Weatherizing Rural Water Systems

A guide to ensuring reliability and quality

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Water professionals shoulder a significant responsibility, particularly in the face of increasingly severe seasonal weather conditions. The density changes in water caused by temperature fluctuations can impact the integrity of aboveground water tanks, necessitating specific measures for both winter and summer seasons. This guide emphasizes the importance of extreme weather preparation to ensure a reliable water supply for rural communities.

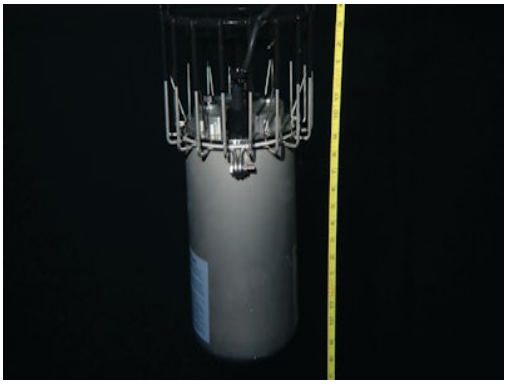
Seasonal Preparations for Water Tanks

As seasons and temperatures change, aboveground water tanks become susceptible to thermal stratification. In the summer, warmer water forms a layer at the top, and colder water settles at the bottom. As winter sets in, this stratification can reverse, causing the warm top layer to drop to the bottom, compromising water quality. Similarly, the cold layer rises, bringing sediment with it and further affecting water quality. This phenomenon also occurs in lakes and poses a challenge for water districts in processing drinking water.

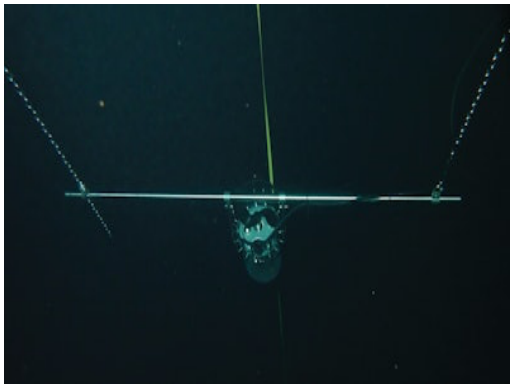
As temperatures continue to drop, ice can form both inside and outside the tank. Each cycle of rising and falling water levels contributes to the formation of ice collars, which become thick and heavy, potentially damaging the tank's integrity.

Proper preparation and maintenance are crucial to prevent ice formation and ensure the integrity of the water tank. Planning ahead can give water managers peace of mind, keep their facilities and equipment in good repair, and prevent unhappy surprises for the communities they serve.

Active Mixing for Ice Prevention and Water Quality Maintenance

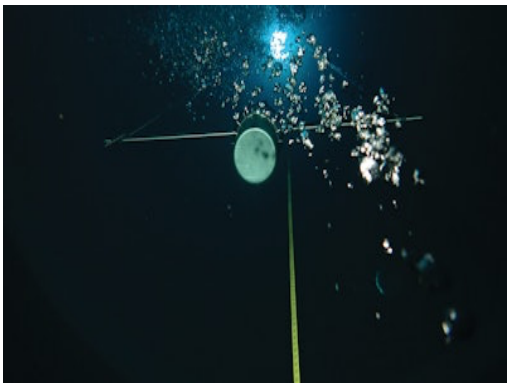


Active mixing is a powerful tool for preventing ice formation and maintaining water quality during the winter months. By continuously circulating water from the bottom of the tank to the top, active mixing keeps the entire water volume at a constant temperature, preventing ice formation. This method is particularly effective when used in conjunction with heaters, as the mixing helps distribute heated water more efficiently.



Case Study: Rye, N.H.

One recent success story we experienced was with the Rye Water District in New Hampshire. Rye faces the challenge of providing a consistent and reliable water supply to its 5,500 residents and 1,702 connections throughout all weather conditions. In particular, the district grapples with the issue of ice formation within its water tanks during the winter months, which can lead to water pressure fluctuations, increased maintenance costs, and even the risk of structural damage. To tackle these problems, the district turned to a powerful, fully submersible active tank mixer designed specifically to prevent ice formation and its associated issues.



The Problem: Water Supply Reliability and Ice Formation

To maintain the correct water pressure within the system, the Rye Water District pumps water into storage tanks, which then distribute water to residents. However, during winter, ice formation within the tanks poses significant challenges, including:

- Adverse effects on water pressure: Ice formation can disrupt water pressure, leading to issues for residents' water supply.
- Increased maintenance costs: Ice within the tanks can prevent routine maintenance, resulting in additional work and expenses.
- Risk of structural damage: In severe cases, ice formation can cause tanks to burst, posing a threat to the community and leading to costly repairs.

The Solution: Active Mixing

The Rye Water District adopted a two-pronged approach to prevent ice formation and ensure a reliable water supply:

1. Active Mixing: The mixer in question employs active mixing to circulate the water at regular intervals. This process pulls warmer water from the bottom of the tank into the colder upper layers, preventing ice formation.

2. Regular Maintenance: In addition to active mixing, the Rye Water District contracted Underwater Solutions Inc., an expert asset management company, to perform regular maintenance checks to ensure the mixer's optimal functioning.

The Rye Water District installed the Kasco CertiSafe™ NSF 3400HC61 240 V 3/4 hp mixer at the Breakfast Hill tank, a welded steel tank with a capacity of 1.2 million gallons (MG). The installation took only one day and involved removing the center roof vent, attaching chains near the vent, and setting the mixer at the appropriate level using the SM100 suspension

mount. The Kasco Advanced SCADA control panel enables remote operation and monitoring of the mixer.

The benefits of the mixer installation were quickly evident. The mixer effectively prevented ice formation within a short time. The Rye Water District observed cost savings compared to potential continuous repairs, damage to customers' homes, and water contamination issues.

Apart from ice prevention, active mixing offers several other advantages, including maintaining chlorine residuals, improved water quality, taste and odor, reducing sediment accumulation, and lowering disinfection byproducts.

Key Takeaways

1. **Thermal Stratification Awareness**
In an unmixed water tank, thermal stratification can occur, leading to changes in water quality. Winter conditions can cause stratification reversal, compromising water quality. Regular monitoring and adjustments are essential throughout the year to manage thermal stratification and prevent water quality issues. Summer is a good time to address any sediment accumulation resulting from temperature fluctuations.

2. **Operator's Checklist: Assessing Your Tank's Condition**

- *Inspect Coatings and Appurtenances*: Check for wear or damage to coatings and internal appurtenances, as damaged coatings can lead to further issues during freezing temperatures.
- *Ensure Free Air and Water Flow*: Clear screens covering vents and overflows to maintain proper airflow and prevent ice formation.
- *Check Ladders and Piping*: Securely attach ladders and piping to prevent dislodging from heavy ice collars.
- *Verify Water Level and Storage Volume*: Regularly monitor levels to ensure an adequate supply of drinking water and firefighting reserves.
- *Inspect Heaters (if applicable)*: Ensure heaters are functional in extremely cold temperatures.

3. **Cold Climate Design Considerations**

- *Appurtenance Placement*: Keep critical appurtenances above the water line to reduce the risk of ice damage.
- *Insulation*: Incorporate insulation to maintain a stable internal temperature.
- *Material Selection*: Choose materials resistant to freezing temperatures and potential ice damage.
- *Tank Shape and Roof Design*: Optimize design to minimize ice buildup.

4. **Active Mixing for Ice Prevention and Water Quality Maintenance**
Active mixing is a powerful tool for preventing ice formation and maintaining water quality during winter months. Continuous circulation, particularly in conjunction with heaters, helps distribute heated water efficiently.

5. **Regular Maintenance**
Continue regular checks and maintenance to ensure the optimal functioning of water systems during warmer months.

Ensuring year-round reliability for rural water systems requires proactive measures. By understanding the challenges of both winter and summer, conducting regular maintenance, and considering design specifications for extreme weather, water professionals can safeguard their water tanks and ensure a consistent and reliable water supply for rural communities. The implementation of solutions like active mixing is effective in preventing ice formation and maintaining water quality throughout the year. Prioritize the safety and well-being of your community by taking proactive steps to prepare your water systems for all seasons.

To learn more about CertiSafe mixers by Kasco, visit KascoMarine.com/CertiSafe.