Technical Bulletin

A Practical Guide *to* Water Testing *and* Documentation

Monthly Testing by your Water Treater

Make-up Water
- ✓ Conductivity
- ✓ pH
- ✓ Calcium
- ✓ Alkalinity
- ✓ Phosphate

Cooling Tower
- ✓ Conductivity
- ✓ pH
- ✓ Calcium
- ✓ Alkalinity
- ✓ Inhibitor
- ✓ Max Temperature
- ✓ Total Bromine
- ✓ Free Bromine
- ✓ LSI
- ✓ Bacteria (on site)
- ✓ Cycles of Concentration

Air Washer
- ✓ Conductivity
- ✓ pH
- ✓ Calcium
- ✓ Alkalinity
- ✓ Inhibitor
- ✓ Max Temperature
- ✓ Total Bromine
- ✓ Free Bromine
- ✓ Azole (Summer)
- ✓ LSI
- ✓ Bacteria (on site)

Chiller
- ✓ Percent Load
- ✓ Condenser Approach Temperature
- ✓ Evaporator Approach Temperature

Weekly Testing *(optional)* by Facility Personnel

Make-up Water
- ✓ Conductivity
- ✓ pH

Cooling Tower
- ✓ Conductivity
- ✓ pH
- ✓ Inhibitor
- ✓ Free Bromine

Air Washer
- ✓ Conductivity
- ✓ pH
- ✓ Inhibitor
- ✓ Free Bromine

Chiller
- ✓ Percent Load
- ✓ Condenser Approach Temperature
- ✓ Evaporator Approach Temperature

An explanation of these parameters can be found on the second page of this document.

Our Environment, Our Priority, Your Peace of Mind

PO Box 5655, Asheboro, NC 27204 (336) 953-9552 or (651) 587-7616

www.SustainableWT.com

Langelier Saturation Index (LSI): A calculated indicator to help determine how many Cycles of Concentration can be run for specific incoming water characteristics. LSI levels trending below 0.5 indicate increasing corrosion potential. LSI levels reaching 2.0 and above indicate increasing scaling potential with a limit of 2.8 using proper water treatment. LSI should be maintained between 1.5 - 2.5 to minimize water consumption and protect equipment from scale and corrosion.

Cycles of Concentration (COC): A consequence of water evaporation in a cooling tower and an important factor in the LSI calculation. Low COC is corrosive and wastes water. High COC increases the scaling potential in the chiller and can lead to fouling in the tower fill and basin. Cycles of Concentration are determined based on the LSI predictions and controlled using conductivity.

Conductivity: A measure of total solids in the water and a factor in the LSI calculation. Also used to control blowdown with an automated controller. The conductivity setpoint is based on maximum cycles possible given the equipment operating parameters and make-up water characteristics.

pH: A measure of the acidity or alkalinity of water and a factor in the LSI calculation. If the pH is too low, it can be corrosive to metals. If the pH is too high it can lead to scale and fouling in the chiller tubes and other heat transfer surfaces.

Temperature: A factor in the LSI calculation. Higher temperatures increase calcium carbonate scaling potential in the chiller due to inverse solubility. Maintain cooling tower fill to maximize air flow and help keep water temperatures low.

Calcium: The main cause of scale and fouling in water-using systems and a factor in the LSI calculation. In addition, calcium levels indicate a balanced system if the cycles based on calcium equal cycles based on conductivity. A calcium level lower than expected can indicate a scaling condition.

Alkalinity: Carbonate alkalinity combines with calcium to form calcium carbonate scale making this another factor in the LSI calculation. Low alkalinity levels are corrosive to the system metallurgy while high alkalinity contributes to the scaling potential.

Inhibitor: Formulated to prevent scale and corrosion and should be chosen based on the make-up water characteristics and operating parameters of the cooling system. Consistent levels of the proper inhibitor will protect equipment, maximize efficiency and reduce maintenance, repairs and downtime.

Azole: An important additive to cooling water treatment products to protect the copper metallurgy in the system including condenser and evaporator chiller tubes.

Phosphate: Added to the city water in varying degrees by the municipality to protect city water piping from corrosion. Cycled up in the cooling tower, it will increase the calcium phosphate scaling potential. SWT does not recommend adding phosphate to inhibitor due to:

- Increased risk for calcium phosphate scale
- Interference from phosphate in the city water. Phosphate testing to control inhibitor levels is inaccurate due to make-up phosphate.
- Phosphate in the city water is variable and cannot be depended upon to provide corrosion protection in the air washers or chillers.
- Phosphate is a nutrient causing microbiological growth in cooling towers and air washers. This will increase the demand for biocide and by increasing oxidizing biocide feed, the corrosion potential is increased, thereby negating any corrosion protection by the phosphate.

Bromine, Total and Free: Total bromine is a combination of free bromine and bromine combined with organic material and other contaminants in the system. Free bromine is most effective in the control of microbiological growth. Bromine should be fed at a level to prevent uncontrolled microbiological growth, but not cause excessive corrosion to copper chiller tubes and mild steel surfaces. The use of a non-oxidizing biocide can reduce the bromine feed rate and associated corrosion. In addition, an azole must be used to protect copper in the presence of an oxidizing biocide.

Bacteria Testing: High bacteria levels will foul chiller tubes and air washer screens decreasing efficiency and increasing energy costs. High bacteria levels also pose a health risk for employees including exposure to legionella. Testing should be performed on site to collect accurate data and have the ability to make results-based adjustments.

Approach Temperatures: Calculated using the water temperature leaving the chiller minus the refrigerant temperature leaving the chiller.

$$Water\ Temp\ leaving\ Chiller - Refrigerant\ Temp\ leaving\ Chiller = Approach\ Temperature$$

The percent load on the chiller must also be considered when evaluating the approach temperature. Higher approach temperatures are associated with scale formation or biofilm.