Real-Time Tracing of Cooling Tower Treatment Programs

Using high-performance inhibitor programs to treat and control water usage

BY JEROLD MURRAY

In many parts of the world, drought and other factors are reducing the availability and quality of fresh water supplies and greatly increasing its cost. In some localities, reclaimed wastewater is even being used for cooling tower makeup despite the considerable water treatment difficulties this presents. These factors significantly increase the technical and economic demands placed on water treatment programs for cooling towers and make effective control of corrosion, scale and microbiological growth more challenging than ever.

Fortunately, high-performance inhibitor formulations are available to provide effective scale and deposit control under the high-stress conditions associated with poor-quality makeup water supplies. However, to achieve good results, the inhibitor concentration must be maintained in a relatively tight range. Low inhibitor levels for even short periods of time under high-stress conditions can result in corrosion and energy-robbing scale formation. On the other hand, high inhibitor levels waste money and, depending on the product technology, can contribute to deposits on heat transfer surfaces.

With traditional corrosion/scale inhibitor feed methods, keeping treatment levels within the tight limits necessary for optimum performance and minimum costs can be difficult. The most commonly used method for controlling inhibitor levels involves adding the inhibitor product to the tower water in direct proportion to the makeup water usage. If the cycles of concentration (a measure of how much the dissolved solids in the makeup water are concentrated in the tower water) remain constant and uncontrolled, water losses are minimal, and this method can provide control. However, consistent inhibitor levels may not be maintained if the makeup water conductivity varies or in towers with multiple makeup water sources. Other inhibitor-feed methods, such as feeding the inhibitor in proportion to metered bleed or bleed time, are even less reliable. Under some conditions, traditional inhibitor-feed methods can result in widely varying treatment levels and this in turn can contribute to poor corrosion and scale control and high operational costs.

Fluorescent-Traced Product Systems

Chemical feed and control systems that use fluorescent-traced inhibitor products are now available to precisely maintain the treatment residuals within very tight control parameters. These inhibitors contain an exact amount of a special fluorescent dye that can be accurately measured using an inline fluorometer mounted in a bypass line on the cooling water system. The fluorometer sends a beam of light through the cooling water flowing past the fluorometer probe. The light beam excites the fluorescent dye molecules, causing them to emit light at a different wavelength. The fluorometer measures the intensity of the remitted light from the dye molecules and correlates it to the concentration of the corrosion/scale inhibitor in the cooling water.

Continuous Monitoring and Control

Fluorescent-traced product feed and control systems offer significant technical and economic advantages. They allow continuous, accurate measurement of the fluorescent tracer concentration at very low levels and can be used to control inhibitor additions so the treatment level is maintained to within 1 to 2 percent of the target concentration. In contrast, a typical and proportional chemical feed system might be able to maintain the inhibitor levels to only within plus or minus 10 percent of the desired concentration. The direct analysis and response technology available with a fluorescent-traced product system eliminates overfeed or underfeed of the corrosion and scale inhibitor.
Another benefit associated with fluorescent-traced product systems is that the inhibitor level can be continuously monitored online in real time. When coupled with a web-enabled controller, a traced product system will continuously monitor and log the cooling tower's inhibitor level, then initiate an email alarm whenever it is out of range. This capability greatly reduces the time it takes to identify and correct a major chemical feed problem, such as a pump losing prime or a feed tank running out. It also allows the inhibitor level to be monitored and data logged in real time as can be done with other key control parameters, such as conductivity, pH, ORP and water usage. This data can be used to continuously monitor and adjust the water treatment program based on changing system demands.

**Fluorescent Tracing Makes Testing Easier**

Trace levels of molybdenum (Mo) are often added to cooling water inhibitor formulations to provide a relatively easy way to determine the treatment level in the system water. Currently, the operator must sample the system water and perform a two- to three-minute wet chemistry test for Mo that...
involves using a thousand-dollar piece of test equipment and adding a couple different reagents. The Mo test is considered simple because the alternative control test typically used in the field (phosphonate) is even more complex and time consuming. In contrast, the addition of the fluorescent dye makes operator testing for product residual quick and easy. A handheld fluorometer can be used to test the water and determine the product concentration.

This test takes about 30 seconds using a meter that operates similarly to a conductivity meter — no testing reagents required. Since the testing is completely equipment based, it is safer than handling or disposing of testing reagents. Because of the straightforward test, the operator’s productivity is improved by obtaining a quick, reliable result from the handheld fluorometer versus more-traditional wet chemistry tests.

Maintenance Considerations
Fluorescent-traced product feed and control systems are not a replacement for routine service visits by a conscientious and involved water treatment professional. As with any water treatment equipment, regular maintenance is necessary to ensure reliable operation. The fluorometer probe must be routinely cleaned to prevent fouling from blocking the light energy. The fluorometer probe, like any other probe used in the water treatment control system, should also be periodically calibrated.

Certain impurities can exist in water that will interfere with the fluorescent molecule being used to track the residual. These interferences are more common in industrial cooling water systems, but may be compensated for by modifying the tracer control range. Routine analysis to determine the specific active constituents should also be performed to make sure the levels properly correlate to the concentration of the fluorescent tracer. This testing is required to validate the direct analysis and response control loop and is an essential part of any effective cooling tower treatment program.

In conclusion, effective water treatment to control corrosion, scale, and microbiological growth in cooling tower systems is becoming increasingly important. A properly designed, maintained and monitored fluorescent-traced product feed and control system can help facilities meet such challenges. These systems precisely control inhibitor levels, provide real-time alerts when levels are out of range, and make testing easier and safer. They also enable high-performance water treatment programs that can improve results and reduce water, energy and labor costs. Fluorescent-traced product systems should be considered for any cooling tower system.

Jerold Murray is the senior product line manager for Chem-Aqua.

---

Get AFE Certified!

UPCOMING CERTIFICATION REVIEW COURSES

<table>
<thead>
<tr>
<th>CPE Virtual Review Course (ongoing)</th>
<th>November 4-6, 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr. 2012 - Jan. 2013</td>
<td>Fort Lauderdale, Florida</td>
</tr>
</tbody>
</table>

November 7-9, 2012
AFE Region 8: Waltham, MA
(near Boston, MA)

---

Learn More About AFE Certification
www.AFE.org/certification • certification@afe.org • 517.203.7171