ONTARIO RECREATION
FACILITIES ASSOCIATION INC.

GUIDELINES

For
Creating and Maintaining
Outdoor Ice

DOCUMENT

June, 2007

1. Background

Offering outdoor ice has a long historical connection with Canadian winters! Ice sports were originally played on natural ponds, lakes and rivers with many communities continuing to offer skating and sporting events on natural or refrigerated outdoor ice. Volunteer organizations or neighbourhood groups maintain many of these facilities.

If an outdoor ice surface is created on municipal land, and made available for use by the general public it must be maintained to a recognized set standard. What the standard is - needs to be defined. However, many of the operational practices of an indoor rink can be immediately transferred to an outdoor rink operation. A municipality that has set operational procedures for an indoor ice facility may need to adopt these same operational activities to an outdoor surface – even if volunteers maintain the outdoor facility!

Understanding user patterns, controls, level of required maintenance and best operational practices need to be clearly defined through policy and procedure. Litigation in parks, swim areas and other outdoor amenities controlled by a municipality continue to increase. Outdoor skating surfaces hold no immunity when it comes to potential litigation – diligence needs to be embraced and practiced.

2. The Law

There are no specific legal requirements to be met for the offering of outdoor ice. Although there is an expected responsibility for safety by anyone who engages in an activity - there is also an expected responsibility for those who own and offer recreational opportunities. This relationship is one of blind trust between the two parties however; the owner is expected to supply a higher level of responsibility. In short, there is no limit to litigation. Each case will have specific concepts concerning responsibility and liability that will require review. Owners must be prepared to offer a comprehensive defense byway of set operational activities. Failing to supply such a report will in all likelihood result in a finding of guilt. By embracing some basic daily activities an owner can help defend against any pending litigation.

Negligence refers to conduct which involves neglect or failure to act with the care that would normally be expected in the circumstance.

Example: Failing to close an outdoor facility when temperature rises causing the ice to begin to melt

Occupiers Liability refers to the person who has control or possession of a facility. They do not necessarily have to be on site. They are bound by their duties of employment or by specific ownership.

Example: A recreation director and/or municipal council may be held responsible for the action or lack of action relating to an accident on an outdoor ice pad regardless of past historical operational practice

Waivers and Signage are tools to help identify risk. They are not all inclusive and they cannot provide a total defense in any litigation.

Example: Posting a sign that indicates *"no pucks and sticks during public skating"* and failing to ensure compliance does not dissolve responsibility

Children are afforded a higher level of responsibility and protection by law. Owners have a heightened responsibility to ensure that children are not exposed to dangerous surroundings or activities that may be irresistible to them.

Example: Posting a sign that indicates *"all children must be accompanied by an adult"* but failing to ensure compliance is a poor operational practice which fails to provide any real level of safety.

Nuisance is an area of liability where no personal injury occurs but rather an invasion of

occupiers interesting the use and enjoyment of their land.
Example: Adding lighting to an outdoor ice sheet that shines into neighbourhood housing may be successfully challenged in the courts.

Volunteers, even though they are unpaid and sometimes appear to be more casual in their approach, they still have a duty towards those they assist. They too hold a duty to ensure their actions do not result in injury; often referred to as the neighbour principle. Further, volunteers who are hurt while conducting work on behalf of a municipality may be successful in entering onto the community WSIB claim system. Training should also be supplied to volunteers specific to the work to be conducted as well as the limitations expected in the relationship.

3. Natural Ice on Ponds, Lakes and Rivers

Workers who are required to work on frozen ponds, lakes or rivers must first conduct a "job hazard analysis". Such an analysis needs to be reviewed each time work is to be conducted in such an environment. Ice thickness testing should be performed and logged. Personal floatation devices may need to be worn. An ice rescue plan may also need to be in place?

Natural ice is cause for greater concern as weather patterns continue to change. It is important that those choosing to utilize a natural water source for recreational activities during the winter months be aware of several risk factors.

1. Neighbourhood storm water retention ponds should not be used! These water areas have a tendency to fluctuate causing ice to weaken.
2. Moving water cannot be trusted! Creeks and rivers which have current will also fluctuate causing different levels of ice thickness and may quickly change from safe to dangerous without warning.
3. Outlet pipes and natural spring sources should be identified as part of the site selection process.
4. Be aware - snow on frozen water can act as an insulator!
5. Choose shallow water whenever possible.
6. Spring ice is rotten! As the weather warms, and ice begins to melt ice depth cannot be used to determine its true strength. As ice melts, it undergoes a process called "candling" which weakens the ice along its vertical channels.
7. Ice thickness must be checked regularly! Ice thickness is based on clear, blue or green ice. White ice has air trapped within it and as such should be treated with extreme caution.

Ice thickness Use Chart
3-inches [7cm] Stay -off
4-inches [10cm] Ice fishing, walking, x-country skiing
5-inches [12cm] 1-snowmobile or ATV
8-12-inches [20-3-cm] 1-car or small pick-up
12-15-inches [30-38cm] 1- medium truck pick-up or van

Source: Life Saving Society

A system to advise the public of the level of safety associated with a natural ice surface should be developed and maintained. A series of coloured flags that can be flown to advise of the level of safety has been effectively used Example: Green=Safe, Yellow =Caution and Red=Danger. Another tool is Public Service Announcements which has the community advise the public through the media of the level of safety for the area.

4. Ponds, Lakes and Rivers

The ice resurfacer may be considered to help in the outdoor ice maintenance plan. Several factors must be considered. Determining, if in fact, the unit is insured must be the first step prior to taking it off site. It will be governed by the Highway Traffic Act and as such, may need to meet all the requirements for the privilege of

public road use. Ice resurfacers that are taken off site need a thorough cleaning to remove any dirt, salts or other foreign matter prior to being placed back into resurfacing service. It is strongly recommended that an ice resurfacer that requires moving any distance should be moved using a flatbed trailer system.

An all too often occurrence, is an ice resurfacer that breaks through natural ice as the operator has under estimated the weight of the unit and the thickness of the ice. A standard ice resurfacer has a dry weight of 7,000lbs-once filled with water it can raise by 1,700lbs for a total wet weight of 8,700lbs. Fuel type and amounts will also lend to the final weight calculation, as well as, the drivers weight. Merging use of battery units add significantly to the final weight of an ice resurfacer.

Ice depth readings should be conducted and recorded prior to any equipment entering onto a frozen pond, lake or river.

5. New Weather Challenges

Traditional outdoor natural ice has fallen prey to the greenhouse effect. Shorter winters and fluctuation in weather patters have put outdoor ice operators in a heightened sense of operational alert. An increased diligence is recommended to ensure ice surfaces remain safe for use at all time

6. Working in Cold Temperatures

Working in outdoor temperatures is strictly controlled under the Occupational Health & Safety Act. Limits to exposure to cold are set in time increments based on temperature and wind chill factors.

Working under cold conditions can lead to various injuries or health effects, which are collectively known as cold stress. Construction workers may experience cold stress when working:

- Outdoors on a cold day
- In a refrigerated room
- In an unheated building
- In cold water, rain, or snow
- While handling cold objects or materials

The hazardous effects of cold on the body may include dehydration, numbness, shivering, frostbite, immersion foot (trench foot), and hypothermia. Hazards associated with cold stress are categorized into systemic and local effects. Local effects impact the part of the body where the exposure to cold is the greatest.

Systemic effects impact more than just the local area and can affect the whole body. Numbness, frostbite, and immersion foot are all local effects. Immersion foot is the result of the skin's having been exposed too long to cold and dampness. Immersion foot can result in swelling, tingling, itching, loss of skin, or skin ulcers. Hypothermia is the most serious effect of cold stress. Once the body loses the ability to maintain its normal temperature, the body temperature lowers, and other symptoms such as violent shivering, slow or slurred speech, confusion, hallucinations, a weak and irregular pulse, or unconsciousness occurs. Certain people are more susceptible than others to cold stress. People who are not physically fit, have a chronic illness, drink alcohol or take drugs (including prescription drugs), are wet or damp from work or weather, are fatigued, are exposed to vibration from tools, don't wear the right clothing, or are not used to working in cold have a higher risk from cold stress.

How can you recognize cold stress? Shivering is the body's response to cold stress and serves as a protection mechanism by increasing the rate of metabolism. Be on guard for cold stress if workers are shivering because it's a good sign of cold stress and possible hypothermia. Subjective responses of workers provide a good tool for recognizing cold stress in the workplace. Worker behaviors that may indicate cold stress exposures include seeking warm locations, adding layers of clothing, or increasing the work rate.

8. Site Selection, Amenities and General Maintenance

Site selection may vary from a flat green surface, soil, crushed stone, concrete or asphalt that has been selected to be frozen; to a controlled environment, which contains a complete dasherboard system and spectator seating. The skating area should be in a shaded area or located as to not directly take sunlight throughout the day. Identifying the level of service to be provided is the first indicator of the required level of maintenance and upkeep to be scheduled for.

A pre-freeze site visit is a must to ensure that the area to be frozen is free of debris or that the existing infrastructure is safe and serviceable. Corrective action must be taken on any discovered faults with such actions being recorded for future reference. Consider drainage pattern requirements when the ice melts at the end of the season.

A water source is very important and should be located as close as possible to the rink. Cold water will work fine for all aspects of flooding. However, hot water if available is recommended, as it will produce a better sheet of ice. The system should be pre-flushed annually to release any built up soils or contaminants within the system and to ensure adequate pressure is available.

General safety to ensure that the rink is located in an area that is hazard free (no obstacles, poles, ditches, low tree limbs, close to roads, bottom of toboggan hills ect.

Lighting and sound systems should be checked well in advance of the projected opening dates.

Outdoor electrical safety requires consideration. Facilities, which offer outside electrical outlets, may require to meet ground fault protection guidelines. Check with local electrical authorities to ensure compliance is being met.

Ancillary facilities must also be inspected for operational and safety levels. If no permanent system is in place, portable washrooms may be required to be arranged for installation. Waste containers and should also be strategically placed. Adequate benches for rest and skate installation and removal should be considered. A maintenance and upkeep plan must also be in place throughout the entire operational season for such amenities.

Greenspace surfaces that are going to be considered for ice must be adequately prepared for. A soil sample would advise of the current condition of the site, while helping to select a proper fertilizer to speed the growth of the grass in the early spring months. Some operations opt to place a protective plastic sheet over the area to be frozen to act as an insulation barrier while offering some protection to the grass. Site selection is paramount to how long the surface will remain usable. Fir trees will provide an adequate windbreak while leaf-bearing trees will require more preparation time at the beginning of the season. The selected area should be given the same consideration as a playground for site lines and overall user safety from individuals who may wish to cause harm to individuals on the way to, from or at the site. Again, lighting is an important part of the original planning process or it must be reviewed for existing locations.

To reduce the risk of damaging the turf try the following; a) Spreading an organic fertilizer will cut down on this magnifying effect and help

fertilize the grass at the same time. b) Wait for 3 - 4 weeks of freezing weather to kill the grass prior to making the ice surface. c) Have a layer of snow at least 15 centimeters (6 inches) deep. d) Start with a fine mist of water and gradually increase the water to a spray. This will prevent the snow from compacting on the grass.

Hard surfaces such as concrete or asphalt should be pre-inspected for cracks and heaving. Cracks in a hard surface should be filled with clean sharp sand to halt further expansion when water is applied. Debris should be scraped and/or swept away and the surface pressure washed to remove any soils or stains. Areas with a high industrial base should be aware of impurities that may be released in the air falling to the surface during the warm months as well as throughout the entire winter operating season. A site plan should be created indicating any imperfections of the surface area to ensure a safe ice depth can be created and maintained. Creating a skating surface on a rubberized outdoor track should be avoided. Skates that break through the ice may damage the track, while the freeze/thaw process of the ice may find the track rubber fail or reduce its overall life expectancy. Any available warranty on the rubber or installation may also be void.

Concrete is considered the very best type of surface to use, if available. It is generally a light colour that doesn't attract the sun, is smooth and level.

Crushed Stone as found in parking lots can be a good surface to use and provides for good drainage of water when the ice melts at the end of the season. However, remember safety when selecting a site! Automobiles, slippery surfaces and ice skaters in the same area could be dangerous. This type of surface is very rough and loose. Make sure that a good base of ice has formed over the stones before skating is allowed. If there is very little snow cover loose stones beside the rink could be tracked onto the ice surface.

Asphalt is one of the most used surfaces when communities combine the sports of tennis and skating. The major problem with asphalt is that the dark colour absorbs the sun's heat, making the ice soft on warm days. This can be overcome either by painting the asphalt with a white wash paint or by packing down 2 inches of snow cover before the ice is made. Insufficient ice covering will allow skate blades to break through the ice and damage the surface of the asphalt. This may be important where the rink doubles as a tennis surface and where colour coatings are used. The freeze - thaw action of the ice may also cause premature deterioration of the asphalt surface.

Parking is an important part of the site selection process. An adequate, safe-parking area must be available, and if available, consideration for close public transit. Planning for snow removal of these areas must be budgeted for and arranged.

Dasherboard and spectator protection requires a detailed pre-inspection to be conducted. Problem areas should be rectified and recorded as complete. Any gap found between the dasherboard and the ice surface needs to be blocked. A non-petroleum based caulking can be considered with more affordable choices being “round” weather stripping found at most hardware stores, paper towels, dry wall tape or strips of rags. A regular inspection schedule by a “competent person” of these areas should be in place throughout the entire operational season.

Refrigeration systems are sometimes used to prolong the outdoor skating season. These systems are used to help speed the natural freezing process in the fall and slow the thawing process in the late spring. These systems are governed by existing refrigeration operational laws based specifically on the size and capacity of the actual horsepower of the plant. A review of the Operating Engineers Act is recommended to ensure compliance is being maintained. An annual review by a recognized/licensed refrigeration contractor may be required? The O.R.F.A. Basic Refrigeration course is a highly recognized professional development opportunity toward understanding the “theory of refrigeration”.

Unique skating experiences have been created in some communities. Skating paths that wander through a park that is lined with scrubs or trees creates a quality skating atmosphere. A caution is given to operators of such sites or those considering creating such an environment to litigation that has occurred when pieces of the trees/schrubs landed on the ice creating a skating trip hazard. Increased

patrols/inspections to ensure the ice remains safe at all time should be considered.

8. Making Outdoor Ice

Regardless of who is chosen to create and maintain a sheet of ice they should be provided with adequate training. The O.R.F.A. Ice Making and Painting Technologies course is a highly respected training sessions that investigates proven ice creation methods and techniques.

Ice creation indoors or out requires the same principles to be adopted and embraced. Knowledge + quality water + reduced air entrapment = quality, durable ice however, outdoor ice creation does produce some additional challenges.

Ice making, if completed in a systematic order can be a simple process! Failure to prepare and adhere to basic installation principles will haunt an operation for an entire season. It is a cold environment, which requires that ice maker to be adequately prepared to endure physical work in unfavourable conditions. By wearing sensible clothing, in layered applications, covered with waterproof outerwear, will help keep staff focused on the job at hand. Frequent, short breaks in a warm environment should be encouraged.

Water plays a key role in success of ice creation. When a sheet of water is frozen, it should be hard, allowing water applications to freeze quickly, leaving little snow development during the harshest use. Both ground sourced and municipally treated waters can contain dissolved minerals, organic matter or the ultimate enemy of ice, “air.” Ice quality will differ in all parts of North America, depending on the water source. Applying “hard” or “soft” water will create two completely different styles of ice, which will perform differently under all conditions. By understanding the properties of water, the icemaker will be adequately prepared to clarify user concerns on ice consistency. For good ice making, there are three general types of water contamination that must be considered:

- Organic matter
- Dissolved minerals - less then 100ppm of TDS (Total Dissolved Solids)
- Air

The actual kind of mineral content is vital to ice performance. Water is one of the few liquids that are lighter as a solid than as a liquid. This is due to a slight reduction in the degree of hydrogen bonding which holds its molecules together. Any further reduction in this bonding will degrade the ice. Highly mineralized water or some free alkalinity will contribute to ice deterioration and coupled with a “salting out” effect will create a lower density or “slower” ice.

When raw water is freshly applied during the resurfacing process, the heat flow travels from the top down. The opposite transpires during an “outdoor” freezing which allows the mineral content to always stay in the liquid phase. During the ice resurfacing process, the film on the surface is the last to freeze, thus trapping the entire mineral content directly at the top of the air/ice surface. The effect is a lack of hydrogen bonding and in extreme instances; the dispersion of mineral salts is so concentrated that sometimes a white powder forms. As the season progresses the skating surface becomes more alkaline and its freezing point will continue to drop. High pH levels cause a freezing rate to slow, which in turn creates a poor ice surface. “Alkaline results in poor ice”…the higher the

sodium content the more evident this becomes. A pH of 7 or less is desirable

Ground preparation requires that the heat be completely removed. Waiting for mother nature to perform this task can be time consuming and if not frozen to an adequate depth prior to water being applied it will quickly thaw releasing surface heat. Applying water in vast amounts to the surface just prior to natural freezing will speed the process by having the ground absorb the water however; water applied to a completely frozen surface in vast amounts will have the water flow uncontrollably – watching and interpreting weather patterns is an essential skill for an outdoor icemaker to obtain. For temperature accuracy, the use of an infrared thermometer is recommended.

A good water base in the ground will further extend the spring operational season.

Sand base vs. greenspace – sand is a better choice. Sand that holds no impurities has no insulation factor and will quickly freeze. Ensuring the sand is level is an important step prior to applying water.
Packing snow as the base has some benefit. The snow will act as an insulator from the ground source heat and will absorb some of the heat generated from the sun. The snow will also provide some optical brightness to the final product reducing the need or quantity for white ice paint application. Ice paint will be discussed later on in the document.

Once the base has been created, the ice building should then commence.

9. How to Lay the First Sheet of Outdoor Ice

<u>OPTION A</u>

1. The temperature must be consistently below freezing. Recommended temperature is between -7 and -17 Celsius.

2. The ground must be frozen. Ideally there should be a blanket of snow 5-6 inches thick.

3. Level the snow and pack with shovel, snowshoes, scrapers, etc. “Back dragging” or patting the surface can do this. As the ground is not always flat where rinks are erected, take the time now to level out the surface, even if it means carrying snow to level it off.

4. Now you are ready for your water. Pick a time when it is the coldest, late in the evening as opposed to mid-afternoon. Be prepared to spend considerable time at this stage, as it is the most important one. Use a 1" diameter hose equipped with a nozzle capable of producing a fairly fine spray. Without the spray capability, ice production will be poor. Turn the nozzle to a fine spray and systematically begin to sprinkle the packed snow. Don't put too much water on the first pass, just enough to dampen the surface. Keep the hose moving. Don't ever stop or stand still. After giving the complete area a preliminary sprinkle, STOP. Return to your starting point. If it's frozen, you are ready for another fine coat. If not, wait until the area is frozen. **Note:** Try not to walk on the rink until a solid sheet is obtained. The snow has a tendency to crystallize and form "channels" if the snow is very light or if too much water is added at one time. If this occurs, fill in the "channels" and sprinkle lightly with water. Continuous sprinkling with the fine coats of water will eventually give you a solid surface of ice that may be walked on. However, it will be rather rough and not suitable for skating. At this time determine if the preliminary sheet of ice has adhered to the rink boards. If it hasn't, sprinkle lightly, adding snow as required, making sure that the water is applied to the side of the board as well as to the snow. After a

solid crust has been obtained and bonding with the boards is firm, it is now time to flood.

5. Flooding is done only when it is cold enough to freeze. Start at one end of the rink and apply an even spray across the width. Recommend spraying strip 6' - 6½' wide. Work progressively down the rink until the entire rink has been sprayed. The flooding pattern should allow you to apply water to the complete surface of the rink without overlapping or causing you to walk on freshly watered surface (this might cause slush to build up)
   Note: If slush builds up remove it immediately.

6. After the first flood is frozen, continue adding floods until you have a 2" base of ice and the rink is somewhat flat and level.
   Water seeks its own level. Eventually if sufficient number of floods is applied, the rink will become flat, level and ready for skating.

OPTION B

1. The temperature must be below freezing point. Recommended temperature is between -7 and -17 Celsius.

2. The ground must be frozen. Ideally there should be a blanket of snow 5-6 inches thick.

3. Level the snow and pack. As the ground is not always flat where rinks are erected, take the time now to level out the surface, even if it means carrying snow to level it off.

4. Now you are ready for water. Pick a time when it is the coldest, late in the evening as opposed to mid afternoon. This stage is time consuming but should not be rushed. As in option A, begin to sprinkle (a fine spray is not necessary) and systematically begin to "soak" the packed snow. As the snow is "soaked" you may begin to pack the "slush". This is best done with a lawn roller but can also be achieved with shovels and scrapers. Working backwards, continue "soaking" the snow and packing the "slush", being sure to cover all foot prints etc. as well as rolling a flat even surface.

5. After the "slushing and rolling" is all finished, be sure that no one walks on the surface until it is completely frozen. Once frozen, begin flooding the surface to develop a flat smooth sheet of ice necessary for skating. It might be necessary at this stage to chip away bumps or ridges cased by the roller, etc. do it carefully so not to break off large chunks of your base.

6. Make sure that your ice is creating a good bond with your boards.

7. Refer to step 6 in Option A.

OPTION C

What happens if the temperature is consistently below zero and yet there is no snow? Do we have to wait for snow to create our base?
No snow is not needed to make ice but without snow, a somewhat different approach is recommended.

1. Since there is no snow to absorb the water it might have a tendency to run off if the surface is not totally flat. Attempt to level the surface as much as possible. The use of sawdust as explained in Option A #6C is also recommended for leveling as well as blocking the holes underneath boards, etc.

2. After leveling and blocking any holes present, first freeze the rink boards into place by watering them down (supports as well). If you have used sawdust, soak it as well.

3. Allow the boards and sawdust to freeze solid.

4. There are two "schools of thought" on the next step. Both methods will be presented so that you may choose the method best suiting your situation.

Method 1 – Fine Mist - With the nozzle of the hose turned to a fine spray (a garden watering can may also be utilized) quickly cover the ground with a light spray of water. Using a predetermined pattern sprinkle the complete rink area. These "sprinkles" should freeze rapidly and by the time you complete one "coat" you should be able to begin giving the surface another light spray. As the droplets of water freeze between coats they create a pebbling effect. After 3-5 coats, a thin layer of ice should cover the complete rink area. The surface is unfit for skating as it will be rather rough. However, it will form a good base for the flooding. (See diagram next page). Now begin your flooding as described in Option A step number 6.

Method 2 - Rolling Floods (no snow present)
With the nozzle turned to a steady flow, begin by allowing the water to run onto the ground. This should be done with as little pressure as possible so that the water will seek its own level naturally. Now walk the hose back and forth across the surface, flooding the frozen ground at the rate of about a yard each pass. With each pass, back up and flood another yard of ground. Don't walk on the ground that is flooded. Flood the complete surface in this manner. Wait until frozen before adding another flood in the exact same manner. Because the ground is not perfectly flat it will take a number of "floods" before all the ground has ice. This method of flooding is time consuming and much more demanding than just spraying with a pressured hose, but the ice is more apt to be fault free and smoother. Continue flooding until enough ice to skate on is achieved.

Remember, the more ice you "build" now, the longer skating season you will have.

10. Ice Paint
A white exterior will reflect heat away from the surface. As previously discussed the use of snow may help in creating this effect or a quality ice paint may be warranted? Red and blue lines will attract the sun causing excessive melting to occur. Painting just the outline of the blue and red lines may help to prevent this problem. These areas should be considered potential hazard spots and skaters should be controlled from using the ice until a safe ice depth can be restored. The use of any ice paint requires a set application and disposal plan, elements of same to be discussed later in this section. Ice paint should never be applied on natural ice areas such as lakes, ponds etc.

The importance of professionally formulated white ice paint cannot be over emphasized. A poorly designed ice paint will produce a meager appearance with poor energy performance. Under no circumstance should hydrant lime be used in ice paint applications. A premium ice paint will demonstrate these primary qualities:

- It will not present a heat transfer barrier. Ideally, it will provide better thermal conductivity than the ice itself
- It will have a high infrared reflectance value. The heat gain from radiation is a large part of any heat load on an ice facility.
- It should contain absolutely no free alkalinity, the migration of which will reduce surface hardness and freezing point.
- It should be non-toxic.
- It should present a high level of optical whiteness and good hiding properties, which remain unaffected by pigment fluctuation
- Easy to apply and remove.
- Meet all set legislated requirements in regards to disposal.

Inspections by the Ministry of the Environment raised issues related to the removal of ice and disposal of ice contaminated with ice paint. Some operations annually leave ice piles outside their facilities to naturally melt. The potential exists for water contaminated with ice paint to enter the environment through storm sewer or natural drainage. This practice may not be viewed as the environmentally friendly image we aspire to project nor, legally acceptable.
The inspection resulted in an order to:

1. Pump out all storm sewer catch basins on the local street and dispose of the wastewater in the sanitary sewer system.
2. Thoroughly clean the street and parking lot.
3. Ensure that the removed ice contaminated with paint was either:
· Trucked to an acceptable disposal area.
· Melted in a contained area.
· Disposed of through a sanitary sewer system.

The O.R.F.A. wishes to remind all operators that ice shavings dropped outside at anytime of the year may contain traces of "human body fluids" [spit, vomit, blood ect.] and as such should be posted as unsafe and controlled to ensure they do not pose an attraction as "child play areas" or used for "cooling purposes" of sport team beverages or "First Aid". Workers should be advised of the possible hidden dangers found in ice shavings.

The O.R.F.A. recommends that you:

- Have a current MSDS for all ice paints used
- Consult with the appropriate authorities for approval of an acceptable ice-disposal procedure - local sanitary officials, local office of the Ministry of Environment ect.

Methods include:

- An ice pad that is 85' x 185' with an average depth of 1.5 inches will be scraped out in 30-35 loads
- If the paint has been installed close to the ice surface, as recommended in the O.R.F.A.'s Ice Making and Painting Technologies training course-only the last 3-5 loads of ice shavings should contain paint-drivers should monitor ice depth and snow shavings to identify when paint is at or near the surface-once identified, a fresh blade should be installed to quickly complete the process
- If acceptable, shavings containing paint may then be dumped into "the snow pit" for drainage into the sanitary sewer system- a thorough cleaning and sanitizing of the snow pit should be conducted once all snow has melted
- Snow pits that empty into a septic system should not be used for paint disposal
- A site inspection of the proposed dump area should be conducted by a "competent person" to ensure ground water from melting shavings will not enter natural waterways such as creeks, rivers or well-water supplies
- The area should be protected from possible human contact-posted with warning signs and/or fenced off
- Shavings with no ice paint may then be placed outside
- Shavings being placed outside containing ice paint should be controlled:
- A barrier such as plastic or tarp should be placed on the ground as a barrier between the contaminated sand and the natural soil
- The ground barrier should have 6-12 inches of sand placed on top to help trap melting paint
- A containment system of one or any combination of 12-inches of sand, hay, or wood box construction is then placed on the outer edge of the ground barrier to help prevent leakage
- The exact size of this containment area will need to be calculated by each facility to best meet there specific needs-the containment area may collect all ice shavings or only ice shavings containing ice paint.
- Paint waste and sand should then be disposed as per local by-laws
- Some operations have been known to use local contractors with portable waste containers in lieu of a ground barrier system to collect ice shavings containing paint
- A final inspection of the disposal area should be conducted and logged once melting is complete

11. Ice Maintenance

Outdoor ice pads with no refrigeration systems require no set ice thickness to be maintained – the thicker the ice the longer it will last in warn weather. Outdoor rinks that utilize refrigeration plants need to be reminded that ice is a natural insulator, the thicker the ice the harder the refrigeration plant will need to work. A comprehensive maintenance plan should be in place for such operations to maintain an acceptable ice thickness that will not over-tax the refrigeration system.

Much like an indoor ice facility, ice depths should be taken and recorded on a regular basis. The number of times ice depths should be

taken need to be based on type of operation and weather patterns.

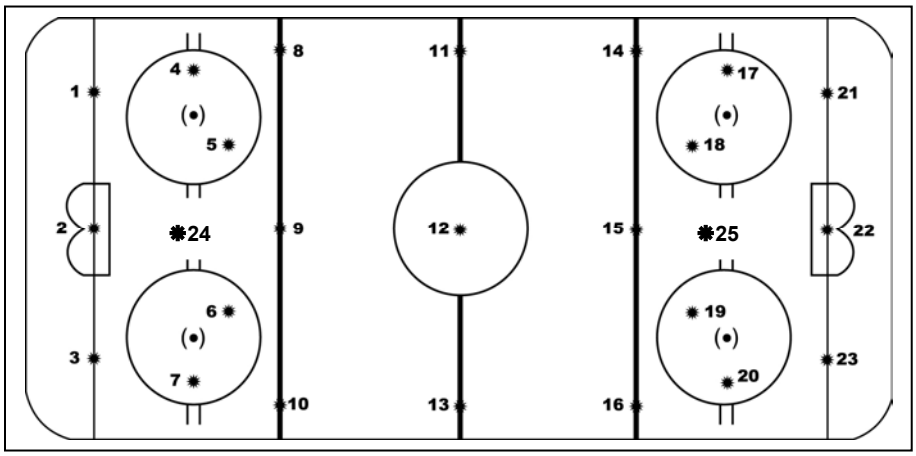
Cuts, gouges, cracks and holes require attention byway of a set maintenance plan. Such a plan is to be determined by a competent person. Equipment can range from hand tools, barrel flooder to an actual ice resurfacer equipped with a front plow and traditional flooder system.

A snow blower may also be on site. This equipment requires adequate training to be provided to all that use it as well as personal protective equipment that may be recommended by the manufacturer. A clearly defined process based on actual snow fall will help ensure all involved use the same procedure under the same conditions.

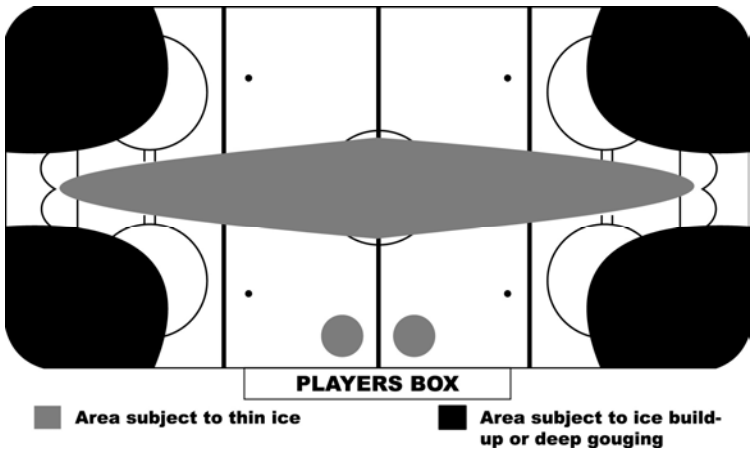
Example:
1-5cm Hand Scrape
5-10cm Snow Blower
10+cm Snow Plow

Ice Test Drilling Procedures - Prior to any use of new ice, detailed ice test holes must be drilled and recorded to ensure that set operational thickness has been met. It is strongly recommended that no one be allowed to use the ice surface when operations do not meet set ice thickness policies. Facility operators must efficiently define their schedule of installation and adhere to set policy. Failing to ensure safe thickness has been obtained may be considered a breach under set legislation. Mangers and staff are cautioned to act responsibly not only during the ice in period but throughout the entire operating year by setting a test hole recording schedule and acting on poor conditions by correcting before allowing any use.

Ice Depth Drilling Location Chart



Traditional Ice Trouble Spot Locations



Flood as often as possible. In this area, the times that ice will freeze properly are numbered, so when it does turn cold, flooding should be escalated. Build up the sheet's thickness so that on mild days the rink can withstand the sun without patches of earth showing through and chunks breaking off the surface. **Caution:** Make certain that each flood is frozen solid prior to adding another.

The ice surface must be scraped clean of all snow, ice chips, flakes and dirt before flooding. A steel scraper is recommended. (Make sure the edge of the scraper is straight).

With a broom (use a good, stiff corn broom or stable broom) sweep around the boards removing snow that the scraper has left behind. This part of the ice is seldom skated on and every precaution must be taken to ensure that it does not build up into a ridge. By sweeping, you are allowing the water to form a good bond with the boards. If you don't sweep, chances of a gap or space between your boards and the ice surface forming is greatly increased.

It is very important, when removing the snow from the ice surface, not to block the entrance used by the snowplow vehicle after a heavy snowfall. Throw the snow clear of this entrance. **This entrance must be kept clear at all times.**

Good ice is clean ice, not covered by dirt or litter. This is primarily a participant concern, however proper supervision will increase awareness and lessen the maintenance frustrations.

Smoking on the ice surface should be discouraged as a lit cigarette butt can melt and mar a good skating surface.

Be aware that many individuals using the rink will be wearing boots or rubbers rather than skates. Restrict the use of salt or sand in areas such as walkways, the equipment storage area, parking lot, etc. otherwise this salt or sand will eventually end up on your rink causing you maintenance problems.

Ongoing repairs to cracks and chips in the ice surface are more desirable than attempting to repair damages to the ice surface through flooding alone.

The steps for repairing a crack, chip or hole are:

1. Sweep or clean the hole of all snow or ice chips.
2. Mix a slush mixture of snow and water.
3. Pack the slush in the hole.
4. Level off the slush with a shovel, trowel, hockey stick or puck, etc.
5. (Optional) Sprinkle with a light flood of water.
6. Keep people from skating on the spot until frozen.

Water run-off sometimes due to the nature of the terrain on which the rink is built, the water is continually seeping through the snow, under the boards and "running off". This occurs when there is a marked slope in the ground or where the boards do not sit flush to the earth. Use the Sawdust technique to correct this problem

The use of saw dust to help stop water run-off by blocking the holes against the inside edge of the boards at the lower end of the rink has been successfully used. Once the sawdust has been spread, moisten it and pack it gently. The sawdust will hold the water until it freezes. Once it is frozen the sawdust acts as a "dam" for seeping water. It also creates an excellent bond with the boards.

There are two concerns with the sawdust technique.
1) Do not use too fine of a dust.
2) Check with the proper authority before using it to see if they have any concerns.

During your flooding, whether it is on your initial sheet or ongoing throughout the winter, be aware of shell ice. Shell ice occurs when for some reason or another, an air bubble is frozen into the surface. A white patch of thin brittle ice that is easily broken

characterizes shell ice. When broken, the layer of ice underneath is exposed.
How do you deal with shell ice?

1) Break the surface.
2) Remove the brittle ice completely.
3) Pack solid with a mixture of snow and water.
4) Level with shovel, trowel, hockey stick, etc. and remove excess slush.
5) Avoid stepping or skating on this area until frozen solid

Don't allow the snow banks to become too high. Periodically lower them by pushing the snow, from the top, farther away from the surface. This will lessen the amount being dragged back onto the surface by participants as well as facilitate easier cleaning.

During mild spells, boards sometimes come loose. Freeze them into place as soon as possible. This will insure the rink's shape being constant and also reduce the operating cost of replacing boards that disappear.

A system of flags has been successfully used to identify ice conditions and permitted use. A red flag signifies “stoppage of use”, yellow signifying “caution when using” and green signifying “ok” to use. Ice conditions, depth and general comments should be recorded in a bound logbook

12. Ice Equipment Care and Maintenance

There is nothing more frustrating than attempting to do a proper job with equipment that is broken, frozen or missing! The proper care of the equipment will ensure that when it is required, it will be available.

Consider the following hints or suggestions on proper maintenance:

1. Never leave any equipment out over night.
2. Every piece of equipment should have a place in the storage room and when not in use should be returned to it.
3. Never allow shovels or brooms to be left lying around. A light snowfall will hide them and increase the probability of loss or breakage.
4. After flooding, roll the hose up and store it properly. By elevating the hose nearest the tap and walking towards the nozzle, any water remaining within the hose will drain. This will minimize excess water or ice build up near or in the storage area.
5. Be certain that the water is shut off completely after every use.
6. Keep the storage area clean and tidy at all times. Proper care of the storage area and equipment not only increases the life expectancy but is contagious as well. If the participant sees that the rink, storage area and equipment are properly cared for, chances are they will also treat it in the same manner.
7. If smoking is allowed in your storage area, make sure proper containers are supplied for ashes and butts. Clean these containers periodically, but not by dumping them outside the storage area. Use the containers that are provided for refuse.
8. Before you leave for the evening, make sure all the lights are out; both on the ice surface and in the storage area.
9. Don't leave the storage area unlocked and unattended. If the rink has been cleaned, the nets in place, etc., there is no reason for the equipment storage area to be accessible. Your judgment on this point is important.
10. If you have hockey nets at your rink, make sure that they are treated like all other pieces of equipment. Don't allow them to be abused and when not in use; they should be removed from the ice surface. Place them in storage every night.
11. Periodically check all equipment for damages, especially the hockey nets. If caught in time, a minor repair is preferable and less expensive than a major one.
12. If you use straw brooms for sweeping around the boards, remember that they do not last forever. Eventually they will begin losing their straw. The presence of large amounts of straw when flooding will reduce the quality of your ice. Change your brooms when this begins to occur.
13. Rink signs announcing rules and hours of operation should be fastened securely out of reach of participants. Eight to ten feet above the ground is the minimum recommended height.

14. Vehicles equipped with snowplowing blades which are considered multi-purpose meaning they are moved from site to site along public roadways must have a system to ensure that the unit is cleaned of salts and soils prior to entering onto the ice surface. Best practice after vehicle plowing suggests that a fresh application of water be applied as any impurities on the surface will be identified through the lack of quick freezing in contaminated areas.
15. A snow blower must only be used by a competent person. They need to be stored inside and secured to ensure untrained personnel cannot gain access to them. Adequate fuel, spare parts and tools should be on hand for quick repairs.

13. Supervision

To provide supervision at outdoor ice skating facilities is a question that must be individually addressed. As previously stated staff must be scheduled for regular maintenance and upkeep of the operation – how much and how often will be based on usage – which will need to be monitored by a competent person attending the site.

Programs such as public skating, figure skating and shinny hockey are traditional artificial ice activities that are offered with little or no supervision. This type of supervision may allow for a reasonable level of risk however, an ongoing evaluation of potential risk should be conducted. Failing to evaluate and respond to the way risk is managed can lead to possible litigation.

Occupier's liability law could come into effect in the event of a patron suffering harm as a result of an accident. Skaters, whether using ice skates, roller skates, inline skates or skateboards, are no different than any other sport, in that the participant must voluntarily assume some of the risk associated with the activity. However, sometimes negligence [Negligence Act] occurs when one participant collides with another – especially when there is a lack of supervision! The courts have spoken Mahlow v. Coquitlam (City) *"I do not think that an occupier can be relieved of responsibility for a failure to keep his premises reasonably safe by saying that he turned a blind eye to the danger because no one had been hurt in the past and because no one else had warned him/her of the danger. If the unsafe condition was there to be seen by someone who was applying his mind to the relevant risks, then it is the duty of the occupier to take reasonable steps to remedy the problem".*

This is not to say you must guarantee each user's absolute safety however, ***"you must take practical care to provide reasonable safety".***

Continual evaluation and assessment of program activities and facility operations can be regarded as the first step of demonstrating "due diligence"! However, you must not loose sight of the fact that your position is one of "information broker"…not only raising awareness, but also offering solutions and possible better operational practices. As such, please consider the following points as a start to a full assessment of your current activities:

- Have you established a method of informing users of the risks associated with their activities; received their acceptance and understanding of the risks, and are they adequately prepared to deal with the identified risks (response plans, insurance, etc.)?
- The "shinny hockey program" is exactly that – a "program" – therefore, you not only have the right, but in fact also have the responsibility, to ensure a safe environment. It is suggested that all participants be required to conform to wearing safety equipment appropriate to the level of play by the participants (some facilities use sponge pucks to minimize the potential for injury).

- Does your facility keep detailed reports on ice conditions and record steps taken to rectify ice-related problems?
- Do you have current emergency evacuation plans in place, are they posted, and do you actually practice them?
- Is there a contact number posted to report problems/issues?

The following information is taken from the O.R.F.A.'s Guidelines for Public Skating document. A complete copy of the guidelines can be secured by calling 1-800-661-6732 or by visiting our web site at www.orfa.com

Although there are no recommended days and times to offer Public Skating, it is most important that the facility manager consider the other scheduled events leading up to
the program. As with all other scheduled ice events, ice conditions must be evaluated for safety prior to the program-taking place. Programs such as figure skating are high performance events such as hockey games or practices may leave the ice in a poor condition. Allowing the general public access to a poor ice pad condition is unacceptable and poses serious risks to skater safety.

Poor ice may include deep gouges, paint or paper lines which migrate to the surface, net peg holes areas, unfrozen areas, dirt from the ice resurfacer tires, debris dropped by skaters or any other item which may cause a skater to fall and/or hurt themselves or others. Staff must check continuously for deteriorating factors and must monitor ice conditions. Any detection of poor ice must be dealt with immediately.

14. Outdoor Skating Surface Sizes

Outdoor skating surfaces are traditionally rectangular or square in shape. Rectangular shape allows for straightaway and turning areas at the ends. Suggested ice surface sizes and pleasure skating capacities for outdoor rinks include;

Small	24' x 40' = 960 sq. ft
Medium	32' x 64' = 2048 sq. ft
Large	40' x 80' = 3200 sq. ft

Note: Traditional indoor community rink size is 85 x 185 = 15,725 sq. ft.

Where practical, the long axis of a rink should run in a north/south direction, this orientation will minimize the number of south facing rink boards (if rink boards are installed), which reflect the sun's rays onto the ice surface.
Ice Load Capacity - "Occupant Load" is controlled under Section 3.1.16 of the Ontario Building Code. Section 3.1.16.1. Occupant Load Determination does not speak directly to ice skating activity. Table 3.3.16.1.of the Code suggests that ice skating activity may be classified under "exhibition halls other than those classified in group E" requires 30.1 feet per-person. This calculation combined with the "public corridors intended for occupancies in addition to pedestrian travel" of 39.8 feet per-person might best serve as a starting point to all calculations.

The O.R.F.A. recognizes that the standard ice surface size in the province of Ontario is 85ft X 185ft or 15,725 square feet. The standard ice surface construction has a minimum of 3-access/egress points to and from the surface area. The set standards outlined in the Ontario Building Code are for a total of 69.9 square feet per-person. The O.R.F.A. recommends that the load capacity for an average ice surface be no more than 160 persons (approximately 100 square feet per skater). Use this as a general guideline for any one time during the open community skating session.

Competent personnel shall supervise each open community skating program. No person under the age of 14-years of age shall be allowed to act as a skate patrol. Persons 16-years of age and younger should not be allowed to solely supervise open community skating programs. However, a person under the age of 16 may be permitted to assist if directly supervised by a person over 16 years of age.

The O.R.F.A. recommends that for an average ice surface, all Public Skating Programs will have on ice supervision as follows:

Patrol On Ice	Patrol to Skater Ratio
1 Skate Patrol	1 to 59 persons
2 Skate Patrol	60 to 119 persons
3 Skate Patrol	120 to 160 persons

Source: O.R.F.A. Recommandation

The Occupational Health and Safety Act requires that all employees will be provided with

adequate training to properly provide service. It is recommended that each on ice supervisor be assessed for and provide with WHMIS training, First Aid, Emergency Evacuation and any other identified training requirements.

To meet the requirements of the Trespass to Property Act no Skate Patrol will have the power of eviction for unruly patrons. It is recommended that each facility create and adopt a policy to govern unruly patrons.

Each facility should have a logbook to record open ice skating events. All acts of vandalism, unruliness, violence, injury or general concerns must be recorded

Any verbal/physical abuse by patrons of staff should have "zero tolerance" applied. Privileges of those found to be abusing staff should be immediately removed.

It is recommended that Skate Patrol wear a helmet at all time while on the ice. It is further recommended that identification of their employment be worn. A whistle for control purposes should be provided. Staff should have access to a phone for emergency purposes. Other equipment may include a disposable camera flashlight, walkie-talkie/radio, and a First Aid fanny pack

- There should be a constant flow of skaters.
- Skaters should not be allowed to gather in any area.
- Skaters should not be allowed into player seating areas or sit on the boards.
- Skaters should leave the ice surface area to rest.
- Any person under the influence of alcohol should not be permitted to participate in any skating event.

15. Outdoor Ice - Quick Facts

- Applying lights sprays of water that quickly freeze when it meets the frozen surface is the best ice creation practice;
- Applying vast amounts of standing water should be avoided as this water will trap air during the freezing process creating a less dense sheet of ice that will not endure a warm spell in the weather;
- Too much water will also create "shell ice" – ice much like a frozen puddle, ice on top trapping air beneath. If this occurs the area needs to be completely scraped away and rebuilt using the method outlined in the first bullet;
- Applying too much water in extreme cold condition will create "ice boils" that cause cracks and heaves as the water freezes too quickly;
- The hose may seem to have cold water in it but in fact it is warmer then the ice being created – keep the hose moving to avoid creating indents in the sheet of ice, and it will further help keep the water from freezing in the hose
- Applying water while it is snowing or if there is a layer of snow on the ice will cause the ice to be rippled or bumpy – avoid applying water when it is snowing; scrape away snow on the surface with a sharp tool or; consider using warm water to flood.
- Outdoor ice has the equivalent legal requirements as an indoor facility – breaches by staff or volunteers may result in litigation
- Sports played on ponds, lakes or rivers should be checked daily for thickness regardless of historical use
- Ice resurfacers can weight as much as 7,000lbs and have been known to break through ice
- Ice resurfacers may not be regulated to operate on local roadways
- Changing weather patterns must have owners/operators of outdoor ice facilities prepared to respond to constantly changing ice conditions
- All workers require awareness training for working in cold conditions
- Outdoor ice facilities require pre-season inspections, regular logged checks and ongoing, planned maintenance and upkeep schedules to be created and implemented
- When making outdoor ice an ice maker should follow the same principles as indoor ice creation – slowly apply small amounts of water
- An ice maintenance and ice depth checking plan should be in place
- Staffing requirements should be based on levels of use and activities being offered

- Logbooks should be used to record maintenance activities, such log books are available at www.orfa.com

References/Resources

- O.R.F.A. Ice Maintenance & Equipment Operations manual
- O.R.F.A. Ice Making and Painting Technologies manual
- O.R.F.A. Guidelines for Public Skating
- O.R.F.A. Guidelines for Waste Management
- Jim Neely, Safety Coordinator Sacramento Builders' Exchange – Cold Stress
- US Army Corps of Engineers www.mvp-wc.usace.army.mil/ice/ice-load.html - Ice Thickness
- Mike Bryson, Executive/Technical Director ARFA – Create a Winter Wonderland
- Leisurelines – Ice Safety Management for Ponds – December 2002
- Dave Wescott, STAR Director of Facilities and Programs
- City of London Outdoor Ice Manual
- Terry Piche, O.R.F.A. Technical Director

The O.R.F.A. continually updates and revises all working documents. Members are invited to submit concerns, suggestions and recommendations to any document controlled by the O.R.F.A.

Should you have any concerns, suggestions or recommendations – please feel free to submit them directly to the O.R.F.A. at info@orfa.com or by fax at 416-426-7385 or by mail at O.R.F.A. Suite 402, 1185 Eglinton Ave. E, North York Ontario, Canada M3C 3C6

The Ontario Recreation Facilities Association
T. 416-426-7062 F.416-426-7385
www.orfa.com
info@orfa.com

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