

## Active Mixing and Ventilation Provide Energy-Efficient THM Removal for California Water Utility

In the summer of 2014, Placer County Water Agency in California was facing a trihalomethane (THM) crisis. Drought across the western United States had led to increased levels of organic matter in the source water and water conservation measures had resulted in lower water usage, resulting in higher water age in their distribution systems. Higher organic levels required higher levels of chlorine disinfectant, which increased THM levels during treatment. Higher water age allowed THM formation to grow further in the distribution system. After registering an Operational Exceedance for THMs in the early summer, PCWA staff wanted to act fast.

Relying on surface water captured by the mighty Sierra Nevada mountain range, PCWA provides drinking water for over 200,000 people in cities, towns and communities along Interstate 80 in the heart of California's "Gold Country." PCWA serves an area of over 1,500 square miles – from the foothill cities of Roseville to Lake Tahoe – and they run multiple water treatment plants for large populations such as their Foothill/Sunset system (population 83,394) and smaller systems for cities like Colfax (population 3,079).

Operators saw THM levels spike in February 2014, and again in May of the same year. "Telling our customers that we were exceeding the MCL wouldn't be fun – we needed to act fast," noted PCWA Drinking Water Operations Manager, Andy Hamilton.

System flushing is one of the most common operational methods for reducing water age and lowering THMs. However, during a drought, flushing becomes problematic. "Flushing was always an option, but we would be sending mixed messages by telling people to save water while we dumped a bunch of water on the ground," noted Hamilton.

PCWA staff challenged themselves to quickly identify and address locations where THMs were on the rise. "We have always been concerned about THMs," noted Hamilton, "but we didn't have a way of assessing THM levels beyond the quarterly [compliance] sampling. Between shipping water samples and waiting for results, the delay was a big issue for me. I had to wait two weeks before I found out what was going on and THMs aren't exactly cheap to analyze."

At the request of Brad Wilkins, Water Quality Supervisor, PCWA decided to trial a Parker Hannifin desktop THM analyzer to gain greater insight into the specific locations where THMs were the greatest problem and to understand how THM analyses could be used to better optimize treatment and distribution. The small



*Figure 1. A pair of welded steel tanks make up the clearwell for the Colfax water system. Both tanks have PAX Water Mixers and PAX Powervents (visible on the top of each tank).*

desktop unit uses helium and an advanced set of sensors to provide highly accurate species-specific THM analyses in drinking water in 30 minutes.

Using the Parker Hannifin unit, PCWA operators made an important discovery: THM levels were forming quickly during primary treatment, and THM levels in the clearwell tanks at the Colfax system were particularly high. Treatment plant operators experimented with lowering the chlorine pre-feed into the treatment plant and saw a substantial reduction in THMs.

With the insights gained from the Parker Hannifin THM analyzer, PCWA operators then explored options for further reducing THMs in the clearwells and in distribution system tanks. PCWA staff had attended webinar trainings by PAX Water Technologies and had learned how the addition of full aeration systems inside water storage tanks could strip THMs from finished drinking water. But under a tight deadline and with limited emergency funds, PCWA wanted to explore how much THM reduction they could achieve with just active mixing and active ventilation alone.

PAX Water Mixers continuously push THM-rich water up to the surface where the THMs can evaporate out of the water into the headspace of the tank. The PAX Powervent is a high-efficiency ventilation system, designed specifically for water storage tanks, that will exhaust the THM-rich air out of the tank.

Some of the targets for improvement were a pair of welded steel tanks (1MG and 300,000-gal) that made up the clearwell (Figure 1) and a 600,000-gal “Ballpark Tank” (Figure 2) in the Colfax distribution system. PAX recommended the installation of a powerful PAX Water Mixer (PWM400) and a Powervent (PPV400) in both the 1 MG tank and 600,000-gal Ballpark Tank and a smaller PAX Water Mixer (PWM200) and Powervent (PPV200) for the 300,000-gal tank. Combined, the three powerful active mixers and three energy-efficient Powervents used only 2,800 watts total.



*Figure 2. The 600,000-gal Ballpark Tank had a PAX Water Mixer and PAX Powervent.*

Initial results were very encouraging. Operators saw an immediate and substantial reduction in THMs leaving the clearwell tanks, and the Ballpark Tank also saw substantially lower THM levels compared to historical values.

“One of my initial concerns was chlorine loss” explains Hamilton. But after installation and operation of the PAX Water Mixers, Hamilton and his team observed that chlorine levels were actually quite stable. “We have been able to maintain residuals just fine.” Before installing the mixers Hamilton’s team observed that as the Colfax tanks drained, they saw residual levels drop. But after installation of the PAX Water Mixers this was no longer observed. “That’s another big benefit: the tanks are homogenized.”

After running the mixers and Powervents for a year, utility managers were eager to quantify exactly how much THM reduction they were achieving with the new technology. The Parker Hannifin THM analyzer was ideal for this study. Water quality experts from PAX Water Technologies developed a sampling protocol that would allow PCWA to not only quantify the level of THM reduction but also to determine the level of THM formation in the absence of a mixer and Powervent.

The results were impressive. The PAX Water Mixer and Powervent were able to remove 45% of the THMs in each of the two clearwell tanks, and 65% of the THMs in the 600,000-gal Ballpark Tank (Figure 3).

“I think the magnitude of THM reduction from just the PAX Water Mixer and the PAX Powervent surprised everyone,” explained PAX R&D scientist Dr. Robin Giguere. “We knew the PAX Water Mixer was powerful but we did not anticipate the efficiency with which it and the Powervent could reduce THMs without any additional aeration equipment. Our results so far suggest that it is by far the most energy-efficient means of lowering THM levels available,” explained Giguere.

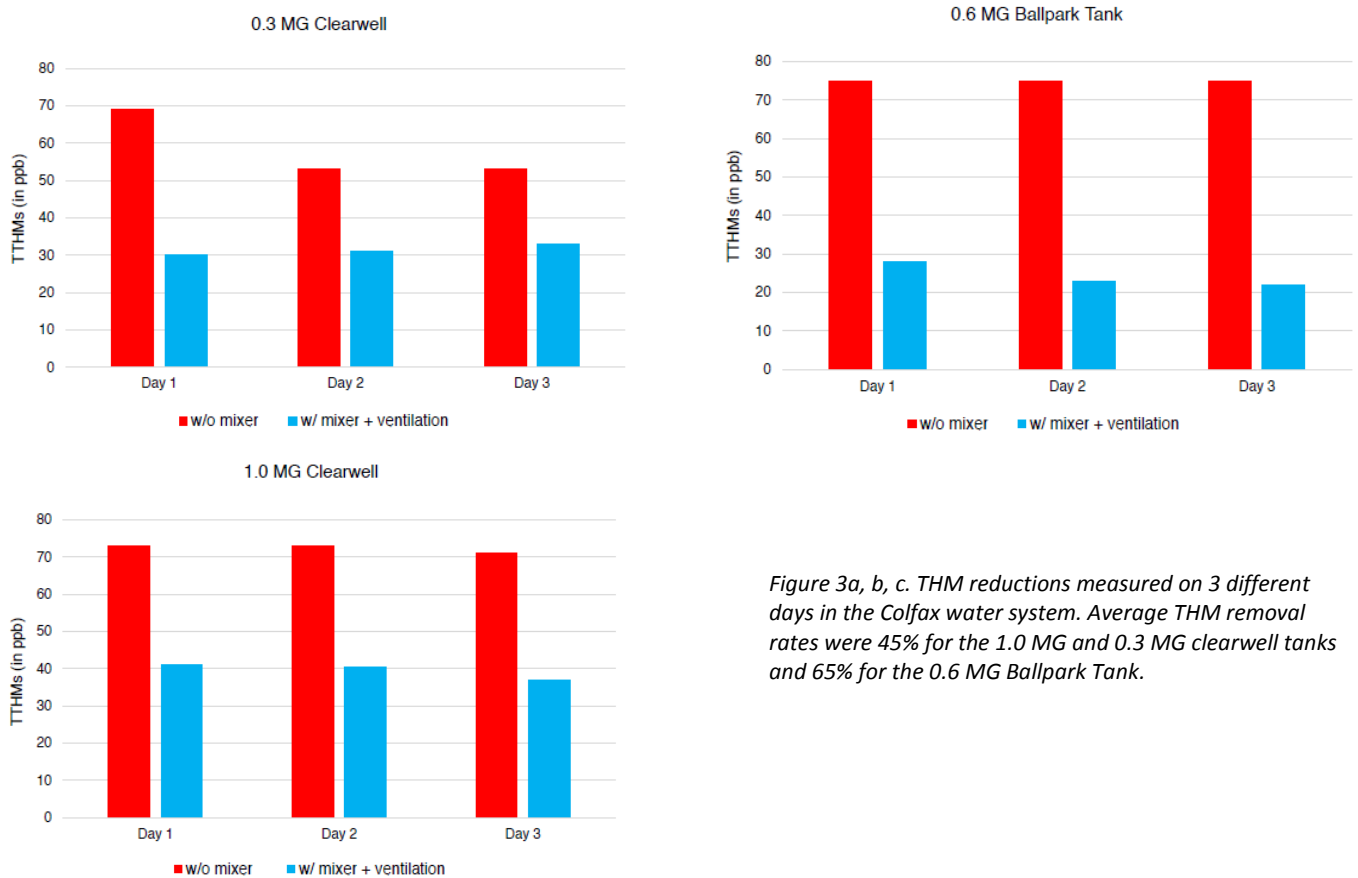


Figure 3a, b, c. THM reductions measured on 3 different days in the Colfax water system. Average THM removal rates were 45% for the 1.0 MG and 0.3 MG clearwell tanks and 65% for the 0.6 MG Ballpark Tank.

*“Prior to installing the PAX Water Mixers, we were seeing TTHM levels in our tanks into the 70s and 80s during warmer months. Our most recent samples were in the 30s and 40s, collected this month. We’ll be keeping an eye on those levels into the warmer months, but I’m confident those levels will stay much lower than we were seeing before.”*

**Brad Wilkins, Water Quality Supervisor, PCWA**