and it was found that one of the pumps had partially lost its siphon, reducing the ferric chloride dose by approximately 50%. After the root cause was identified and remedied, the operators fully bought into SCM technology as a valuable process monitoring tool providing very fast response to even subtle changes in the sample quality.

The value of streaming current technology can be seen by examining the charts presented in Figure 1 in more detail. In addition to the immediate decrease in the SCM reading after pump failure, the chart shows the eventual impact this event had on the settled water turbidity, which increased by ~ 60%. This increase was gradual and not uncommon for the application, and the peak in the settled water turbidity only became evident approximately three hours after the event. The delayed system response emphasizes the benefit of the early detection provided by the SCM.

In summary, the SCMs provided excellent early event detection warning. If the streaming current monitor had been integrated into the plant's alarms, it is probable that the subtle fall off in the ferric dosage would have been caught and corrected even more quickly with a correspondingly smaller impact to both the settled, and eventually, finished water turbidity.

Conclusions

- The coagulant feed failure event at the WTP was easily and rapidly detected by the SCM technology.
- The ability to easily set zero point reflecting optimal coagulant feed provides a simple means of problem identification.
- Since the evaluation study, this water plant has acquired a second Accufloc SCM and gained a significant amount of trust and confidence in the SCM technology and the monitor.

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