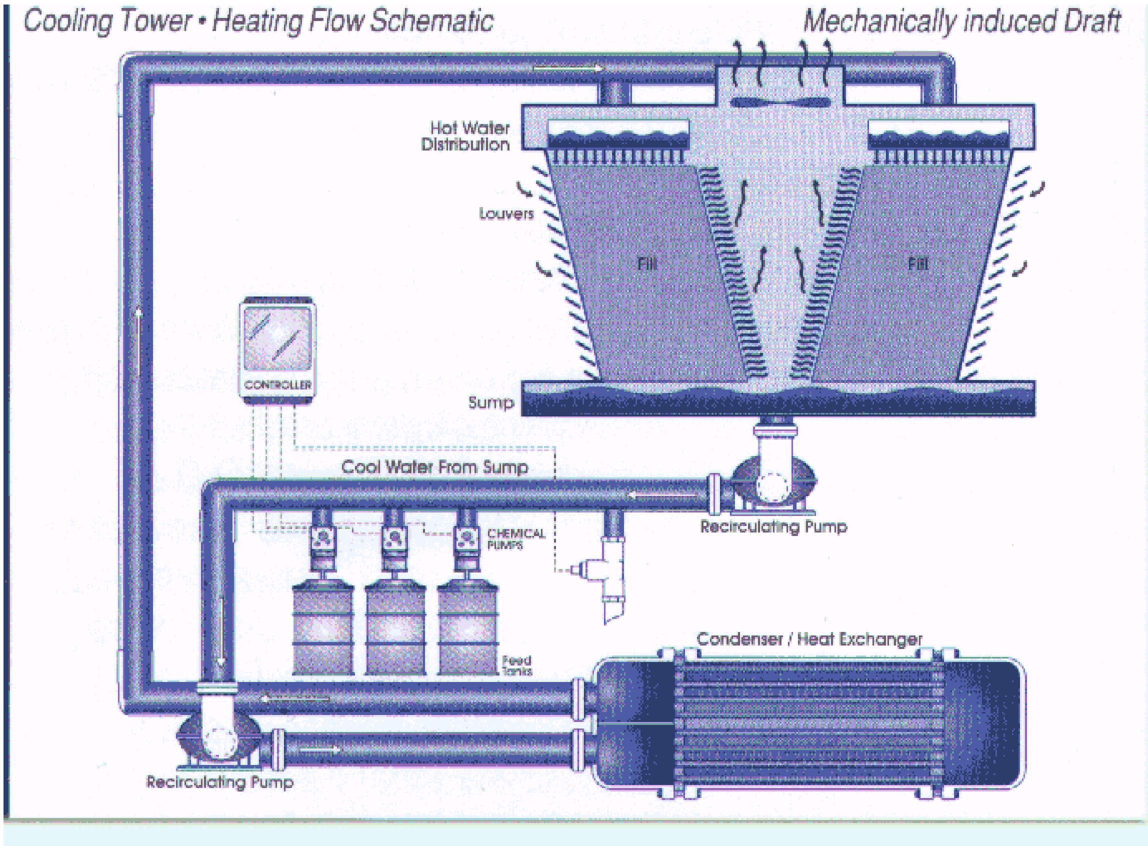

Should you use Reclaimed Water In *your* Cooling Towers?

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To quote the economists maxim: "*there ain't no such thing as a free lunch* . . . " This is also true when it comes to using reclaimed water in your plant cooling towers.

Your facility may have been approached about the idea of using "reclaimed water" from your friendly municipal treatment plant as a way of helping with the current water shortage or drought conditions in your area. Reclaimed water is normally not drinkable and refers to treated wastewater from a wastewater treatment plant or water that has already been used in another industrial process.

There is often a discount for using reclaimed water as compared to using normal potable water. However, when you consider this option, you should realize that there are several key issues to evaluate. The following are three of the more common operational issues:

Corrosion Issues

First, you should realize that in many cases the reclaimed water is more “aggressive”, or more likely to cause or contribute to corrosion than normal potable water. One method of evaluating the corrosion potential of water is to calculate the Langelier Saturation Index (LSI). The LSI is an evaluation of the calcium carbonate ($CaCO_3$) saturation capabilities present in the water.

There are five water quality factors that are used to calculate the LSI:

pH,
Total Dissolved Solids (TDS),
Water Temperature,
Calcium Hardness, and
Total Alkalinity.

In most cases, TDS, Hardness, and Alkalinity are higher in reclaimed water than they are in normal potable water. Also, there is frequently a higher amount of phosphorus in reclaimed water than in potable water, and this also can contribute to corrosion or scaling issues. LSI values of less than a value of (-1) tend to expose metallic surfaces to corrosion or will leach out the minerals from concrete.

Mineral Scale and Clogging Issues

Second, the next step is to consider mineral scale and clogging issues. In a typical cooling tower, water falls through “fill” which provides surface area to allow water to be exposed to air. Air is drawn into the tower by fans, and a small portion of the water evaporates in this process. For every pound of water evaporated, roughly 1,000 BTUs of heat are extracted.

As evaporation occurs, the salts in the circulating cooling water concentrate. If not controlled, salts will form mineral scale and corrosion and will impair operation of the plant, so makeup water is used to compensate for the evaporation effect and blowdown is utilized to control the salt and TDS content of the cooling water.

A key parameter used to evaluate cooling tower operation is "cycles of concentration" (sometimes referred to as cycles or concentration ratio or just “C of C”). This is calculated as the ratio of the concentration of dissolved solids (or conductivity) in the blowdown water compared to the dissolved solids in the make-up water. As cycles of concentration increase, the dissolved solids will increase, and this increase can cause scale and corrosion problems unless the ratio is carefully controlled. Of course, the target cycles ratio will be different when using reclaimed water than it is when using normal potable water.

Both mineral scale and corrosion risks are exacerbated with the use of reclaimed municipal effluent. Also, reclaimed water is usually higher in total suspended solids (TSS) than is potable water, and the greater TSS content in reclaimed waters can also contribute to clogging problems.

Health & Safety Issues

In addition to the corrosion, scaling, and clogging issues discussed above, there are also concerns about the issue of possible human exposures to pathogens and other chemical and microbiological hazards potentially present in reclaimed waters and released from cooling towers in the form of aerosols. The psychological effect of these hazards has been termed the “yuck” factor with regard to use of reclaimed waters.

Recent studies have shown that applying redundant disinfection techniques, such as combining ultraviolet radiation with chlorination, indicates “pathogens will be reduced to negligible levels in properly treated reclaimed water and there will be no realistic opportunity for human exposure to pathogens from the beneficial uses of the reclaimed wastewater.” [Sobsey report] Of course, the interests of safety may require adding more chlorine at the cooling tower site, and addition of an oxidizing agent such as chlorine can also promote materials corrosion. So again, there is no free lunch.

Treatment Options

Degraded water, including reused or reclaimed water, requires treatment to be appropriate for plant cooling. (In most states, including in North Carolina, legal considerations regarding treatment and use of so-called “gray water” also pertain.) *Pre-treatment* is typically necessary to render degraded water environmentally safe and chemically appropriate for cooling tower operations.

Pre-treatment can remove contaminants, adjust pH, soften the water (remove calcium and magnesium), and reduce silica (grit) or settle out total suspended solids (TSS). *Sidestream treatment*—treating a portion of the recirculating water—can also soften, reduce silica, and reduce TSS, thereby preventing fouling/scaling and increasing the cycles of concentration. Even post-treatment may be required in some cases.

Of course, such treatment options require equipment, chemicals, labor, and monitoring. That means they cost money, and these costs are to be factored in to the decision process. Also, the risks of possible equipment damage represent another factor to include in the cost analysis.

As one person said, I don't want to explain the following to my boss: "*The good news is we saved some water, but the bad news is it'll cost us millions of dollars to replace our cooling towers and system components*."