The Benefit of Chemically Treating an Open Cooling System Part 3

In the first two segments of this series, we took a look at the benefits of regulating the cycles of concentration and controlling bacterial levels in open cooling systems. This time, we're going to delve into a discussion about the water temperatures in these systems and the role they play in formulating an appropriate chemical treatment program.

Because open cooling systems remove heat from a process, the water temperatures in a system are both "hot" and "cold," relatively speaking. In some scenarios, they can be "hot" and "hotter!" But let's just focus on the fact that the waters have two distinctly different temperatures.

Earlier on in this series, we talked about how scale or corrosion will occur in systems with uncontrolled bleed/blowdown, which is related to a system's Langelier Saturation Index (LSI) or Ryznar Stability Index (RSI) values. A factor in calculating the LSI or RSI is temperature. With systems that have as much as 20°F temperature differences, which temperature, hot or cold, do you use for the calculation? Compare this to swimming pools where the temperature is reasonable constant. In swimming pools, the water is "balanced" to create as close to a neutral LSI as possible (-0.3 to +0.5). In these waters the conditions are neither overly scaling or corrosive. This works because there is only one temperature.

Since we have two somewhat extreme temperatures in open cooling water systems, we cannot use the swimming pool/neutral LSI strategy. If we use the cold-water temperature and "balance" the water, we can have scale forming at the hot-water side of the system. Similarly, if we "balance" the water for the hot temperature, we could have corrosion in the cold-water side.

In cooling water treatment, we are in essence pushing the water one way or the other: Feed acid to lower the pH and make it corrosive, or let the water chemistry naturally cycle up and make it scaling. This is where a proper chemical treatment program enters the picture, giving us the best chance of protecting the cooling systems and the associated equipment.

In cooling systems with corrosive water, a corrosion inhibitor, like orthophosphate or zinc, is fed to the system to prevent corrosion. Maintaining a consistent amount of corrosion inhibitor, along with regularly testing their levels, is essential to protect the systems from corrosion, while the low LSI will protect the system from any appreciable scale formation. Side note: Closed cooling water systems are kept on the corrosive side and use corrosion inhibitors, like nitrite and molybdate, to protect the systems.

With a scaling water, the cooling systems will need chemicals to protect them from scale formation. Generally, phosphonate compounds are used for this purpose. The phosphonate compounds need to be constantly in the water for proper protection of the systems, and their concentrations regularly confirmed through testing. There are a variety of phosphonate compounds, and these treatment chemicals need to be carefully selected for the specific cooling water chemistries created. This is where knowledgeable chemical suppliers and technical direction are needed.

Whether the cooling systems' waters are corrosive or scaling, the application of the proper polymer dispersant goes hand in hand with the treatment chemical. Whereas a corrosive system is quite a bit more straight forward, in scaling systems the combination of scale inhibitors and dispersants can be a bit overwhelming. Again, this is where knowledgeable chemical suppliers and good technical direction are paramount. A robust water chemistry modeling program helps determine the best combinations and, certainly, improves confidence in an effective treatment program.

We're not finished yet…there's still more to discuss! In the next installment we'll examine the advantages of using filtration to remove suspended solids in open cooling water systems.