Advances in instrumentation control costs and meet regulations

By Tim Schilz, Rosemount Analytical

From meeting ever-stricter governmental regulations, to tightened operations budgets, to new security concerns, demands on drinking water plants today are numerous and wide-ranging.

When meeting these escalating requirements is such an overwhelming task, it would seem that something as simple as analytical instruments would be a fairly low priority. However, small steps like the effective use of analytical instrumentation for two of the most critical measurements for drinking water plants, turbidity and chlorine, can help meet these demands, and add up to a very big deal in terms of reduced costs, fewer headaches and increased efficiencies.

Critical measurements

The measurement of turbidity, the relative clarity of water, is an important indicator of water quality. As such, turbidity is a critical measurement for drinking water plants both for compliance with more stringent USEPA regulations, such as the current Surface Water Treatment Rules (Long Term 1 Enhanced Surface Water Treatment Rule or LT1ESWTR), and international regulations for quality. Securing high-quality water for consumer protection is the number one responsibility of water utility superintendents and drinking water treatment plant operators alike.

Water utilities have been using free chlorine and monochloramines to disinfect drinking water for over 100 years and have been measuring chlorine residuals for almost as long. Monitoring the product water ensures adequate chlorine is present for disinfection, but also helps the utility prevent taste and odor problems arising from over-chlorination. Over-chlorination can also increase the formation of harmful disinfection by-products or THMs (trihalomethanes). Initially, utilities relied on laboratory testing to monitor residuals, but in the last 40 years, continuous chlorine analyzers have become a standard feature in the plant.

Reagent-free chlorine and monochloramine measurement system.

Security and regulatory requirements

Drinking water plants have implemented advanced filtration and disinfection techniques and procedures to produce high-quality water. However, the threats facing water supplies today are more dangerous, varied and complex than ever before. While plants diligently strive to secure the water being treated in the facility, it is a much more complicated task to secure it throughout the distribution system.

As infrastructure for water plants and distribution systems ages, there arise new challenges to the prevention of water-borne disease. Outmoded electronics or poorly maintained electronic monitoring systems, make detection of serious contamination events problematic. Water distribution systems get larger, but utility staffs and budgets shrink. So while high-quality water may leave the treatment plant, few installations can claim excellent oversight of water near the consumer.

Parameters such as the clarity, taste, odor and hardness of the water must be controlled to assure the potability and safety of the water supply. Employing accurate measurements throughout the water-distribution system has become a necessary step to ensuring the ongoing quality and safety of the water supply.

The key to detecting potential problems in the water quality is identifying changes in the water. Plants can then more quickly determine if there is a contamination that will affect the community's water. In order to protect against contamination risks, measurements must be conducted on-line and continuously, so plants can evaluate any changes in the water filtration and overall treatment process. Changes must be watched very carefully as they can indicate a pollution source and possibly signal the need for a change in water treatment.

Chlorine and turbidity measurements are particularly critical for ensuring water quality and safety. The addition of chlorine is a vital step in the disinfection process to kill harmful organisms. Turbidity can be affected by the presence of microscopic particles such as clay, silt and other fine undissolved matter. These microscopic particles, even at a very low concentration, can promote microorganism growth that can then harbor pathogens and also inhibit the chlorination process.

Clarity II on-line turbidimeter.

There are several analytical methods for turbidity that drinking water plants must follow. The most common followed by manufacturers of laboratory and online turbidimeters is USEPA Standard Method 180.1. Internationally, Standard Method ISO 7027 is an alternate design criteria followed by many outside the US for turbidity measurement.

Reduced costs and maintenance requirements

The effective use of chlorine and turbidity analysis systems can help lower overall expenses and reduce equipment maintenance time.

One key area where drinking water treatment plants can reduce costs is by

selecting reagent-free systems for free chlorine and monochloramine measurement. Typical chlorine analyzers use chemicals. The chemicals, also called reagents, are needed to convert chlorine into a form an instrument can measure via select, approved methods.

Reagent-based analyzers do have drawbacks, however - the biggest one being reagent consumption. Typically, a bottle of reagent or sample buffering agent lasts about a month, so chemical costs are a constant drain on plant budgets. In addition, there are labor costs for changing out bottles and for ordering, storing and keeping track of stock. When remotely monitoring residual chlorine levels at points further out in the distribution system, this problem is compounded.

A reagent-based analyzer also requires a sample conditioning system, a pump to inject reagents, tubing to carry reagents and sample, and a mixing device. Tubing needs periodic replacing and mixing chambers need cleaning, so a reagent-based system requires maintenance beyond simply replacing chemicals. Finally, an instrument technician who is busy replacing reagents and tubing is not getting other jobs done, so it is a drain on skilled personnel.

Today, reagent-free analysis systems for free chlorine and monochloramine monitoring are available that help plants reduce expenses significantly.

Selecting the appropriate turbidity monitoring system can also help reduce costs and headaches. Today's advanced turbidity systems are offered as either single or dual-channel options so that a single instrument can continuously measure multiple points in the water filtration process. This dual-channel option is more cost-effective for many water facilities.

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Additionally, there are both chlorine and turbidity measurement systems available that can be purchased as complete "plug and plumb" packaged solutions. These complete systems require very little time or cost involved for installation. And when selecting a turbidimeter or chlorine analyzer, as with all instrumentation, it is important to select a system that is easy to use and that has minimal maintenance and calibration requirements.

Between water safety concerns, governmental regulations and shrinking staff and budgets, no one would say that today's drinking water treatment plants have it easy. However, the proper analytical instrumentation can help plant managers find new ways to improve operational productivity and ensure water quality and safety, while significantly lowering overall costs.

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