Take Control of Your Flood: It Just Makes ene

Introduction
There are approximately 725 ice arenas in Ontario with an estimated 1000 ice surfaces requiring ice a resurfacing each hour. Although there are arenas that offer ice rentals year round or have extended daily schedules, most rinks continue to be seasonal operations (September through April – or an 8 to 9 month operating season). Most are heavily scheduled Monday to Friday 4pm to midnight with Saturday and Sunday scheduled 6am to midnight. Using these general use criteria, it can be estimated that a typical ice rink is resurfaced 72 times per-week, 288 times per-month or 2592 times over a 9 month season.


Figure 1: Maintaining the ice surface

ORFA has long been a proponent of the 20-minute flood. Although 20-minutes is not required to resurface the ice, additional time needs to be factored in to allow time for the operator to fill the unit; conduct a vehicle circle check; dump shavings; and to store the equipment upon completion of task . What this means is 5-minutes for set-up; 5-minutes for clean-up; plus the traditional 10 minutes to resurface making the total flood time approximately 20 minutes.

Floodwater Tank
An ice resurfacer has a floodwater tank that can hold between 665 – 760 litres (146 – 167 gallons) of water *[Figure: 2].* The tank is designed to provide replacement water to freeze in place after a small amount of ice is shaved away. Many operators cannot identify how large the water tank is on the equipment or know how much water is actually required to complete a typical resurfacing on their specific sheet of ice, can you? Common practice is to fill the unit until it overflows, thus giving the driver a sense of security that they will not run out of water before the flood is complete.


Figure 2: Floodwater tank

If a driver has an ice resurfacer that holds 665 litres (146 gallons) of water, but only needs 551 litres (121-gallons) to complete the task yet allows the unit to overfill during the preparation period by 19 litres (4 -gallons), a significant amount of hot water is continually going to waste; and the cost to heat this unused water will only increase total energy expenses.

Did you know that on average a typical ice resurfacer runs 10-minutes per-flood x 2592 floods per-season = 25,920 minutes/60minutes = 432 hours of operation? Using the industry standard (based on engine and drive train stress not actual speed capability of the equipment) of 30mph or 50kph an average unit is driven 12,960 miles or 21,600 kilometres each season! Remember to schedule your ice resurfacers' maintenance according to the manufacturer's recommendations.

Wasteful Practice
If a typical operation overfills their equipment by 114 litres (25-gallons) of water each flood and allows 19 litres (4-gallons) to go to waste by overfilling and conducts 2592 resurfacings a season they have heated and/or wasted 344,736 litres (75,168 gallons) of water. If all ice sheets (1,000) in Ontario are as wasteful, a total of 3,422,736 litres (751,680 gallons) of water are wasted annually. If we apply this calculation across Canada using the estimated 3200 ice sheets a total of 110,310,552 litres (24,053,760 gallons) of hot water could be wasted in the ice arena business each year.

"Overfilling of an ice-resurfacer by 19-litres or 4-gallons of water for 1-operating season can cost a facility using a Natural Gas (NG) hot water system $800-$1600 depending on the current NG pricing! This estimate is based on an incoming water temperature of 4°C (40°F) and heating it to 60C (140F)" Greg Kempa, Union Gas

Facility managers like Derrick Neelands, Supervisor of Arenas for the Town of Milton are aware of the operating and environmental costs of such waste and have taken action through the installation of a computerized water valve system *[figure 3 & 4]*. Operators now have the ability to pre-set the amount of water dispensed into the ice resurfacer tank.

Figure 3: Computerized water valve (Town of Milton)

Systems that are installed according to the *Ontario Building Code* by a professional plumber have a payback estimated to be less than one operating year. The commitment by the Town of Milton to reduce operating costs and their impact on the environment is one that all arena operations need to consider.

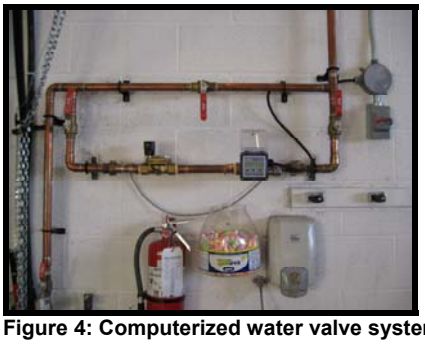

Figure 4: Computerized water valve system (Town of Milton)

Water Level Indicator

Smaller arenas on limited budgets do not have to be left behind. Facility managers who lack the financial resources to install an electronic water control valve need to instil a sense of environmental awareness in their staff.

Figure 5: Ice resurfacer water level indicator (Air Canada Centre)

Each ice resurfacer is equipped with a water level sight gauge on the unit. [*Figure 5]* The water level is indicated with a tube or sight glass on the side of the machine and then marked. The marker encourages operators to fill to water use level. Operators need to determine by trial and error how much water is actually needed to conduct the resurfacing process. Concerns about floodwater losing heat as it sat between intermissions and wasting water is what prompted staff at the *Air Canada Centre* to find a solution. By determining the number of gallons required for resurfacing and indicating this directly on the unit, staff has helped to improve upon efficiencies at the ACC.

Water Fill Nozzle

When filling the ice resurfacer with heated water, it isn't unusual for the operator to allow some spillage. This wastes water and the energy used to heat the water. To reduce the chances of this happening, some operations use heavy-duty water fill nozzles installed with automatic shut-off feature.*[Figure: 6]*. The fill nozzles work similar to typical gas nozzles to prevent over-filling; water is automatically shut off when the tank is full, preventing water spillage. Purchasing the right nozzle is important as many are not designed for water and will fail due to corrosion.

Figure 6: Water fill nozzle

Floodwater temperature
Ice resurfacing represents a significant operating heat load. To restore the ice surface condition water is flooded onto the ice surface usually at temperatures between 55 and 80°C. The resurfacing water temperature affects the load and time required to freeze the floodwater.

Water Temp. C/F	Air Approx. (Mils / Litre)
0 °C [32°F]	29.9
4.4°C [40° F]	25
10°C [50° F]	23
15.6°C [60° F]	20
21.1°C [70° F]	18
26.7°C [80° F]	16
32.2°C [90° F]	14
37.8°C [100° F]	12
43.3°C [110° F]	10
48.9°C [120° F]	8
54.4°C [130° F]	6
60°C [140° F]	4
65.6°C [150° F]	2
71.1°C [160° F]	TRACE

CAUTION: Water above 71.1°C [160° F] increases the risk of burns to skin.

The principles of physics and chemistry indicate that hot water holds less air than cold water (see chart); and further, water above 71.1°C [160° F] keeps the same air water soluble consistency. There is no advantage in heating flood water above 71.1°C [160° F] as it will only increase operating costs.

Note: *The ORFA is aware of some new designs for ice resurfacing attachments that are intended to reduce the air solubility levels in colder water. Some operations are using flood water at temperatures lower than 32.2°C [90° F] claiming positive operational results.*


Figure 7: Temperature gauge

No Room for Errors
The legal profession thrives on loop holes. It is industry best practice to fill the tank from empty each time. However, filling the tank to capacity and allowing 114 litres (25 gallons) of water to remain in the tank after each flood will cause the water to cool below the recommended flood temperature of **60 - 71°C [140-160°F]**. The prime reason for heating flooding water **140-160°F** is to remove as much air as possible; fresh water is added for the next flood and as it mixes with the stale cooler water remaining in the tank, it draws down the tanks total water temperature potentially leaving a legal loophole for managers to defend against in court. *[Note: Stale flood waters should be drained if they become too cool between flood schedules*]

"That's our legal department."

Risky Behaviour
Some operations do not have the hot water capability to fill the resurfacer tank prior to each flood, so they allow the water to trickle into the tank between resurfacings; leaving the machine to fill "unattended". One of the factors (there were many) that lead to the explosion and the tragic death of a young arena worker was that the ice resurfacer was left unattended while refilling, only for a few moments, while the operator assisted users on the ice with a malfunctioning scoreboard. The resurfacer exploded when water overflowed on to the unit. A coroner's inquest resulted in 20 recommendations.

"…*By the time he returned a few minutes later, the hot water was overflowing on to the adjacent gasoline tank. This caused a pressure build-up in the gas tank and gasoline vapour could be heard escaping from around the cap. At this point, after turning off the water, he released the pressure by removing the gas cap. An explosion then occurred when the gasoline vapour, being heavier than air, settled on the floor and ignited, probably from the pilot lights of the gas water heaters…" [Source: Verdict of the Coroner's Jury. Fatality Report 2628. NCSP]*

The results of the Coroner's Inquest put forth a list of 20 recommendations for the City of London. The ORFA continues to support these recommendations through ongoing operator training and awareness, "It is unacceptable to leave an ice resurfacer unattended while it is refilling…"
[ORFA Certified Ice Technician Program]

Ice Resurfacer Rooms
Ice resurfacer rooms must be designed in accordance with local building codes. Rooms must be designed or retrofitted to deliver adequate amounts of hot water for the resurfacing demands of the facility. Failing to provide such basic operational needs hinders safe efficient operations and could result in litigation.

Water Quality
Maintaining good water quality through proper treatment may allow for lower flood water temperatures and less volume. The purity of water used for flooding is critical to the quality of the ice produced. Any impurity in the water adversely affects the making of ice. (Source: *ASHRAE Handbook - Refrigeration c2006*)

The ORFA encourages members to become environmental stewards for the industry by committing to ongoing operational efficiencies.

Sources:
Energy Management Manual for Arena and Rink Operators.SaskPower;SPRA c2007
ASHRAE Handbook - Refrigeration c2006
ORFA Certified Ice Technician Program (CIT)
City of Toronto Environmental Initiatives www.toronto.ca
Jet Ice Limited
Union Gas Limited
ORFA Arena Technical Advisory Committee
Fatality Report 2628. National Chemical Safety Program
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