Waste Not: A Water Conservation Plan for Ice Arenas

by Jack Vivian, Ph.D.

Water is the lifeblood of humankind and of mechanized history. Its life sustaining qualities and ability to perform work and transfer thermal energy, coupled with its abundance, helped facilitate the industrial revolution and our current way of life. Today, however, the culmination of several powerful forces is posing a serious challenge to our traditional way of life and the work practices of our businesses and will become more threatening in the years to come. Consider the following problems:

• The depletion of groundwater reserves.

• The rising costs of freshwater consumption and waste-water disposal.

• The increasingly stringent mandates of environ-mental laws.

• The rapid rise in public awareness of the need for resource preservation and pollution control.

• The water and waste-water infrastructures in many cities are in need of repairs and major upgrades; the result is a need to spend billions of dollars in maintenance and new construction.

• The fact that state and federal governments are cutting back on funding of water and sewer projects; the cost of opening and maintaining those systems is being shifted to the user in the form of rate increases.

In less than five years, arena managers in several areas have seen water go from being a low-cost, limitless resource to one that is expensive and scarce. During this time, water prices have doubled or tripled in many locations, even in areas not always associated with water supply problems.

The price and availability of water are pitting homeowners against agricultural and industrial interests. Unless users reduce demand for water through conservation efforts, economic development will suffer. These trends will cause the ice arena industry and others to give high priority to the development of economically viable water conservation programs.

If ice arena managers are to significantly reduce water usage in their facilities, they must combine new technologies and good operational practices in a comprehensive water conservation plan. Start with an examination of how water is used in the facility's restrooms, locker rooms, cooling tower and ice resurfacing operations. Have standard fixtures been replaced with water conserving fixtures that conform to new standards? Depending on the rate charged for water, it may be economically beneficial to upgrade the fixtures solely for the purpose of reducing water use.

• Install low-flow aerators or laminar flow restrictions in all faucets; better yet, replace with spring loaded types that automatically shut off.

• Install shower heads that flow at no more than 2.5 gallons per minute.

• Install 1.6 gallon per flush toilets and 1.0 gallon flush urinals. Reduce flows delivered by flush valves. On flushometer-type toilets, have a plumber inspect valves for reversible conserving rings or acceptability for other modifications to reduce flow.

Cooling tower water requirements can be reduced by properly maintaining the drift, makeup water and bleed or blow-down systems. As air passes through cooling towers, a portion of the tower's water becomes entrained as water droplets in the airflow and is carried out of the tower; this water loss is known as drift. A well-maintained and properly operated tower will have drift losses of approximately 0.2 percent. New tower designs can reduce drift to 0.1 percent. A poorly operating tower can lose one to two percent of the water flowing through it to drift.

One or two percent may seem like a small amount of potential savings but the average tower has a three gallon per minute (gpm) evaporation rate, 0.3 gpm drift, and makeup of four gpm; this can be significant over time. To estimate the average evaporative cooling tower water consumption, consider that the tower may run on the water cooling mode only 50 percent of the time (assuming that the fan mode can satisfy the heat transfer for the other 50 percent of the time.) This means that, for an average spring or summer day, the cooling tower system uses 2,880 gallons (12 hours x 4gpm x 60 minutes) of water per day. Even a savings of two percent would result in a sizable reduction in water consumption. This is without calculating the bleed or blow-down that must occur to keep the tower from excessive scale.

Bleed or blow-down is controlled water loss from the system so that the dissolved minerals in the water do not accumulate in the cooling system. The amount of bleed required depends on the quality of the makeup water, particularly the calcium concentration. Calcium carbonates deposit along tubing surfaces in heat exchangers, or chillers insulate the water from the pipe and diminish heat transfer from the water to the pipe. This causes compressors to run on higher head pressures, use more energy and results in more equipment wear. Keeping tower scale at a minimum and controlling the amount and frequency of the bleed or blow-down are important steps to conserving water energy.

Other suggestions for cooling tower water conservation are:

• Maintain the cooling tower water treatment system.

• Prepare performance specifications for chemical service vendors; require proposals with projections of water consumption and chemical use. Many providers will give glowing reports on the chemical side but neglect to reflect how much water is consumed to reach the desired results.

• Control cooling tower bleed-off, based on conductivity, by allowing bleed-off within a high and narrow conductivity range – this will achieve high cycles of concentration in the cooling system and reduce water use in the cooling tower.

• Inspect drift losses – if excessive, install drift eliminators or repair existing equipment; achieve at least five cycles of concentration, or the maximum number of cycles achievable, without scale formation – implement measures to remove or compensate for minerals which may form scale.

Water for ice resurfacing can amount to more than 20 to 25 percent of the consumption of an arena. Below is a rough calculation of the water used for a typical two-surface arena with normal usage on week days and early mornings and late evening use on weekends.

Monday – Friday 5 p.m. – 11 p.m.

10 resurfaces @ 60 gal. = 600 gal./day

Saturday – Sunday 6 a.m. – 12 p.m.

18 resurfaces @ 60 gal. = 1,080 gal./day

Total estimated water consumption for ice resurfacing = 5,160 gal./week

Ways to conserve ice resurfacing water:

• Use the fill gauge on the side of the resurfacer to only put in the quantity of water needed to resurface the ice properly. Water left in the tank will not be of proper temperature for the next resurface, so to overfill wastes heated water and results in the next ice surface being of less quality.

• Check the fill hoses to be sure they are shut off after each filling. Don't allow the resurfacer tank to overflow during filling as the tank will hold 85 gallons and only 50 to 60 gallons are required for a normal resurface.

• Don't use water to melt the shavings on the top of the melting pit. A heat coil system using waste heat from the compressors should be able to melt the shavings. Have the operator shovel or alter the grate system so water is not needed in this process.

Efficient water management for ice arenas is analogous to energy conservation in the early 1970s. Its effectiveness will increase as new applications of water conservation measures evolve. Below are several initiatives that arena managers can implement to prepare for the crisis ahead:

• Conduct a water audit to assess current water uses.

• Ask your water and waste utilities for projections of future rates. Learn as much as possible about the methods used to calculate rates and the nature of the water problem in your area.

• Investigate capturing run-off or rainwater from the arena's roof structure and storing it in-retention ponds or cisterns.

• Look into using water from on-site retention ponds or nearby lakes for makeup water for the cooling tower and air handlers.

• Consider installing a system to recycle ice resurfacer shavings by filtering and water purification as part of the dump pit system. Check the health standards for this process in your area.

• Investigate the potential for converting or adding more air-cooled capacity for HVAC and ice making purposes. Have the manufacturers calculate the savings and pay back, if any. The electrical costs may offset the savings.

• Check your area building codes to see if the ice resurfacing water must be placed in the sanitary system or can be dumped into the storm sewer. Many municipalities are discounting water and sewer rates if the arena can prove evaporation rates and that resurfacing water is being discharged into the storm sewer and not treated by the sewage plant.

Well-planned water management is often accompanied by savings in energy and waste water treatment. These long-term savings can reduce expenses and sustain the viability of the ice arena business. Managers with a thorough knowledge of their site's water use will be better able to lessen the impact of future water shortages on their operations. They will also be better informed and able to converse intelligently with conservation officials and better represent the industry when the time for conservation comes.

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