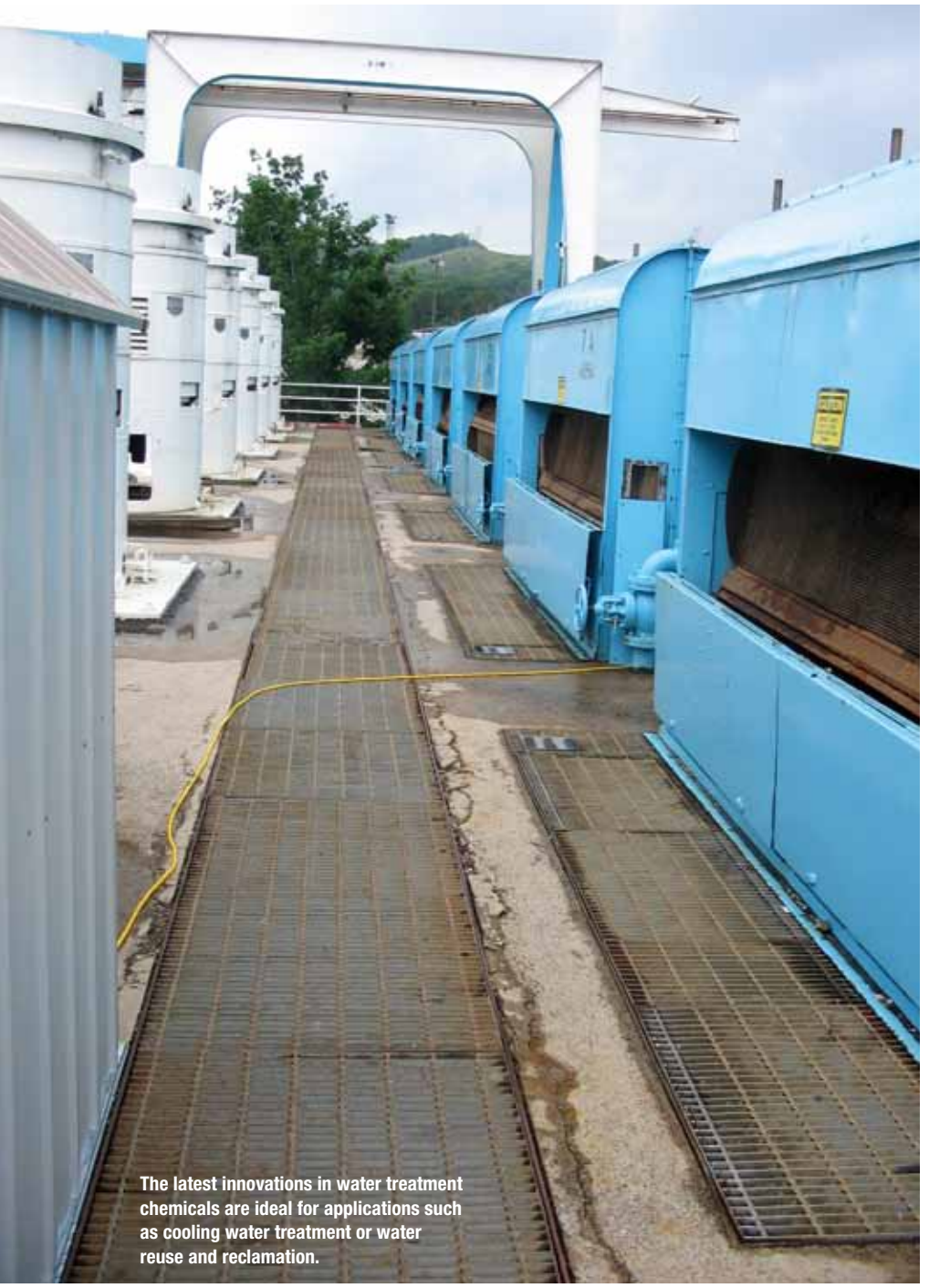
Critical Chemicals

By Mary Wolter Glass

Green chemicals play a role in water treatment & reuse applications

On April 11, the U.S. Environmental Protection Agency (EPA) announced its 2014 to 2018 Strategic Plan, with goals that include protecting U.S. waters, ensuring the safety of chemicals, and protecting human health and the environment through enhanced compliance activities. In a press release, EPA noted that it "will continue its efforts to improve water quality, given the nation's significant water infrastructure needs, focusing on common sense, flexible approaches that rely on sustainable solutions, such as green infrastructure." To accomplish these goals, the agency envisions working more closely with other levels of government and industry to deliver environmental benefits in a pragmatic way.



The latest innovations in water treatment chemicals are ideal for applications such as cooling water treatment or water reuse and reclamation.

To some, chemicals have played a necessary but unappealing role in the past, but they continue to be essential in supplying water of acceptable quality for a wide range of uses, from drinking water to industrial process water. Similarly, chemicals are necessary for wastewater treatment to ensure that discharges meet all standards for environmental acceptability. Nonetheless, popular discussions of new options for water treatment often focus on technologies that totally eliminate the need for chemicals. The hurry to adopt these chemical-free technologies could lead to installations that are not adequately vetted to ensure their effectiveness and sustainability.

Looking forward, chemical water treatment continues to hold promise as one of the tools that can effectively meet EPA's goals for green technology to promote human and environmental health. Many new chemicals are being offered in the market, and innovative applications of established chemicals provide opportunities for immediate use to improve water quality.

Furthermore, some chemical options facilitate water reuse, promising benefits for the efficient use of our water supplies. As discussed in the *Water Quality Products* article, "Efficient and Effective Water Reuse" (November 2013), this practice is becoming a necessity for economic and regulatory reasons in some locales. With water supplies increasingly burdened by greater demand and heightened regulatory pressure to recycle, chemicals that allow these alternatives to be adopted will be increasingly useful.

Green Water Treatment

In developing better chemical alternatives that meet a specific application's requirements, it is important to recognize that the shortcomings associated with chemicals can come from the nature of each specific chemical employed, as well as the design of its dosing program. Additional risks can result from the interactive effects of using more than one chemical in the program, or the cumulative effects of the program over time. The safe handling of chemicals is also a key consideration in protecting human health and the environment. New chemicals and treatment programs have been developed to address each of these situations.

Finding acceptable chemicals can be a challenge. For example, oxidizing biocides have long played an important role in providing safe drinking water and controlling biological contamination of non-potable water circuits, including cooling tower and industrial process applications. The benefits and risks associated with these chemicals are well understood and can be responsibly delivered in well-designed programs. Nonetheless, concerns remain regarding some characteristics of their use, including byproducts and the cumulative effect of large-scale use on the aquatic environment. While research into alternatives is underway, any call for an immediate ban on chlorine without demonstrated, reliable substitutes would be irresponsible.

The good news is that promising alternatives are emerging. For biological control, some non-oxidizing biocides that are less toxic or have fewer problem byproducts are now on the market. Multifunctional chemicals that minimize chemical load and potential chemical interactions have been developed. Some chemicals now are available in solid or concentrated forms that allow for steady, slow release and/or safer handling. Some chemicals now can be generated on site at small to medium scale, reducing the potential for accidental chemical releases on site and in transit. Chemicals that reduce fouling in water circuits also can improve heat transfer and reduce energy requirements.

Many new chemicals can be combined effectively with other mechanical technologies such as filters, reverse osmosis or continuous tube cleaning devices for greater efficiency and lower environmental impact.

Similarly, modifications in operations and dosing patterns can significantly reduce the effects of chemicals. Sequential dosing of separate parts of the water circuit has been successfully used to dilute chemical concentrations. Timing of dosing and discharge also can be adjusted to minimize environmental impacts without sacrificing the critical functions performed by the water system.

Chemicals & Water Supply

Chemicals can play a strategic role in water reclamation and reuse, especially for industrial facilities, power plants, and heating and cooling facilities, which are some of the largest consumers of water. Industrial facilities and power plants use large volumes of water in open and recirculating cooling systems. Cooling towers for HVAC also are large consumers of water, but they are spread out in hundreds of thousands of heating and cooling systems across the country.

Other applications of reclaimed water include agriculture, landscaping, public parks, golf course irrigation, dust control, construction activities, concrete mixing and artificial lakes. Each of these applications will save freshwater supplies if the water quality requirements for the application can be met. Chemicals can allow this to happen by effectively treating wastewater from municipal plants or process and cooling water from industrial or power plants to acceptable levels for these applications. Effective treatment that allows recycling and reuse also will lower the total level of discharges to the environment.

Green Strategies in Practice

Cooling water treatment. Water treatment programs for HVAC and industrial-scale cooling water systems are in place across the country. These programs provide an important service by maintaining the efficiency and life expectancy of the equipment. Traditional treatment programs have addressed a wide range of fouling problems, from biological to mineral scaling to corrosion, using combinations of up to six chemicals, depending on the unique problems at each site. Some of these chemicals are receiving increased scrutiny from regulatory authorities, which in some cases are limiting the dosing times and levels, as well as the discharge concentrations allowed into municipal wastewater systems or surface waters.

Among the potential chemicals available to address these problems is a single emulsion recently approved by EPA that prevents most types of fouling in cooling systems. The Mexel product is a blend of filming amines that addresses fouling by using a molecular coating mechanism to thwart microbiological and other fouling, rather than remediating it by treating the entire water column. The coating is renewed daily with brief injections, is biodegradable, and has low toxicity and no dangerous byproducts.

In use in other countries for more than 20 years, it has been proven effective in controlling potential health risks from macro- and microbiofouling in applications of all sizes. The product has been effective in a wide range of water conditions, including freshwater and saltwater, making it a viable choice for reclaimed water applications.

The concentrated formula is easy to handle and safe for the public and environment, because it cannot burn, explode, volatilize or be weaponized. Research has shown that it does not adversely affect municipal wastewater treatment systems and can be safely discharged into surface water under applicable permits. Field studies also have documented improved heat transfer and energy efficiency resulting from fouling control.

Water reuse and reclamation. One of the most established uses of reclaimed water is reconditioned municipal wastewater employed for cooling and process water in industrial and power plants. The U.S. Department of Energy has determined that more than 60 plants are current users of reclaimed wastewater, with more in development.

Regulatory initiatives at the federal and state levels indicate the potential for significant expansion. To accomplish this, chemical treatment of wastewater for each intended use will be beneficial. For example, in power plant cooling uses, after removing suspended solids and other contaminants, the treated water usually requires antimicrobial treatment, as well as anti-corrosives, anti-scalants, surfactants, and/or neutralizers before reuse. If the cooling water or cooling tower blow-down is not recycled, the impacts of these additives must be taken into consideration when discharging. By using new chemicals in combination with innovative dosing programs and mechanical devices, this important "new" water resource can be fully realized in many locations in the U.S.

While it may seem paradoxical, adding new chemicals for water treatment can play an important, beneficial role in meeting EPA's water quality and supply goals. The challenge is to identify and implement the best available technologies to protect human health and the natural environment most efficiently. *wqp*

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