

## In-Tank THM Removal System Keeps Water System in Compliance

Monterey, California is a seaside town that enjoys cool weather, picturesque beaches and, for the most part, excellent water quality. However, over the last few years, Trihalomethane (THM) levels in the Ryan Ranch part of their system have risen dramatically. Despite aggressively flushing this part of the system and periodically boosting chlorine at the tank to improve residual levels, Monterey was on track to breach their Total Trihalomethane (TTHM) levels in the summer of 2011.

The Ryan Ranch area is the easternmost part of the Monterey system. While the rest of the Monterey system (closer to the coast) is often shrouded in coastal fog during hot summer days, the Ryan Ranch area is sunny and hot. Furthermore, the 500,000 gallon Ryan Ranch tank receives an average of 100,000 gallons per day of water from three wells in the area. These wells were known to have bromine levels around 70 ppb.

The combination of warmer temperatures and lower turnover had made it difficult to maintain an adequate level of chlorine disinfectant residual. As such, operators had periodically spiked the tank with additional disinfectant and frequently flushed the tank and surrounding system in an attempt to control THMs.

Beginning in 2010, TTHM levels spiked, and the running annual average for the Ryan Ranch system rose dramatically (Figure 1). The dominant THM species was bromoform, “which poses the greatest health risk and is hardest to remove using conventional aeration technologies. Water quality managers calculated that they needed to achieve a TTHM level of less than 50 ppb for the June 2011 measurement for the locational running annual average (LRAA) to remain in compliance. Historical estimates suggested that without a major intervention, TTHM levels were on track to reach 140 ppb by June.

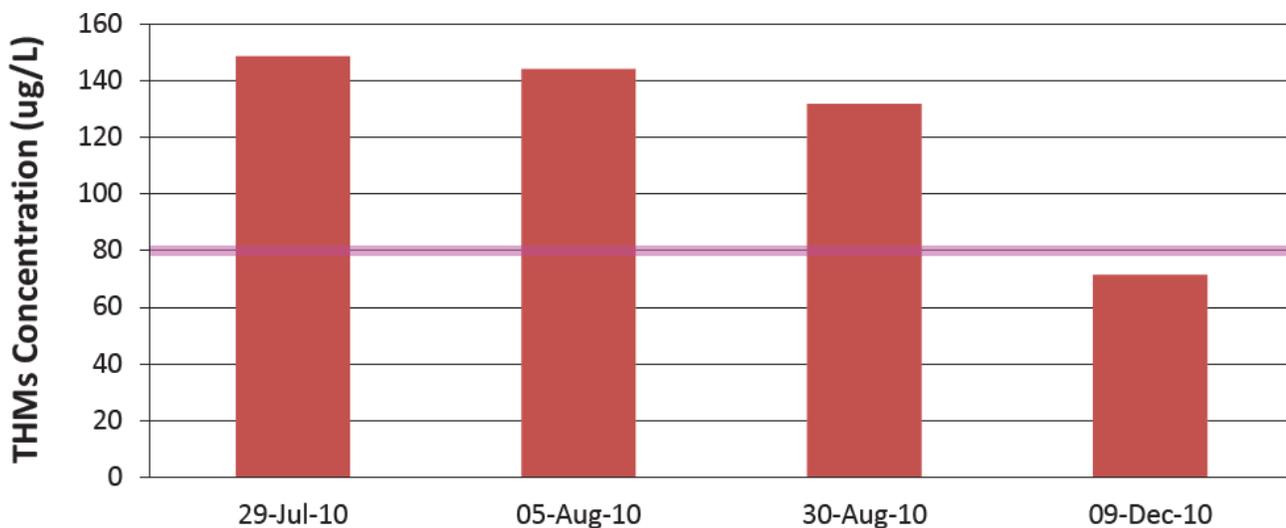


Figure 1. Historic TTHM levels (ppb) per quarter at Ryan Ranch. Locational running annual averages were expected to exceed the Maximum Contaminant Level (MCL) in Q2 2011.

The precise cause of the dramatic increase in TTHMs in the Ryan Ranch tank were uncertain, but several factors likely contributed to the problem:

1. The combination of high temperatures and low turnover likely led to thermal stratification during some months of the year. Thermal stratification leads to high water age and high rates of residual consumption – both of which can elevate THM levels.
2. The use of source water with high bromine levels likely stimulated the formation of brominated THM species such as bromoform.
3. The tank had been periodically washed out, but it had not been chemically cleaned to remove biofilms. The presence of biofilms and sediment provide additional organic matter that can react with disinfectant to produce DBPs.



*Figure 2. The Ryan Ranch tank is a 500,000 gallon steel ground storage tank*



*Figure 3. Interior conditions of the Ryan Ranch tank prior to TRS.*

Operators at Monterey had considered an in-tank aeration system to lower THM levels, but the initial cost estimate they received was not attractive. Complicating the issue was the fact that there was only a limited amount of power available at the Ryan Ranch tank, and a conventional aeration system would have required a substantial electrical service upgrade.

PAX Water Technologies, in partnership with Utility Service Company, proposed a multi-staged approach, using a combination of energy-efficient aeration and mixing, combined with a thorough clean-out of sediment and chemical cleaning of the tank interior. The total system was designed to use less than 30 amps at 120V – and leave power to spare for other systems. The combination of power constraints and the high goal for THM reduction (~60 percent reduction) left no room for error.

Installation and start-up was completed on June 23rd, 2011, just 5 days before the Q2 compliance sample was to be taken. Figure 4 shows the results of the chemical clean and installation of the PAX mixer.



Figure 4. Interior conditions in the Ryan Ranch after cleanout and installation of the PAX mixer.

On July 11, the staff at Monterey received their results: TTHM levels were measured at 49.2 ppb (~65 percent reduction), which brought their LRAA to just below the Maximum Contaminant Level (MCL). “This result was HUGE”, according to Monterey water quality superintendent Leslie Jordan. Subsequent measurements have shown that TTHM levels have remained under control (Figure 5).

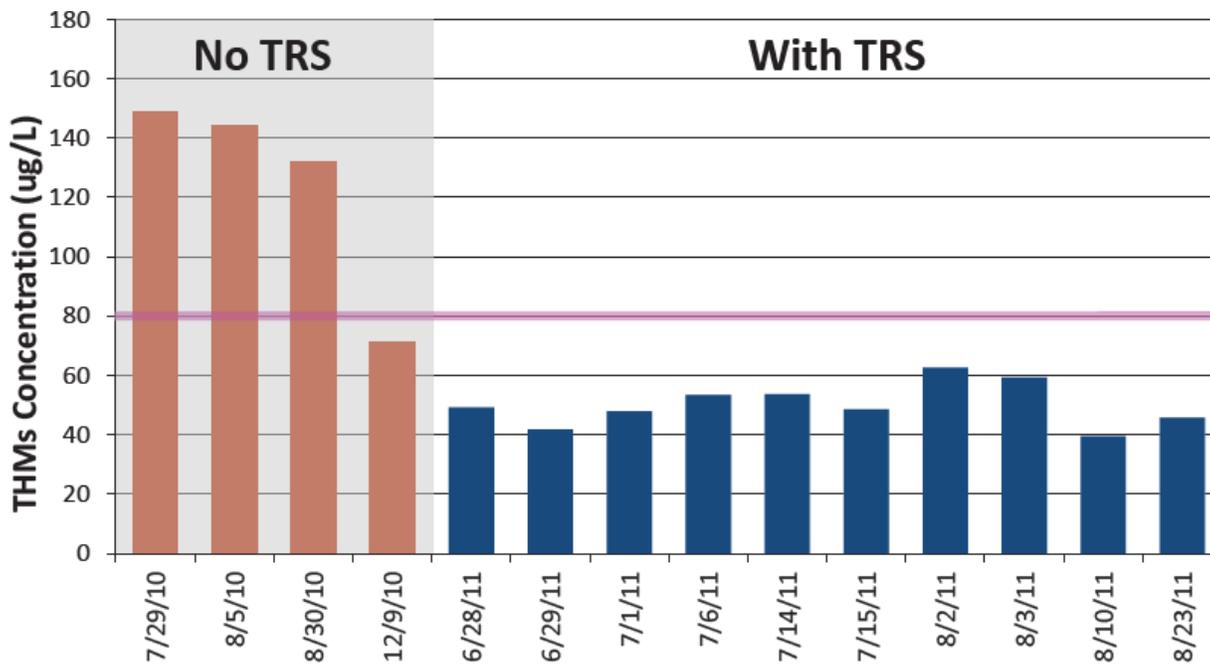


Figure 5. TTHM levels at the Ryan Ranch tank in 2010 (without TRS) and 2011 (after installation of the TRS).

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It is impossible to know with certainty which parts of the TRS made the greatest contribution to the reduction of THMs at the Ryan Ranch tank. Mixing, aeration and chemical cleaning all likely worked together synergistically to produce the successful results. And, by working together, PAX Water Technologies and Utility Service Company were able to provide a comprehensive and multi-pronged approach to THM reduction that could be implemented quickly.