ASSOCIATION OF WATER TECHNOLOGIES

# COOLING WATER MANAGEMENT

## Intent

To minimize the carbon-footprint, water usage and environmental impact of HVAC cooling systems and process cooling systems, generally by optimizing the control of water chemistry, and specifically by:

- minimizing water usage, including using non-potable makeup water where available;
- maximizing energy efficiency through maintaining clean heat-transfer surfaces;
- extending the life cycle of equipment by controlling corrosion and mechanical deterioration of materials;
- reducing carbon footprint of facilities personnel by integrating cooling water data mining into building management systems;
- and favoring materials and processes friendly to the environment and operator safety.

## Requirements

*OPTION 1*. Water Systems Management Program (1 point)

Develop and implement a water systems management program for the cooling tower (meant to include all types of evaporative cooling equipment) and associated water systems. Address best environmental practices for heat transfer efficiency, equipment reliability, asset life expectancy, maintenance costs, minimization of water and energy inputs, hygiene risks, safety, and environmental impact. Such a program should also address the use of peer-reviewed, proven equipment suitable for pretreatment, plus inhibitor treatments for control of scales and deposits, corrosion (including microbial induced corrosion), and fouling (including biofouling). All equipment and treatment methods should be appropriate for the specific makeup water source. Additionally, the water systems management program should address equipment maintenance issues, layup, and regular technical support services from a qualified professional, certified by an independent third party. Required technical support services will include training of operating personnel, inspection of treatment pumps and other feed systems and control devices, regular water testing and interpretation of results, and periodic technology and management oversight.

Improve water efficiency by minimizing water system bleed-off and system losses. To accomplish this include in the system the following: water meters on makeup water line and on the bleed-off; a conductivity controller on the recirculating water; and automatic controls to adjust the bleed-off rate. Maximize energy efficiency by ensuring the cleanliness of all heat transfer surfaces through additives that control corrosion, deposits and fouling.

OR

*OPTION 2*. Non-potable Water Source Use (1 point)
Use makeup water that consists of at least 50% non-potable water, such as harvested rainwater, harvested storm water, air-conditioner condensate, swimming pool filter backwash water, pass-through (once-through) cooling water, gray water, foundation drain water, municipally reclaimed water, steam condensate, treated industrial wastewater, or any other appropriate on-site water source that is not naturally occurring groundwater or surface water. All non-potable, recycled, or reused waters will require pretreatment (such as filtration, oxidation, and/or disinfection) before being suitable as an alternative source of cooling system makeup.

Have a measurement program in place that meters makeup water quantities used from non-potable sources as well as potable sources. Meters must be calibrated within the manufacturer's recommended interval if the building owner, management organization or tenant owns the meter. Meters owned by third parties (e.g. utilities or governments) are exempt.

Utilize bleed-off for on-site irrigation, when permitted and appropriate.

OR

*OPTION 3*. (2 points)
Achieve both Options 1 and 2.

## Benefits and Issues to Consider

### Environmental Issues

Water-cooled systems utilize the natural cooling effect from evaporation of water to remove heat from buildings or processes. Proper stewardship minimizes water consumption while maximizing energy efficiency in the cooling of the building or process. Water-cooled systems are more energy efficient than alternatives, such as air-cooled, consequently requiring less electricity in their operation.

Water usage in cooling tower systems consists of three types: evaporation, bleed-off, and losses. Evaporation is the principal mode of cooling and is both intended and desirable. Bleed-off is necessary to avoid excessive buildup of minerals and other solids that enter the system. In minimizing bleed-off, it must be controlled in conjunction with the water treatment program so that the minerals and solids do not precipitate and deposit in the system. The control parameter recommended is conductivity, and that parameter should be used to control the amount of bleed-off by use of an automated bleed controller. Using a constant bleed-off rate or periodic manual bleed is not recommended, as this practice wastes water and may compromise the useful life of the equipment.

Losses are largely avoidable if facility staff are trained to identify them. Proper maintenance can reduce problems with overflowing basin, leaking seals, splash out onto surrounding areas, excessive drift, and back-flooding. Staff should also be trained to inspect and adjust ball float valves periodically, check drain valves for proper closure and sealing. Improper pipe configurations, especially in systems that have undergone many additions, are common sources of large, unseen losses. Environmentally sound best practices call for constant attention to water losses, not just from cooling tower systems, but from all water systems in the facility.

**Economic Issues**

Water system management for cooling towers requires investment in a regular, comprehensive maintenance program coupled with water treatment program technical support services, in order to save money and energy while increasing the tower's life expectancy and reliability. Water meters installed to measure cooling tower make-up and bleed-off and the application of effective inhibitor programs, help conserve water and lower operating costs. In addition, conductivity control systems and regular water analyses with capable interpretation of results provide some of the tools needed to operate and maintain equipment at higher cycles. Because of the substantial water savings, water utilities in some locales offer incentives and rebates for the installation of conductivity meters on existing cooling towers.

Best Management Practices articulate the need for routine measurement and verification of data sets. This includes metering all make-up sources, system bleed off, as well as minimizing water usage. Effective implementation of these practices requires the installation of "smart" controllers capable of properly administering cooling water control chemistry. To promote water conservation, some systems are supplied with multiple water sources of variable water quality. In order to allow for efficient program administration, systems should be equipped with controllers that are programmable via remote access.

Data acquisition can be designed to generate automated system summary reports, alarms, and preventive maintenance notifications in order to enhance the troubleshooting capability of facilities personnel. These controllers should have open protocol communication with building management system through integration platforms giving building managers/owners the opportunity to administer long-term water efficiency and conservation objectives. Building management systems are designed to mine data from multiple sources such as chillers, air handlers, and cooling towers to optimize system efficiency. Integration into these systems allow for the proper balance of water and energy conservation, resulting in lower operating expenses.

Water conservation in buildings can also lead to more stable municipal taxes and water rates. For utility districts that provide potable water, every cubic foot of water recovered as a result of improving conservation produces more revenue than the same amount obtained from a new water source for bleed-off, drift loss, and water lost through leaks, spills or overflows. The amount of water fed into the system to replace what is lost is referred to as makeup water. With proper cooling system maintenance, water losses can be kept very low, allowing a project to conserve significant amounts of water. However, this objective has to be tempered by the need to also conserve energy inputs, heat transfer efficiency, and equipment life and reliability.

Conductivity controllers that can vary the bleed rate and well-maintained drift eliminators are long proven means to reduce water loss and conserve resources. A more recent method is to utilize non-potable water sources for cooling systems, which provides additional environmental benefits by using water that would otherwise be considered waste. Potential sources of non-potable water for cooling systems include treated contaminated groundwater, treated municipal effluent, industrial process water or wastewater, irrigation return water, and other types of water affected by humans or naturally occurring minerals.

**Water Chemistry and Biological Control**

Engage a qualified water management professional to design and administer a best practices water management program that meets water conservation and other environmental objectives. Controlling mineral scales, biological deposits, foulants and corrosion through the appropriate use of filtration equipment and treatment products helps maintain water system cleanliness, hygiene, and efficiency, as well as minimizing microbial growth. Mineral content is typically managed through a combination of bleed-off and appropriate additives that prevent precipitation of dissolved solids. Effective water management maintains heat transfer efficiency and reduces the need for bleed-off, thereby conserving both energy and water.

Select a water management provider capable of delivering best overall value in terms of water conservation and total water management operating cost. A professional water management consultant should be capable of utilizing the data collection tools of the controller to routinely adjust program parameters to effectively promote water, chemical, and energy conservation.

Outbreaks of Legionnaires' disease have been associated with ineffective treatment, maintenance and management practices. ASHRAE Guideline 12-2000, "Minimizing the Risk of Legionellosis Associated with Building Water Systems", offers guidance for developing an effective biological control program.

Consider using corrosion monitoring to ensure that the water management program is appropriate for all metals in the system. Establish performance metrics to help assess the effectiveness of a water management program, such as acceptable corrosion rates based on metal types, and maximum acceptable microbial concentrations.

Maintain treatment records of what products are used, and investigate the use of newer, environmentally friendly technologies and control solutions, and environmentally preferred products utilizing the principles of green chemistry. Establishing technical service schedules will help ensure regular and effective maintenance and program oversight, including checks for leaks or overflow problems, regular cleaning, and recalibration of conductivity sensors, ORP meters and the like, per the manufacturer's recommendations.