Currently, we’re experiencing the worst drought in over 100 years. We’re all faced with the challenge of using our water resources more effectively.

Brisbane Water is one of Australia’s largest water utilities and an industry leader in supply management. By partnering with our commercial clients, Brisbane Water’s Watersense program is designed to help implement water saving initiatives.

Conserving water in your business helps maximise your resources and saves you money. You will also actively contribute to reducing demand on our precious drinking water supplies.

Why is water efficiency in cooling towers important?

In Southeast Queensland there are 1600 registered cooling towers. Cooling towers typically consume 10-25% of a commercial building’s total water use and 20-30% of water use at a manufacturing facility.

Measure your water efficiency

Regular monitoring of normal usage patterns will help to quickly identify any irregularities. To find out how much water your cooling tower is using, install a meter on the make-up water line. Installing an additional meter on your blowdown line will help to verify water readings. Differences in readings between these two meters are a good indication of losses in the system.

Tip: if the hole into the meter on the blowdown line is narrow your meter will need regular cleaning to avoid fouling.

Cooling tower water usage

**Evaporation**
Water is lost as humidity while performing the “cooling” function.

**Make-up**
As water evaporates, salts and minerals accumulate in the circulating water. The build-up of these contaminants can cause biological growth, corrosion and scale, so a portion of the circulating water is released or “blown down”. To replace this lost water, make-up water is then added.

**Blowdown or bleed off**
Conductivity sensors compare the conductivity in the basin water with a maximum allowable conductivity level. When the levels become too high the blowdown valve is opened to bleed off the water. Fresh make-up water is then added.

**Overflow**
Water is lost to the drain when the level of water in the cooling tower basin rises above a predetermined level. This can be due to a faulty valve on the incoming water pipe or blocked pipes.

**Splash**
Water is lost due to turbulence or wind.

**Drift**
Water is lost as droplets in exhaust air.
Once you have determined your cooling tower’s water usage you will be able to determine your current level of efficiency and set targets for improvement. The graph, right, illustrates cooling tower water usage for commercial buildings in Brisbane.

Maximising the efficiency of your cooling tower can lead to savings in water as well as associated wastewater, energy, maintenance and chemical charges. Your business can use one or more of the following suggestions to maximise the efficiency of your cooling tower:

1. optimise your current system
2. alternative water sources
3. maintenance and operation.

Step 1: optimise your system
A tower’s “cycles of concentration” compares the level of contaminants in the tower’s circulating water to the level of contaminants in the make-up water, (e.g. if the circulating water has five times the concentration of the make-up water, then the “cycles of concentration” are five). By increasing the number of “cycles of concentration” the volume of blowdown will be decreased and consequently the make-up water needed will decrease.

The concentration of contaminants must be managed to control biological growth, corrosion and scale build-up. The maximum “cycles of concentration” will depend on the quality of your make-up water and it is very important that any changes are carried out in consultation with your water treatment contractor.

Step 2: alternative water sources
Cooling towers do not need potable (drinking) water and alternative water sources such as rainwater, condensate, recycled water, process water and bore water have been used successfully. The Millennium Arts Project at the Queensland Cultural Centre will save about 85 million litres per year or about $100,000 per year in potable water costs alone by installing a new river-water cooling system in place of more traditional cooling towers. Brisbane BP-Amoco is using 10 million litres a day of recycled water from a water reclamation plant at Luggage Point for use in its cooling towers as well as for boiler feed and fire control.

The ability to use alternative water sources will depend on the water quality.

Step 3: maintenance and operation of your cooling tower
Poorly maintained and operated cooling towers not only wastes water but it costs your business money. Efficient operation can:

- reduce water costs
- reduce wastewater costs
- reduce chemical costs
- reduce energy costs
- prevent system failure
- extend the life of the system, minimising repair and maintenance costs
- reduce the risk of legionella contamination.

To ensure the efficient maintenance and operation of your cooling tower, work closely with your cooling tower contractor. Things you can consider include:

- ensuring your service provider knows that water efficiency is a priority
- considering a performance-based contract related to reducing water consumption while still keeping scale, corrosion and fouling at an acceptable level
ensuring you are aware of what chemicals are being used and their purpose – where possible, choose chemicals which have a lower potential impact on the environment

ensuring you understand any analysis tests

conducting occasional independent testing to verify your service provider’s performance

informing maintenance staff immediately of leaks, faulty valves or other maintenance requirements

ensuring chemical suppliers provide quotes for their services that include the project costs for water and wastewater as well as the costs for chemicals and service visits.

Checklist for contractors

In addition to checking on chemical requirements and performing water analyses, service providers should regularly:

✓ check and adjust the make-up ball float. If the ball is too high, water will be lost into the overflow drain
✓ check and report to maintenance staff any leaks from the tower casing, basins, connections, pump gland seals, air intake or exhaust ducts
✓ clean and recalibrate the conductivity sensors according to the manufacturer’s specifications. A portable conductivity meter or lab analysis can be used to measure the conductivity of basin water for comparison with the control system data to ensure accurate calibration. Inaccurate or fouled conductivity commonly causes excessive blowdown
✓ clean the whole system according to manufacturer’s specifications
✓ provide a written report after each service.

Eliminate “once through” cooling

Many businesses use “once through” systems to cool small heat generating equipment such as dryers, air-compressors, welders etc. “Once through” systems consume large amounts of water as the water is only used once before being released to drain. Investigate if you have excess cooling capacity that could be utilised, e.g. connect the system to existing cooling towers. Research if a cooling tower or condenser that recycles water would be more economical or if it could be replaced with air-cooled equipment. If none of these options are viable, reuse “once through” water for other purposes such as cooling tower make-up water, wash down water or landscaping.

Troubleshooting

Overflows

• Check that the valve on the make-up line is able to close and seal.
• Check that the overflow pipe is not leaking.
• Cooling towers should be at an elevation higher than most of the piping into the system. Water in the pipes feeding into spray heads at the top of the tower will drain into the tower and down the overflow pipe when the pump is stopped. To reduce the amount of water lost, keep the lengths of water pipes feeding into the tower’s spray heads to a minimum.
• If the water level in one of the basins is higher than the other basins the water will flow to the lowest basins when the pump is turned off, causing overflow. The pump may also suck in air. Adjust the ball floats so the water levels are balanced.
• If water is overflowing over the edge of the basin check that the overflow pipe is not blocked or that the fill pipe has been left on after cleaning.
• Correctly set the ball float and check periodically to avoid overflows.

Splashing

• The design of your tower or wind conditions around the building may be causing excessive splashing. Consider installing anti-splash louvres or wind breaks. Also check that water flow rates are not too high. Check the fan speed and fan pitch on induced-draft systems.
High efficiency drift eliminators can be installed or repaired to reduce excessive drift. Under the current standard AS/NZS 3666 new cooling towers limit drift to 0.002% of the circulating water.

Other maintenance ideas
- Consider replacing pump gland seals, which can leak excessive amounts of water, with mechanical seals.
- Use a by-pass valve to let water that does not need to be cooled during low load times to by-pass the tower. Less water through the tower will mean less water lost through evaporation, splash and drift.
- Alternative water treatment methods such as ozone, ionisation and ultra-violet disinfection may enable the system to operate at higher cycles of concentrations, reducing blowdown, chemical and wastewater costs.

Case Studies

The Broncos Leagues Club and the Royal Brisbane Hospital increase the cycles of concentration in their cooling towers

The Broncos Leagues Club have increased their water use efficiency through simply raising the set point at which the automatic cooling tower bleed valve opened. This decreased their blowdown rate from 1,057 litres every hour at 1.8 cycles to 211 litres every hour at 5 cycles. This is a water saving of around 5 million litres (about $11,000 in water and trade waste) every year providing an immediate payback.

The Royal Brisbane Hospital has installed on-line and continuous multi-parameter control technology on their cooling towers. The new control system has enabled the hospital to increase its cycles of concentration from 4 to 8, which is projected to save the hospital 85,000 litres daily in the summer months and around 70,000 litres daily in winter (about $35,000 per year in potable water). The system is able to adjust to changes in water quality, allowing the hospital to use other water sources such as recycled water and rainwater.

The Riverside Centre

The Riverside Centre in Brisbane has 37 office levels, retail, service and restaurant facilities and car parking. The management team identified that the water used in the Centre’s cooling towers accounted for over 30% of its total water use. As well as optimising the operation and maintenance of its cooling towers, the management team is now embarking on a world class water recycling initiative. The project involves capturing cooling tower blowdown water, which will then be treated before being re-used for toilet flushing. The project is expected to save about 3,500 kL of water each year and has a payback period of 3 to 4 years.

Castlemaine Perkins reuses process water

Castlemaine Perkins previously sent water used in the packaging process to trade waste. A recycled water system was installed to collect each grade of water and treat them separately by filtration and chemical treatment as required.

The water was then used for cooling tower make-up water as well as boiler make-up, irrigation and washdown water. It is estimated the system saves 30 million litres, or around $50,000 annually and has a payback period of around four years.

Further information

For further information on how to be more water efficient, please refer to other fact sheets in this series, or contact your Brisbane Water Customer Liaison Manager on (07) 3403 8888.