The Four Principles of a Water Treatment Program

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Water is considered the "life blood" of any facility for the simple reason that it transfers heat from one location to another. A complete water treatment program has one goal: to manage the efficiency of that heat transfer. That said, a water treatment professional should not be looked upon as a "chemical guy" but rather a "heat transfer efficiency manager." It is only through this paradigm that a complete water treatment program can be achieved.

Knowing that water is the absolute best of all heat transfer mediums, what makes a water treatment program complete? This question can be boiled down into four areas that MUST be addressed:

- Control of corrosion
- Control of scaling
- Control of microbiological fouling
- Control of general dirt and debris

CONTROL OF CORROSION

Let's look at each one of these areas separately, starting with corrosion. Corrosion is the deterioration of metal in the system. Water is the universal solvent, it likes to dissolve everything and given enough time, it will. Metal wants to be in a more stable state, so it rusts. The fact that we are using water to transfer heat in a system made of metal poses a problem. Corrosion is going to happen. While corrosion cannot be totally stopped, it can be slowed down. Water treatment's objective is to minimize the effect of corrosion. Several different products inhibit corrosion and regular tests are run to evaluate the level of active ingredients of these products in the system water to ensure maximum efficacy.

A true water treatment professional will always give you metrics to gauge the performance of the program being utilized. The metric for monitoring corrosion is running corrosion coupons. Corrosion coupons are small slips of metal, which represent the metal in the system being treated. These coupons are placed in the system for a scheduled number of days and then removed, cleaned and weighed. The difference between the initial and the final weights can reveal the corrosion rate in the system. This result can then be compared with industry standards as a measure of the success of the water treatment program. Without corrosion coupons, there is no proactive approach in measuring corrosion.

CONTROL OF SCALING

The next area is scaling. Scaling occurs when the dissolved solids in the water come out of the solution and attach themselves to the heat transfer surfaces, acting as insulation. In fact, if a small amount of scale were present—the same thickness as a sheet of paper—it would increase the energy consumption of that system by 10 percent. This is due to the heat now having to move not only through the heat interface, but also the added scale. Heat transfer equipment is normally the biggest expense on any facility's energy consumption. Ten percent of the average utility bill is a significant number. That being said, a complete

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water treatment program should more than pay for itself by optimizing heat transfer. An efficient water treatment program may even put money on a facility's bottom line.

Water treatment companies use various products to increase the solubility of the dissolved solids in the water, thereby reducing the tendency to scale. Regular tests are performed to measure the amount of active ingredients in the system water to reduce the tendency of the water to scale. However, there is also a mechanical component to scale control; we call this bleed.

Water being used as a heat transfer medium in an open environment will evaporate. Only pure water will evaporate, leaving its solids behind. To prevent the system from running dry, additional water is added to compensate for what has evaporated. This new water also brings in dissolved solids. All of these dissolved solids will concentrate in the system. Eventually, we reach a point where the water can no longer hold these dissolved solids, no matter what chemical treatment is used, and they come out of solution forming scale. This is where bleed comes in.

A bleed valve is set to only allow so many concentrations of these dissolved solids before bleeding them out of the system and replacing the wasted water with new, low solids "make-up" water. Good, solid control equipment is needed to keep this balance. A complete water treatment program will not only look at minimizing the scale potential of the water, but also at getting the maximum use of the water in the system before it is bled off. So a good water treatment program will also pay for itself in water usage optimization.

The metric for scale control is looking at the actual energy being consumed and water being utilized. This can be achieved by trending utility bills, compiling chiller data, trending data from the building management system, etc.

CONTROL OF MICROBIOLOGICAL FOULING

The third area to consider in a complete water treatment program is also the most unpredictable and difficult to control: microbial fouling. Microbial fouling components such as algae, fungi, bacteria and molds have two goals in their life: eat and populate. Microbial fouling will increase corrosion and scaling in a system. Products called microbiocides are utilized to kill these bugs so they do not over populate in the system. This overpopulation is called biofilm, and it will reduce the efficiency of heat transfer tremendously. These microbes may also be pathogenic, meaning they can be harmful to people.

Microbial fouling control is crucial to every program. Given the fact that it can make people sick makes it imperative that all systems are being treated properly and responsibly. One of the better known pathogenic bacteria is Legionella. Protocols for diligently treating against Legionella are a MUST for every water treatment program. A recognized due-diligent Legionella prevention program is the use of a dispersant and an oxidizing biocide. This approach combined with a water treatment controller that will monitor the amount of oxidizer in the system constitutes a due-diligent prevention program (CTI standard). Since "bugs" are unpredictable, utilizing a controller with the ability to increase or decrease oxidizing biocide dosages is paramount in the endeavor to controlling biofilm.

The metric for monitoring the success of a biological control program is both visual and analytical. A visual examination of the system for biofilm is a good barometer of the program's success. However, this visual inspection along with analyzing the amount of living activity in the water (microbe content) is crucial in determining proper adjustments to the program. Taking cultures or samples from an area that will harbor biofilm is very important to determining if proper dosage is being achieved and the biofilm is being controlled. Most water treatment systems start to fail at this step due to lack of proper monitoring and program adjusting.

CONTROL OF GENERAL DIRT AND DEBRIS

The fourth and final area is control of general dirt and debris. The air around us contains particulates. These particulates, when drawn into a heat transfer device such as a cooling tower, will be "washed" out of the air

and float around in the water. This becomes an issue when these particles settle out. Accumulation of these settled particles will increase corrosion, increase the tendency to scale and give microbes a place to populate. Dispersants can help with this issue, but a mechanical approach is required. The mechanical approach is a filter. The more that is filtered out, the cleaner the system will be. The cleaner the system is, the easier it is to treat and the more energy efficient the system will be. This is why a filter will pay for itself in a very short amount of time. The metric for general control of fouling and debris is visual and trending data, similar to how we trend scaling data. It is far easier to keep a clean system clean, than it is to clean up a dirty system.

TWO STEPS ABOVE COMPLETE

The control of all four of these areas is a must for a water treatment program to be complete. "Complete" means all four areas are being addressed. It can also be said that any program that does not address all four of these areas is not controlling any of the areas because each affects the other. Just one area out of the four not having proper control will cause the other three to also be out of control.

An additional consideration goes over and above the four areas discussed and that is energy and water consumption. We mentioned that if all four areas are being considered, then optimal heat transfer should be a result. This will translate into lower operating costs (lower energy bills), fewer shutdowns, lower labor costs, etc. In addition, making sure that the water in the system is being used to its full potential before being bled will save water costs on both incoming water and sewer. Many counties offer a credit for water that is being lost to evaporation and not going down the sewer. In some cases this may pay for your water treatment program.

Finally, the last piece of the puzzle goes with your relationship with the team providing your water treatment service. It should be the mindset that the water treatment vendor you are working with is a member of your team when it comes to

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the water treatment program. You should seek their advice as well as let them know about what is going on with your system in between the scheduled visits. A complete water treatment program is not one-sided, it is a partnership between the owner/operator of the equipment and the water treatment professional.

Many people look at water treatment as a necessary evil or something they know they need but don't entirely understand. With this description of what a complete water treatment program should contain, you should now view your water treatment professional as a valuable member of your team.

ABOUT THE AUTHOR

R. Trace Blackmore is the owner operator of Blackmore Enterprises, Inc., an Atlanta based business and BOMA Georgia member. Mr. Blackmore is considered to be one of the country's top water treatment experts by his peers. His credentials include the Certified Water Technologist designation, LEED AP O+M, and Past President of The Association of Water Technologies (AWT.) Mr. Blackmore is currently serving as the Education Committee Chair for the AWT where he is responsible for training new and current water treaters on industry standards.

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