COMMERCIAL WATER EFFICIENCY

Heating & Cooling

FACT SHEET

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

This fact sheet provides an overview of water efficiency strategies for single-pass cooling, cooling towers, and boilers. Efficient operation of these heating and cooling systems is critical for saving water, energy, and money. If you have a system that is not described here or you are interested in additional technical assistance on how to make your system more water-efficient, call the water efficiency hotline at (503) 823-4527.

Cooling Towers

Cooling towers recirculate a stream of warm water that is brought into contact with an air flow, causing a portion of the water to evaporate, thereby cooling the remaining portion of water. The water then circulates though a cooling system (typically a chiller) or through process equipment, absorbs heat, and returns to the tower.

Cooling towers need to be expertly operated and maintained to ensure efficient operation. Facilities that receive Bull Run water may be able to operate towers at up to 10 cycles of concentration due to the low mineral concentrations. When groundwater is blended with Bull Run water, cycles may have to be reduced because the natural concentration of silica and other solids is higher in groundwater than in the Bull Run supply. Regular water quality testing can be used to help ensure that suspended solid concentrations remain at recommended levels and to identify bio fouling.

Water Efficiency Opportunities

- **Evaluate whether reducing the amount of blow down is possible.** In most cases, up to 10 cycles of concentration are possible with Portland's Bull Run water. In addition to reducing water use, decreasing blow down can also lead to cost savings with wastewater, energy, and chemical use.
- **Control blow down using automatic controls**. Use automated controls such as a conductivity controller. Improvements can also be realized by operating the bleed-off on a more continuous basis and maintaining the conductivity of the tower closer to its limits.
- **Submeter make-up usage**. The City of Portland's Bureau of Environmental Services (BES) offers a sewer volume credit for water lost through evaporation from cooling towers. This program requires the installation of one or more submeters and BES should be contacted before installing them (503-823-7856). The use of submeters also allows the operator to monitor changes in the volume of water being used in the tower.
- **Establish an effective scale, corrosion, and bio-fouling protection plan**. Work with your tower treatment professional to develop the proper protection program.
- **Install a basin high-level or overflow alarm**. A one-day overflow event could waste as much as 33,000 gallons for a 1-inch make-up supply.
- **Make sure high-efficiency drift eliminators are installed and functioning properly.** Drift eliminators are used to reduce the amount of water removed from the system due to wind and fan flow.
- **Make sure cooling towers are appropriately sized for the cooling load**. Many sites have two towers that, when combined, make up the peak load for a building. When demand is low, one tower can be shut down enabling the system to operate at higher energy efficiency. This type of sizing is better than using a single, large tower and operating it at half load capacity during low-demand periods.
- **Use 2-speed or variable-frequency drives on tower fans**. These devices match air requirements to load more effectively and reduce water use as well as the overall energy consumption of a tower.
- **Consider sidestream filtration**. If airborne contaminants are a problem use sidestream filtration to reduce the build-up of solids.
- **Work with your vendor.** Tell your vendor that water efficiency is a priority. Ask about alternative treatment programs that can reduce consumption and blow down.

Single-Pass Cooling

Single-pass cooling systems remove heat from products, processes, or equipment and transfer it to a supply of clean water which is discharged directly to a sewer drain. Single-pass cooling uses a significant amount of water and can result in unnecessarily high water and sewer costs. For example, a single-pass cooling system uses 40 times more water than a cooling tower operated at 5 cycles of concentration to remove the same heat load.

If possible, eliminate all uses of single-pass cooling by connecting the equipment to a closed-loop system, cooling tower, or by replacing water-cooled equipment with air-cooled models. Single-pass systems should be maintained to ensure efficient operation until they can be retrofitted or replaced with air-cooled equipment.

The types of equipment that typically use single-pass cooling are heat pumps, air compressors, vacuum pumps, ice machines, condensers (for refrigeration), degreasers, hydraulic equipment, welding machines, X-ray equipment, CAT scanners, and air conditioners.

Water Efficiency Opportunities

- **Check operation of the water control valve**. Water control valves adjust the flow rate of water to match the cooling needs of the equipment. Valves that are out-of-adjustment can needlessly waste thousands of gallons of water daily.
- **Properly insulate**. Absorption of additional ambient heat by the cooling water stream can be prevented by ensuring that the piping, chiller, and storage tank insulation is sufficient. This can help prevent a higher flow rate than could be needed to maintain the exiting temperature of the cooling stream.
- **Monitor flow rates, and entry and exit water temperatures.** For maximum water savings, flow rates should be near the minimum allowed by the manufacturer. Monitoring temperatures can ensure that they are within the manufacturer's recommendations.
- **Regularly clean heating coils.** Clean coils will help maximize heat exchange.
- **Consider reusing single-pass discharge water for other processes.** Single-pass discharge water can, in some cases, be used for boiler make-up supply or landscape irrigation. Note: some single-pass water may contain contaminants that will preclude its use in boiler make-up or other secondary uses.

Steam Boilers

Boilers use varying amounts of water to produce steam or hot water depending on their size. Steam boilers require make-up water to compensate for unreturned condensate and to replace blow down discharges that are required for water quality control. These units have a tendency to develop leaks as they age. Always work with a boiler expert before making any changes to your boiler system.

Water Efficiency Opportunities

- **Install a condensate return system**. A condensate return system reuses condensate water as make-up water. Reuse of condensate can reduce operating costs by up to 70 percent.
- **Locate and repair leaks.** Boilers can develop leaks in steam traps and the distribution system. Escaping steam wastes both water and energy.
- **Install automatic controls.** For steam boilers greater than 200 hp, consider installing automatic controls to treat boiler make-up water and regulate blowdown based on conductivity.
- **Install make-up water meters**. Water meters on the feed water make-up and condensate return (if possible) can help monitor water use and guide efficient chemistry control.
- **Limit blow down.** Adjust blow down limits to near the minimum required to properly flush the system and maintain desired water quality. Work closely with a boiler professional.
- **Establish an effective corrosion and scale program.** Regularly inspect boiler water and fire tubes for corrosion and scale. Reducing scale by chemical treatment or mechanical removal will increase heat transfer and energy efficiency and will reduce the amount of blow down necessary to maintain water quality.
- **Eliminate systems that use cool fresh water to temper hot condensate**. Employ an expansion tank to temper boiler blow down instead of cold-water mixing.

Additional Web Resources

- http://www1.eere.energy.gov/femp/program/waterefficiency_bmp.html
- http://home.howstuffworks.com/ac3.htm
- http://www.joliettech.com/variable-frequency-drives_and_cooling-towers.htm
- http://www.ebmud.com/sites/default/files/pdfs/Thermodynamic-Processes_0.pdf