COLORADO
Water Quality Control Division
Department of Public Health & Environment

# Pursuing Excellence Program

## Optimization Action Plan

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| **System name:** | Castle Pines Village MD (Castle Pines Metropolitan District) |
| **Improvement activity:** | Water Plant #2 Influent Chlorine Automation |
| **System contact for more information:** | Jason LeTellier |

| Action steps | Position(s) responsible | Timeframe |
|---|---|---|
| 1. Purchase and install Hach CL10 amperometric analyzer to measure free chlorine, pH and temperature.<br>2. Design, build and implement custom sampling system to provide filtered flow to analyzer.<br>3. Implement PID for influent chlorine injection system using data provided by analyzer to automate chlorine injection based on desired mg/L concentration at head of plant.<br>4. Utilize data for monitoring and alarming.<br>5. Confirm analyzer consistency, accuracy and reliability.<br>6. Recycle sample flows to head of plant. | ORC: Jason LeTellier | 1-2 months |

### Indicators to measure activity success

1. Accuracy of free chlorine readings.
2. Consistency of free chlorine readings.
3. Frequency of cleanings and calibrations.
4. Effectiveness of chlorine injection system automation, especially during dynamic conditions.
5. Responsiveness of alarm system.

### Expected results

1. Smoother chlorine injection system automation.
2. Less maintenance and calibrations needed.
3. Improved alarm notification.
4. Improved operation under changing plant condition.

## Summary of results and conclusions

New analyzer performed well under changing conditions and increased the efficiency of plant operations. The new analyzer sends its data to our SCADA system which uses the information to determine the speed of the chlorine injection pump. This pump, and its backup, uses a Variable Frequency Drive (VFD) to accomplish this task. The operator provides a chlorine concentration target and the analyzer, SCADA, and pump VFDs work together to make adjustments automatically to maintain that concentration. Further improvements were needed to adjust for problems arising from dissolved oxygen and the precipitation of iron.

## Follow-up actions using results

1. Precipitation of iron caused by the addition of chlorine to the ground water led to improvements needed for filtering system for chlorine probe and a separate sample line for pH probe.
    a. Chlorine filter system improvements: Installed Amiad disc filter system and designed and implemented custom backwash for filter to occur on user-given time frames. Micron rating of disc filter seems to work best at 50 microns. Secondary filter is standard particulate filter at 20 microns and must be replaced when dirty. Disc filter with backwash system significantly lessened the load on the standard filter and reduced the frequency of filter changes.
    b. pH probe would slowly drift out of calibration as iron would accumulate on sensor. pH probe appears much more sensitive to this than the chlorine probe. Provided second sample line which uses unchlorinated influent water for the analysis of pH and temperature, but is fed to the same analyzer. This eliminated the issues associated with iron accumulating so quickly on the sensor and led to more accurate chlorine and pH readings with less calibration.
2. During certain periods of the year, high amounts of dissolved oxygen would accumulate on the amperometric sensor. Installed bubble trap to eliminate these issues.
3. Due to the high resolution of data from the sensor (reads collected every second), it was necessary to make programming changes to the PID for the automation.

## Lessons learned

1. Amperometric sensors can be sensitive to sample conditions, but when properly supplied, provide excellent data to streamline water plant operations.
2. Water sources high in iron can cause issues with reading, particularly pH probes, which have to be cleaned and calibrated regularly as a result. If possible, provide sample prior to chemical addition, as this can dramatically reduce these cleanings while still providing the analyzer with the correct influent pH readings to use for its chlorine calculation.
3. Dissolved oxygen issues can be easily dealt with using a proper bubble trap system.
4. Once the analyzer was properly supplied, cleaning and calibration frequency was dramatically reduced.
5. The high resolution of data provided by the analyzer greatly increased the plant's ability to respond to changes in flow and/or chlorine demand, as well as provide a more responsive alarm system.