



## GREEN COOLING TOWERS – PRACTICAL APPLICATIONS IN SUSTAINABILITY

by [Michael C. Nines, P.E., LEED AP](#)

Technical Consultant, Manko, Gold, Katcher & Fox, LLP

Cooling towers are a common and critical component to most commercial, institutional, and industrial facilities and can represent up to 30 percent of a building's overall energy budget, and 50 percent of the water usage. Yet unfortunately, these workhorses of facility HVAC systems are often forgotten about in terms of environmental impacts to businesses which rely upon them. Recent trends in sustainable cooling tower design and operation may present some unique opportunities for reduced environmental impacts as related to these systems. Whether managing environmental risk or exploring sustainability initiatives within your organization, the operation and maintenance of these critical building systems deserves a closer look from corporate counsel and engineering staff.

### What is a Cooling Tower?

A cooling tower is a heat removal device used to transfer process waste heat to the atmosphere. Most cooling towers derive their primary cooling effect from the evaporation that takes place when air and water are brought into direct contact. Evaporative cooling towers are the most common as they provide the most cost effective cooling technology for commercial air conditioning and industrial processes by allowing heat laden water to flow into the cooling tower over a series of baffles, exposing the heated water to air.

Unfortunately, as water evaporates and removes heat from the system, dissolved solids inherent in the water supply become more concentrated. At some point, the dissolved materials exceed their solubility limit, which results in precipitation and formation of undesirable scale (i.e., calcium carbonate) which can severely damage expensive equipment. In order to prevent scale formation, a portion of water within the cooling tower is intentionally drained to keep the buildup of dissolved solids to acceptable levels, known as blowdown. As water is blowdown from the cooling tower, new "make-up" water is added to replenish the system. This "dance" between the water subtracted and then added back into the system constitutes a significant usage of water.

Treatment chemicals to control corrosion and biological growth are typically used in addition to blowdown to perfectly balance the system. Since cooling tower systems are exposed to the atmosphere, biological growth is a particular concern (e.g., [Legionella](#)). These same chemicals are included in water that is blowdown or discharged from the system during normal operation. The blowdown is typically discharged

- more -

## GREEN COOLING TOWERS (cont'd)

to a public sewer for treatment or is discharged to surface water, where allowable. As one might imagine, the chemicals used in cooling tower systems are often toxic to aquatic life and in many cases are restricted for discharge into surface waters under [National Pollutant Discharge Elimination System \(NPDES\)](#) authorization.

### **Driving Toward Sustainability**

Ideally, the elimination of water treatment chemicals would be a preferred route if it not for the need to control the potential harm to equipment that scale, corrosion, or biological growth would otherwise cause. Fortunately, there have been some significant strides made by industry to design and implement creative technologies which enable the total elimination of treatment chemicals in cooling towers. For example, electrical pulse technology is now gaining wide use in cooling towers. This technology alters the electrical charge of the dissolved mineral particles within the system so that they form precipitating solids instead of harmful scale. The technology also acts to destroy biological growth by damaging cell walls of microorganisms, eliminating the need for biocides altogether.

In many instances, the electrical pulse systems operate as add-on “aftermarket” equipment which can be relatively cheaply added to the cooling tower system. The resultant effect is the elimination of toxic chemical usage along with greater reuse of water within the system by significantly reducing the need to blowdown to the sewer. As environmental concerns associated with cooling tower operation become more widely established, organizations with sustainability goals in mind are encouraged to look at their cooling towers as a source of opportunity instead of concern.