Remote Monitoring For Water Quality And Public Health

New technology helps utilities meet the challenges of maintaining a safe and adequate public water supply.

Water utilities exist to protect the public health and environment of the communities they serve. The availability of clean water has been a primary factor in society's development over the past several hundred years. We live longer — and we live in a more pleasant place — because water utilities continually search for the highest quality water sources, treat the water to remove biological agents and contaminants, and produce water that is safe for us to drink.

In the perfect distribution network, water would be protected from all outside contaminants and biological agents as it travels through miles of pipeline, and the water reaching the end consumer would be as safe as the water leaving the treatment works. But our water distribution networks are aging, and many public water systems are showing the effects of decades of underinvestment in their upkeep. Corrosion and buildup of organic matter and biofilms on underground pipes expose carefully treated water to contamination as it travels through the system.

The U.S. EPA maintains drinking water regulations for more than 90 contaminants, including microorganisms, chemicals, and the disinfection byproducts created when disinfectants used to treat the water react with pollutants and naturally occurring elements that infiltrate the water distribution network. To ensure that treated water is still fit for consumption when it reaches the consumer, utilities perform primary and secondary disinfection with disinfectants including chlorine, chloramine, and chlorine dioxide (Source: U.S. EPA National Primary Drinking Water Regulations).

Water utilities are required to comply with EPA and state environmental regulations for the minimum and maximum allowable levels of disinfectant (residual chlorine) in drinking water, from the point water leaves the treatment works right up to the point of distribution. Today, utilities verify and maintain those levels primarily through testing at the treatment works to confirm that treated water contains sufficient levels of disinfectant to counteract any contaminants picked up along its journey to the consumer. Once the water leaves the treatment works and enters the distribution system, utilities have very little visibility into its condition.

To fulfill EPA monitoring requirements, utilities periodically take water samples from points throughout the system and test them in a laboratory to ensure that they meet required standards. While this practice gives utilities a snapshot of water quality throughout the system, the inherent latency of testing and response means that contamination events may go unnoticed between testing dates. Even if samples are taken the very day a contamination incident occurs, the lag

between sample collection and laboratory analysis may allow contaminated water to reach the consumer.

New monitoring and alert solutions coming to the U.S. market help utilities address these challenges by allowing them to efficiently and economically monitor water quality within and throughout the distribution network, improve their response time for contamination events, and reduce the risk of delivering compromised water to the consumer.

Thanks to recent advances in technology, the latest monitoring solutions can perform both as an early warning system to alert operators in the event of a contamination incident and a tool to help determine the best response to that incident as it occurs. For example, a utility may see that contaminant levels are rising in a section of the distribution network and attempt to correct it by flushing that portion of the system. However, if the source of that contamination is a backflow, flushing may have the very undesirable effect of drawing more contaminants into the system. New monitoring solutions would detect contaminant levels rising further in response to the flushing, allowing operators to immediately stop and take alternative action.

Municipalities can place monitoring systems at critical sites such as hospitals or government institutions at risk for malicious contamination, allowing officials to initiate a rapid response to any changes in contaminant or disinfectant levels.

Some of the new solutions rely on amperometric measurement, an electrochemical technique that detects the change in current resulting from chemical reactions within the water system. Amperometric devices can be easily retrofitted into an existing distribution network and placed directly within the water main without interrupting service. The devices measure four parameters in the treated water:

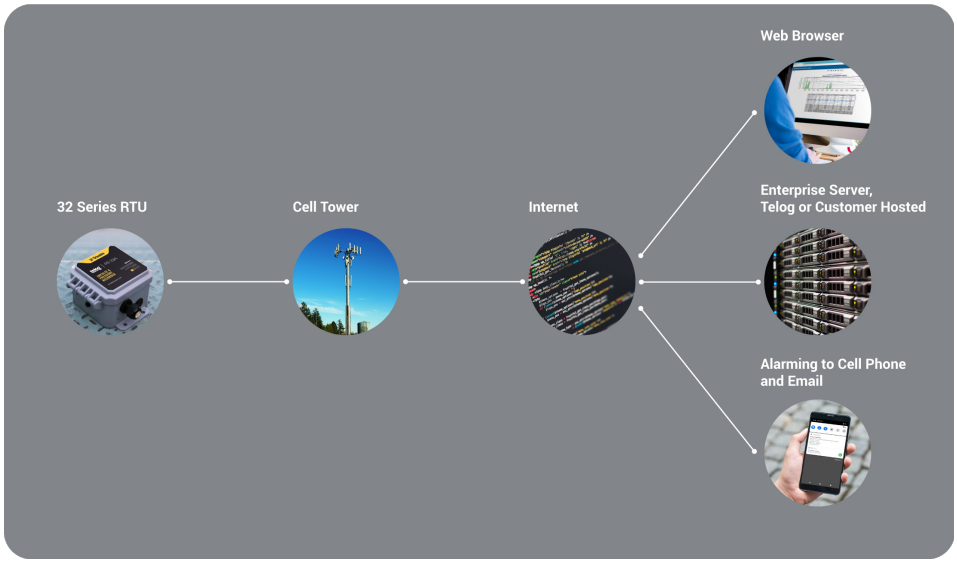
1. Free active chlorine, an indicator of disinfectant levels in the system. Operators can also use free active chlorine levels to determine the age of water in the system. Drops in free active chlorine levels indicate elevated levels of contaminants in the network.

2. Conductivity, an indicator of water composition and changes in water composition

3. Temperature, an indicator of water composition and ingress of water or other fluids from sources outside the system

4. Water pressure, to ensure that pressure is maintained above a specified positive threshold to prevent inflows of contaminants through any leaks or weak points in the network.

Data collected by the devices is wirelessly transmitted to the treatment works on a regular schedule determined by utility operators (and as needed if water conditions trigger an alert or an alarm). With near real-time insight into these four key parameters, utility operators are able to reliably monitor and assess the quality and condition of water within the network.



While amperometric technology has been proven and widely deployed for water quality testing in Europe, it has only recently become available in the U.S. market. The monitoring devices are wireless and battery operated, making them easy to install without any power connections. And because amperometric technology works without chemical reagents, it eliminates the need for the sewer hookups otherwise required to discharge effluent.

Perhaps most importantly, suppliers have adopted a subscription service model, shifting the burden of operations and IT management from the utility to the supplier, significantly reducing the need for upfront capital investment and allowing municipalities to instead spread their costs over the duration of the subscription period.

By providing continuous monitoring, near real-time insight into the water network, and a cost-effective means of installation and operation, new wireless monitoring solutions help water utilities fulfill their mission of delivering clean, high-quality water and safeguarding public health and safety. ■