

HAVRE

City of Havre, Montana Successfully Utilizes Mechanical Tank Mixing to Prevent Ice Formation and Improve Water Quality

OVERVIEW

Located in north-central Montana, the City of Havre is located in a geography that sees summer temperatures over 100°F (38°C) and winter temperatures that can plunge as low as -40°F (-40°C) accompanied by sustained arctic winds of over 20 mph. These dramatic swings in temperature can wreak havoc on disinfectant levels in the summer by creating a “stratified” tank environment conducive to pathogen growth and allow for ice formation in the tank during the winter. Ice formation can lead to tank coating and appearance damage as large chunks of ice can suddenly drop from a higher tank elevation and create catastrophic tank damage.

Normally, above ground water storage tanks tend to have their water collect in layers of similar temperature. This phenomenon can be experienced in swimming pools during the summer which often exhibit this “stratification”. Cooler water is experienced at the bottom of a summer pool and warmer water collects near the surface due to inherent density differences between warm and cool water. In the summer, warm water layers near the top of a water tank have the least amount of chlorine disinfectant which can promote the growth of “bio-film” often observed in rings near the top of a tank. Conversely, cool water layers at the bottom of the tank have adequate chlorine concentrations. Trouble in the form of taste and odor complaints or even Bac-T or coliform “hits” can occur when a tank is pumped down and layers of water with low chlorine concentration hit the downstream distribution network.

Curiously, in frigid winter conditions, the situation is reversed with the warmer water staying near the bottom of the tank and the coldest water near the top. This is why fish can live through winter at the bottom of a pond without freezing solid. Ice being significantly less dense than liquid water forms at the top of a tank in the winter. Ice “shelves” can break loose as a tank is pumped down and create extensive damage to corrosion protection coatings and internal structures. The City of Havre realized that adding simple mechanical mixing to their newly refurbished 3.5 MG West Water Tank would solve both the potential summer water quality and winter asset protection issues. In 2017, the City added a PAX PWM 400 tank mixer to the West Water tank. The 0.5 HP PAX mixer was sized to ensure the entire tank volume would be fully mixed (over six tank turnovers per day) with temperature convergence throughout the tank to 0.9°F (0.50°C)



Winter ice formation can damage water tanks

between any two internal locations. By eliminating temperature stratification, the tank would get the maximum benefit of the incoming warmer water in the winter; reducing the chance for ice formation. In the summer, full mixing of the incoming water with higher chlorine concentrations would help to prevent biofilm formation and allow for a consistent disinfectant concentration in the tank volume.

The PAX Mixer™ system passed the first winter test in 2018 with flying colors. The PAX PWM 400 mixer prevented ice formation in the tank by helping to distribute the incoming warmer water throughout the tank and protecting the City's investment in the tank's refurbishment.



Off-center location of a PAX PWM 400 tank mixer

We were a little surprised that a ½ horsepower mixer operating off of a 20 amp circuit could fully mix our tank, but it did. The PAX Mixer™ did the job for us.

**Dave Peterson –Public Works Director,
Havre MT**

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