by Jim Lauria

Effective Disinfection

Optimizing Chemical Use in Treated Water Applications

Controlling chemical use in treated water has never been more important, no matter whether the drivers are cost, handling concerns, environmental issues or wear and tear on equipment.

Optimizing chemical use starts with optimizing the condition of the water, or whatever fluid is being treated. Contaminants in the fluid can interfere with variables ranging from system flow – which could necessitate chemical cleanout – to the efficacy of treatment chemicals themselves. As a result, an effective filtration system can be an integral part of an effort to more closely manage chemicals to deliver treated product water that meets spec and reflects well on bottom line business considerations.

Drinking Water Disinfection

Disinfecting drinking water is a costly process in which "close" is not good enough. Most communities – or manufacturers who use water as an ingredient in food and beverage products – have little tolerance for off-colors and off-flavors, and log removal values (LRVs) of pathogens are typically measured at the 2-to-4-log level, or 99 to 99.99 percent removal. That means every ounce of disinfection chemical needs to be doing its job. Removing the contaminants physically rather than fighting them chemically can add tremendous efficiency and save money over time.

Sediment can have a tremendous impact on water quality and disinfection. Those impacts can differ depending on the nature of the contaminant. For example, many charged particles, such as clays or metals, can tie up oxidants like chlorine, which is used in the vast majority of drinking water systems in the developed world.

Organic particles can combine with chlorine ions to create a host of disinfection byproducts, or DBPs, such as trihalomethanes (the family that includes choloroform), haloacetic acids, aldehydes and other chemicals. At the beginning of the decade, the U.S. Environmental Protection Agency (*www.epa.gov*) set tolerances for DBPs because some have been demonstrated to cause cancer at high rates.

Filtration of organic sediment in the water to be treated is a very direct way to minimize the amount of trihalomethanes and other DBPs. It can also reduce the amount of chlorine needed to adequately control bacteria and viruses. After all, if less chlorine is bound up in DBPs, more is available to oxidize and control biotic targets.

Beyond Chlorine

Like chlorine, ozone disinfection relies on the interaction of molecules to fight pathogens – in ozone's case, a free radical that aggressively shares its spare oxygen atom to oxidize another molecule. The more sediment on-hand to trigger unnecessary oxidation reactions, the more ozone molecules must be introduced to the water to tackle biotic targets in a costly and energy-intensive process.

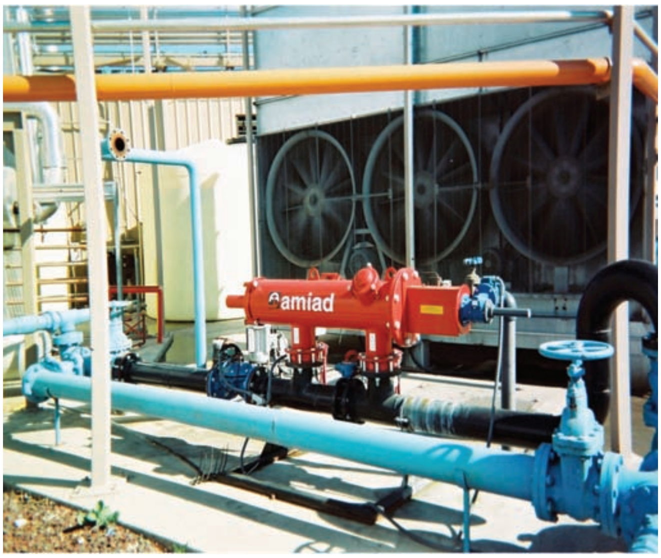
Finally, membrane technology is increasingly common in potable water treatment, either for ultra-fine or reverse-osmosis removal of submicron particles. Sediment, scale and even invasive mollusks such as zebra and quagga mussels interfere with the proper function of membranes and require costly and interruptive chemical cleaning, which can reduce the working life of the systems.

The automatic self-cleaning screen filters protect ultra-filtration membranes from sediments in a California drinking water plant. Removing organic particles also helps reduce disinfection byproducts in chlorinated systems.

Many membranes are already protected by fine cartridge filters. However, those cartridges can be quickly overwhelmed by sediment and biological contaminants if they are improperly used to provide gross filtration instead of the fine filtration they were designed to accomplish. Frequent replacement of cartridges is costly from the standpoint of materials, labor, downtime and disposal, so protecting them can quickly deliver a positive return on investment.

Self-cleaning woven screen filters – which automatically draw filter cake off of the screen through focused backflush nozzles when a target pressure differential is reached between the inlet and outlet sides of the screen – have proven to be a highly efficient technology, either as a stand-alone sediment system or as pre-filtration before cartridges, thread filters or membranes.

Automatic self-cleaning screen filters offer a compact footprint, minimal backflush and power requirement, and nearly maintenance-free operation.



A sidestream filtration system can reduce biocide use in cooling towers by as much as 20 percent, cut labor costs, and dramatically improve energy efficiency.

Cooling Water Challenges

Water for cooling towers can face many of the same challenges as drinking water, including the need to maintain cleanliness for public health reasons. In fact, cooling water was implicated in the first diagnosed outbreak of Legionnaires' Disease in 1976, when a Philadelphia hotel's HVAC system propagated and distributed the *Legionella* bacterium, and in several cases in Europe since.

Mineral scaling and biofouling can also represent significant challenges that can be measured in astronomical energy costs and high rates of biocides, anti-scalants and corrosion inhibitors. Plugged tubes and fins significantly reduce the area available for heat transfer. Thermal resistance can also significantly decrease heat-transfer efficiency. In fact, according to the Carrier *System Design Manual*, a fouling layer of just 0.001 inch on a condenser surface can increase overall energy consumption by 10 percent.

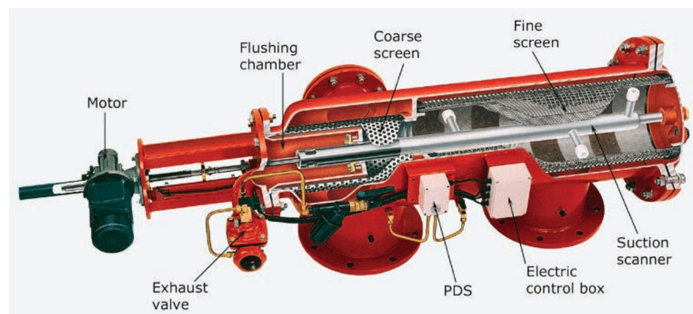
Side-Stream Filtration

Unlike drinking water – all of which must be treated all of the time – cooling towers may be adequately addressed through side-stream filtration, in which a portion of the total flow is directed through a filtration system at a time. Side-stream volume can range from five percent of the total flow, which is common for sand media systems because of the size of the media tanks and the relatively low flowrate through the filtration media, to as much as 20 percent, which can be easily achieved with compact, automatic self-cleaning screen filters. Ideally, the system can be designed to handle the entire turnover of the system in one hour, though that may not be feasible for very large systems.

Side-stream filtration is especially useful in retrofits, in which efficiency, space considerations and the use of an existing main pump to feed the filtration system are all key benefits.

Dollars & Cents

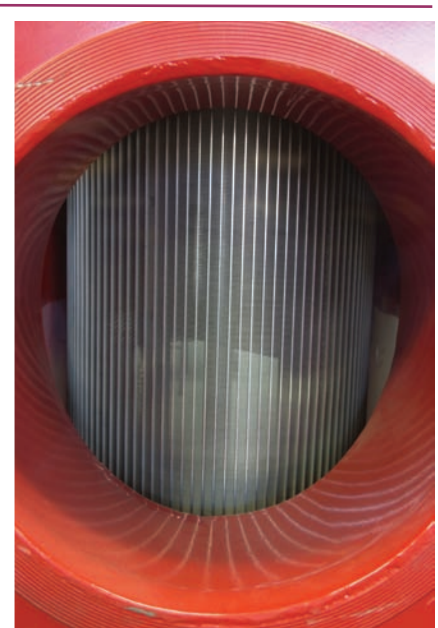
Biocides, anti-scalants and corrosion inhibitors are a fact of life in cooling towers. In fact, biocides represent the highest cost for a conventional water treatment system. But filtering



Compact and efficient, automatic self-cleaning screen filters use suction scanners to focus flushing action on concentrated areas of the screen. The 25-to-40-second cleaning cycle occurs while the filter is still online.

out fine suspended particles can reduce the amount of biocide needed by as much as 20 percent.

Using filtration rather than blowdown or manual cleanout of cooling tower water can also lower water waste and minimize the amount of chemical that goes down the drain by reducing the number of times basins need to be cleaned. Automatic self-cleaning screen filters further reduce water waste by minimizing backflush water. In fact, automatic self-cleaning filters produce 75



Weave-wire screens can be selected to optimize the level of filtration needed, based on the contaminants in feedstock and the desired use of the treated fluid.

percent less backflush water compared to sand media systems.

The economic benefits add up quickly. A power generating company installed a side-stream screen filtration system to handle 2 percent of its 150,000 GPM cooling tower flow. Its engineering staff determined that it would save $818,000 per year, including:

- $306,000 savings through improved condenser efficiency;
- $170,000 in cooling water chemicals;
- $30,000 in tower basin and condenser tube cleaning costs;
- and $312,000 in high-efficiency fill costs.

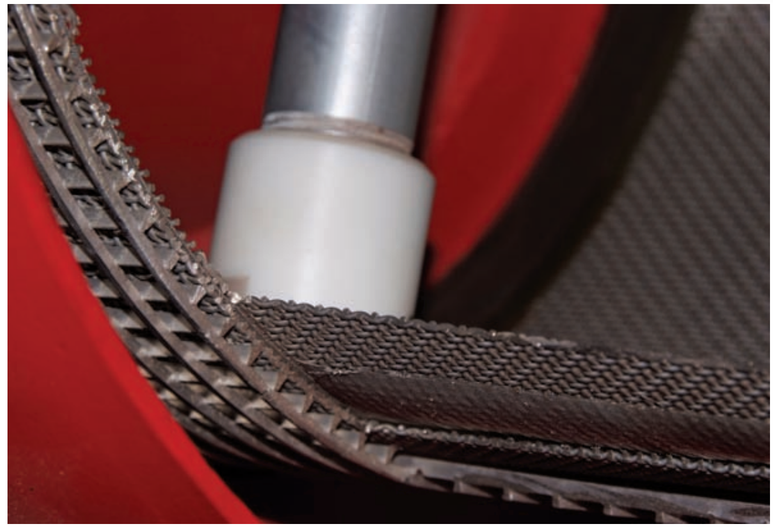
Selecting a Filtration System

The key to specifying a particular filtration technology requires looking both upstream and downstream. What is the condition of the feed water? How much flow, pressure and heat is there? What contaminants does the water carry? Looking downstream, it is important to know what the water will be used for, the desired condition of the water, and the technology that might provide polishing or disinfection.

Another variable is footprint, both physical and environmental. Many industrial or municipal setups lack the space for large installations of media tanks or settling basins. Compact technologies such as screen filters can be a good physical fit with the existing system.

Environmental footprint is an extension of the increasingly common look at the greenhouse gas implications of a wide variety of technologies. The water industry must look beyond carbon footprint to also consider the water footprint, the energy demand, and ultimately the impact on the chemical footprint of a particular technology.

As filtration systems are increasingly considered part of the chemical optimization process, their return on investment (ROI) will be matched, or even exceeded, by their return on environment (ROE) – especially in scenarios where other variables such as energy, backflush water and space are taken into account. FC



When an outlet valve is opened, pressurized water inside the automatic self-cleaning filter pushes trapped particles through a rotating scanner to clean the screen with a minimum of backflush water. Scanning nozzles focus that cleaning action on a square inch of screen at a time.

The automatic microfiber (AMF) filtration system pictured here traps particles down to two microns in size in tightly wound polyester fibers, then uses focused jets of water to automatically clean the system.

Jim Lauria *is a vice president for Amiad Filtration Systems, a manufacturer of clean technology water filtration systems for agricultural, industrial and municipal applications. He has over 30 years of experience in liquid-solid separation processes, water treatment and resource optimization. Prior to joining Amiad, Jim owned Team Chemistry LLC, a consultancy that focused on developing new business opportunities for clients' water treatment technologies. Before that he was president of an $80 million filtration media company, and during that time provided peer review for the World Health Organization's publication on drinking water treatment. He also led a team in partnership with a university that pioneered arsenic reduction in drinking water. He earned a bachelor's degree in Chemical Engineering from Manhattan College. Mr. Lauria can be reached at jim@amiadusa.com or 800 969-4055.*

www.amiadusa.com