

# NORTHGLENN

Active Mixing in Distribution System Helps Colorado Utility Lower THM Levels While Reducing Chlorine Used for Secondary Disinfection



## OVERVIEW

Large seasonal variations in drinking water demand can often complicate distribution and treatment operations. Northglenn, Colorado experiences variations in demand ranging from 9.5MGD in summer months to 2.0MGD in winter months, a 400% fluctuation. The treatment plant draws raw water from a terminal reservoir and treats it through a series of processes, including flocculation, clarification and mixed media filtration. To optimize plant performance and operating costs, operators strive for relatively constant throughput rates and gradual changes in volume.

In early 2018, operators attended a local educational seminar entitled *Tools for Distribution System Water Quality* to learn about a new suite of technologies for mixing storage tanks. Fundamentally, properly sized tank mixers can “de-stratify” water storage tanks, completely mixing tanks to create consistent disinfectant residual throughout. The submersible active mixers from PAX Water Technologies are powerful enough to fully turn over the multi-million gallon water tanks several times each day. Moreover, they provide a platform for supplemental technologies that can be added to remotely monitor and dose residual, as well as to volatilize disinfectant byproducts such as trihalomethanes (THMs). Together, these technologies allow operators to target individual water storage tanks to regulate residual levels while reducing THM levels across pressure zones.



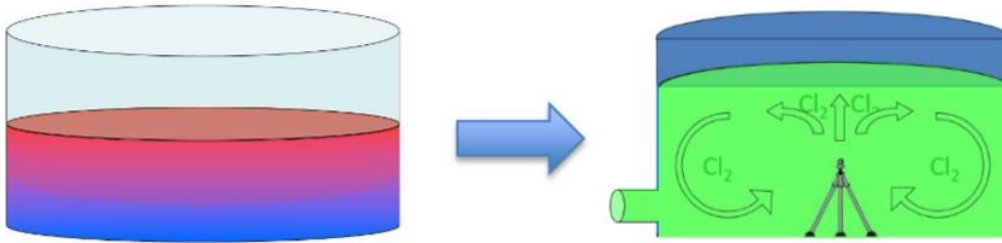
Northglenn Water Treatment Plant and the terminal reservoir

Given the dramatic increases in temperature and demand for water in summer months, coupled with declining network residual resulting from the higher temperatures, operators at Northglenn typically increased exit residual targets at the treatment plant to about 1.40mg/l. An unintended consequence of the increased disinfectant was higher levels of trihalomethanes (THMs) - a disinfection byproduct - at several locations. The utility had an internal THM threshold of 40ppb, above which additional sampling and testing is required, resulting in increased costs to the City. The challenge for Northglenn operators was to maintain sufficient (and consistent) disinfectant residual levels, while avoiding elevated THM levels.

As they compared various technologies to address the issues, operators were pleased to learn they could begin with tank mixing, evaluate those results, and then add additional technology to address specific areas as needed. This incremental approach eliminated the risk that capital would be spent unnecessarily by enabling the City to determine whether mixing alone could improve water quality before spending additional funds. By adding mixing to achieve homogeneous residual levels in its tanks, the City hoped to utilize the incoming residual dose from the treatment plant more efficiently throughout its distribution network. Limiting the amount of chlorine dosed into the

distribution network would, in turn, reduce THM levels.

A series of three storage tanks were identified for installation of submersible active mixers. The tanks ranged from 2MG to 3MG and were hydraulically linked to each other. A single PAX PWM400 Mixer was installed in each tank in October of 2018. The mixers operate with a 0.5hp motor and an impeller spinning at over 1,000 revolutions per minute (rpm) to create a vortex flow pattern capable of fully mixing the entire volume of water inside the tank several times per day in order to overcome thermal and chemical stratification.



***Powerful PAX Mixers overcome thermal and chemical stratification in water storage tanks.***



***Submersible PAX Mixer***

Post mixer installation, operators climbed the tanks to obtain residual and temperature samples. Within one week, there was a noticeable difference in disinfectant residual and temperature levels as the tanks became fully-mixed and homogenous. Residual stratification began decreasing, which led to steadier (and higher) average residual levels. Within a short period, operators reduced the chlorine residual leaving the plant from a targeted range of 1.30 to 1.40mg/l to 1.00 to 1.10mg/l. As residual levels held steady at 1.0mg/l leaving the plant, they were still able to maintain an adequate 0.60mg/l residual at the furthest point in the distribution system.

Since the PAX Mixers have been in operation, they have eliminated thermal and chemical stratification, allowing the utility to use less chlorine, maintain consistent residual and stay below the THM threshold. Should the time come when the utility needs additional treatment technology, it can easily add components to the PAX Mixers to provide greater residual control and THM removal.

*“Since installing the PAX Mixers at three tanks we have been able to lower our chlorine residual from 1.4 to 1.0mg/l. Consequently, our THMs have stayed below our goal of 40ppb. In addition, operators have commented that they observe the “chlorine smell” is less pungent and there is no accumulation of condensation inside the tops of the tanks.”*

**Jason Hensel, Operations Manager, City of Northglenn**

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