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FREQUENTLY ASKED QUESTIONS

Cold Plunge Tanks and Pools

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Introduction

Cold water swimming and cold plunging (also referred to as cold water immersion) have increased in popularity in Canada, the United States, and internationally.[1] Cold water swimming is typically done in winter in outdoor bodies of water. Cold plunge tanks and pools (herein referred to as 'cold plunge tanks') are not typically intended for swimming and are instead used to partially or fully immerse oneself in cold water for a short period of time. Cold plunge services are currently available to the public in some commercial establishments in Ontario. Examples include: a dedicated establishment for cold plunging; an outdoor thermal spa with alternating warm saunas, heated spa pools and cold baths; and an ice bath offered to athletes when they complete a race.[2]

This Frequently Asked Questions document is intended to address questions received from local public health units about cold plunge services in their communities. The following topics are included: cold plunging, pertinent regulations, health and injury risks, and infection risks. The reported health benefits of cold plunge tanks are not included.

Cold Plunging

1. What is "cold plunging" and what are "cold plunge tanks"?

Cold plunging (or cold water immersion) refers to the act of partially or fully submerging your body in cold water**.** Cold plunging has likely increased in popularity due to reported benefits to health and well-being.[3,4] Offerings for cold plunging include both indoor or outdoor tubs and pools, and are often specially designed tanks or plunge barrels.[5] Examples of cold plunge tanks include a bathtub, a metal tub in an athletic rehabilitation facility, and small pools in thermal spa facilities.

Given the broad range in both the size and type of available tanks in commercial and recreational settings, the following characteristics may vary:

- Temperature range
- Volume of tank
- Number of bathers
- Water circulation systems
- Water emptying practices

2. What is the temperature of cold plunge tanks?

Cold plunge tanks in Ontario reportedly operate at temperatures as low as 1-5°C, with some claiming to operate at 0°C.[6] While there is not a consistent definition of what water temperatures constitute "cold water", cold plunge tanks are colder than temperatures typically associated with cold water. Published literature suggests most observable physiological reactions to cold water peak when immersed between 10-15°C or colder.[7] The Centers for Disease Control and Prevention (CDC) 2023 Annex to the Model Aquatic Health Code (MAHC) is a scientific research and best practises document for aquatic settings, and includes some information on cold plunge tanks.[8] The MAHC states that water below 21˚C is considered cold by most people, as it can feel uncomfortable or painful and may restrict normal physical activity.[8] The Annex to the MAHC provides a range of temperatures based on activity (See Table 1). The MAHC states that cold-water plunge tanks generally operate at temperatures between 7-10°C.[3]

Table 1: Select Temperature Ranges from CDC's Model Aquatic Health Code (2023)

Aquatic Activity	Temperature Guideline
Cold water plunge tanks	7-10°C
Competitive swimming training or meet	21-27˚C
Recreational water usage	28-30˚C
Therapy & rehab	33-35˚C
Hot tubs	Maximum of 40˚C

3. How are cold plunge tanks typically used?

Cold water immersion is typically a short term activity, and may or may not include full body immersion.[2,9] For many bathers, water that is too cold will not be utilized for an extended period of time and will not be used by individuals seeking a recreational swimming experience.[8] While cold plunging will typically be a single short (30 seconds to 2 minutes) immersion for casual users, athletes have been reported to use cold plunging as a form of post-sports recovery, with immersion periods of up to 20 minutes, or alternating between a cold plunge and tepid water, each lasting 1-5 minutes.[6,10] In thermal spa settings, cold plunge tanks may be small and deep, and are used in conjunction with saunas or steam baths.[8] Manufacturers and cold plunge advocates typically recommend starting with shorter immersion times and warmer water, and gradually building up tolerance to the cold water.[5,9]

Inspection Considerations

1. Does the Ontario pool and spa regulation apply to cold plunge tanks?

Cold plunge tanks that meet the definition of a "public pool" in the *Health Protection and Promotion Act* are further classified as a Class A, Class B, or public spa under Ontario Regulation 565: Public Pools (O. Reg 565)[11].

2. How are cold plunge tanks regulated in other jurisdictions in Canada?

As of August 2024, no regulations were found in Canada at the local, provincial, or federal level that specifically addressed cold plunge tanks. Many local jurisdictions are handling cold tanks on a case-by-case basis. The MAHC refers to cold plunge tanks as either pools or spas, depending on their size and features.[8]

Health and Injury Risks

1. How does the human body respond to cold water?

Literature on cold water swimming has established physiological risk phases for cold water immersion up to and beyond 30 minutes.[12,13] Since cold plunges are approximately 30 seconds to 2 minutes,[6] it is unlikely the serious outcomes associated with cold water immersion would be applicable to cold plunging, but they are included below to illustrate how the body responds to cold water. The times associated with each phase are approximate; exact timing will depend on factors such as water temperature, body composition, age, and sex:[14,15]

- **Cold shock** (0-3 minutes): upon immersion, the skin's cold receptors may initiate a "cold shock" response that increases heart rate (tachycardia) and may result in an involuntary gasp.[7] Cold shock can occur in water at temperatures as high as 10˚C-15˚C.[16]
- **Muscle failure** (3-60 minutes): Involves the diversion of blood flow to the core (i.e., visceral area), which can impair muscle function. Loss of motor function due to cold water could lead to drowning or a fall-related injury when exiting the water.
- **Hypothermia** (after 30-60 minutes): The body begins to lose heat faster than it's produced. Lengthy exposure can lead to lower core body temperature.
- **Post-immersion collapse** (After removal from a > 30 minute immersion): In the first 5-10 minutes of rewarming up to 24 hours post-immersion, core temperatures can continue to drop. Symptoms include an excessive drop in blood pressure. This can lead to brain or heart failure, even many hours after exiting the water.[17]

2. What are the injury risks associated with cold plunge tanks?

CDC's Model Aquatic Health Code outlines a number of potential adverse health outcomes from sudden and intense changes in temperature from the use of cold plunge tanks, including immediate impaired coordination, loss of breathing control and, after some time when the core body temperature has fallen, slowed heartbeat, hypothermia, muscle cramps, and loss of consciousness.[8] Literature on cold water immersion identified additional risks:

- "**Cold Shock" response**: This can include gasping, hyperventilation, stress hormone release, hypertension and arrhythmias.[16] If a gasp occurs while a person's breathing passage is submerged, drowning can result, as even a small volume of water (150 mL) entering the lungs can result in drowning.
- **Fall-related injury**: Injuries from a fall upon exiting cold water tanks due to muscle failure or impaired coordination.[15,16]
- **Decreased blood flow**: Cold exposure can reduce blood flow, both to muscles and to the brain.[18,19] Reduced circulation may be more pronounced in women than men.[20]

3. What can bathers do to reduce injury risk from cold water immersion?

In general, exposure to extreme water temperatures should be avoided by pregnant women, those with pre-existing medical conditions, and young children.[8] Some considerations for bathers have previously been suggested[16] to reduce the risk of injury or illness while cold plunging:

- Consult with a physician prior to engaging in cold water immersion activities. The use of certain medications, alcohol or drugs can negatively affect cold tolerance.
- Adapt to cold water immersion gradually, in terms of both of the temperature of the water, and the length of time immersed.
- Enter cold water gradually to account for possibility of cold shock. Allow this response to subside before immersing the face, and avoid prolonged breath holds.
- Focus on breathing while entering water.
- Ensure there is supervision in case support is needed.
- Take care exiting the tank due to potential loss of motor control.

4. What can facility operators do to reduce injury risk from cold water immersion?

With respect to maintaining a safe bathing environment, reducing injury in cold water immersion settings are similar to other bathing settings. For example, operators could ensure supervision by trained staff. The following recommendations were also identified:[16]

- Understand and recognize the risks of immersion in cold temperature water
- Consider requirements for participant health and fitness, swimming ability, and limits for water depth
- Consider time limits for cold water immersion
- Provide safe methods for entry and exit
- Provide a pre-immersion briefing (similar to what is done with scuba divers)
- Provide a rewarming area and complete checks to ensure participants have rewarmed sufficiently before departing

Infection Risks

1. How does infection risk differ between cold plunge tanks and swimming pools or spas?

Infection risks from cold plunge tanks are similar to other recreational water settings, with cold water environments posing some unique exposure risks compared to swimming pools or spas.

Factors that may *increase* the risk of infection:

- Compared to spa users, cold plunge bathers may be more likely to fully submerge their head in the water, meaning that ears, eyes, nose or mouth may be exposed to cold plunge tank water. If bathers are intentionally immersing their head, some cold water may also be swallowed.
- Similar to spas, cold plunge tank exposures to cold water have been documented to reduce the skin's barrier function after 10 minute exposures, although less so than exposure to hot water.[21]
- While exercise is unlikely during cold water immersion activities, bathers may choose to use a cold plunge tank after exercise, introducing organic material into the water, similar to swimming pools. On the other hand, exposure to cold water is associated with gastric emptying, increasing the risk of fecal contamination relative to traditional pools.[22]
- Similar to spas, cold plunge tanks would be expected to have a higher ratio of bathers per unit volume of water, compared to a swimming pool. This means the risk of pathogen contamination would not be mitigated by dilution.

Factors that may *decrease* the risk of infection:

- Exposure times (i.e., bathing times) are likely to be shorter in cold plunge tanks
- Bathers in a cold plunge tank may produce less organic material while bathing, compared to a spa of a similar volume where warm water can lead to contaminant generation (e.g., increased sweating).[23]
- A cold plunge tank would likely have fewer contaminants, and less disinfectant fluctuation than a similarly sized spa. This is because spas use warm water, leading to disinfectants dissipating more quickly[24] and pathogen amplification in the case of *Legionella* and *Pseudomonas*.[25] In addition, spas use massage jets which can deplete halogen-based disinfectants like chlorine or bromine due to aeration.[25]

2. How are pathogens affected by cold water?

Compared to swimming pool temperatures, survival of waterborne pathogens, including viruses, bacteria and protozoa, is generally *increased* in cooler water temperatures.[26] For example, the survival of *Giardia* increases 5.5 fold, from 14-days at 25°C to 77-days at 4 to 8°C

E. coli is also able to survive and grow at temperatures as low as 7°C, and *Salmonella* can grow at temperatures as low as 5°C.[27] Certain viruses[28] and oocysts[26] can also survive cold water temperatures.

There are exceptions, where growth rates of pathogens *decrease* in cold water. For example, Legionella, non-tuberculosis mycobacteria and pseudomonas present the most serious risk of infection in water at higher temperatures (from 20°C to 50°C).[25]

3. How are disinfectants affected by cold water?

Cold water temperatures result in slower inactivation of pathogens from disinfectants like chlorine, when compared to warmer water with an equal chlorine concentration. For example, based on Ontario's Procedure for Disinfection of Drinking Water,[29] Giardia inactivation at a pH of 7.5 (middle of range for pools/spas) and the pool standard value for residual chlorine (1 ppm free chlorine), would require:

- At a temperature of 25°C, 30 minutes for 99% inactivation.
- At a temperature of 5°C, 119 minutes for 99% inactivation.

Virus inactivation times are similarly affected by temperature. At a pH of 6-9 with 1 ppm of free chlorine, virus inactivation would require:

- At a temperature of 25°C, 1 minute for 99% inactivation.
- At a temperature of 5°C, 4 minutes for 99% inactivation.

Increasing the chlorine concentration can reduce inactivation time. At a temperature of 5°C, and a chlorine concentration of 3 ppm (the highest value provided in the Disinfection of Drinking Water Tables), the time for 99% Giardia inactivation is 49 minutes, and the time for 99 % virus inactivation is 1 minute, 20 seconds.[29] Based on the reported typical temperatures of cold plunge tanks (1-10 °C), a higher chlorine residual may help to partially address the slower disinfection times. Though bromine is not used as a drinking water disinfectant in Ontario, the effectiveness of bromine is reported to be similarly affected by temperature and concentration.[30]

4. What can bathers do to reduce infection risk from cold plunge tanks?

Recognizing that bathers will be a source of contamination in these tanks, bather hygiene practices are appropriate to recommend to bathers using cold plunge tanks. As in other recreational aquatic settings, typical instructions for bathers will include showering before entry or re-entry, and to avoid introducing organic matter(i.e. spit, urine, mucus) or communicable diseases to the tank.[8] These hygiene requirements are addressed in posted signage for pools or for spas as required in O. Reg 565.[11]

5. What can facility operators do to reduce infection risk from cold plunge tanks?

In addition to encouraging bathers to follow hygiene practices, the following are considerations for operators that may help to mitigate infection prevention and control (IPAC) risks specific to cold plunge tanks:

- **Regular maintenance** - Ensure that non-recirculating tanks are drained, cleaned, and disinfected with an intermediate-level disinfectant, at a minimum, between uses. Recirculating tanks must be equipped with a primary water treatment system capable of destroying and/or removing potential pathogens, including viruses, protozoa and bacteria. This may also be supplemented by secondary treatment measures such as residual chlorine, UV light, and sub-micron filters. Because of the small water volume, water chemistry may fluctuate more in these tanks compared to a swimming pool (though likely less than a spa, due to the lower temperatures and the absence of jets). As with spas, because of the higher bather load per unit of volume, cold plunge tank operators could consider checking disinfectant and pH levels more regularly than with pools.

- **Water changes** – As with spas, regular draining and replacement of water will help to address some of the risks introduced by small water volumes relative to the number of bathers. Frequency is outlined in O. Reg 565 section 7, subsections (14) and (16) and will depend on the number of bathers and whether the volume of the tank is greater or less than 4,000 litres.[31] Some manufacturers of smaller cold plunge tanks offer approximate schedules for changing the water, indicating that water change frequency depends on the level of usage.[32,33]
- **Chlorine residuals** - Given the potentially high bather load relative to water volume and the reduced effectiveness of disinfection at lower temperatures with respect to pathogen inactivation[29], a higher minimum concentration of chlorine may be considered for cold plunge tanks as compared to swimming pools.
- **Fill and dump operations** - For tanks without re-circulation, "Fill-and-dump" operation of tanks in combination with disinfection between users would mitigate infection risk.[34]

Final Takeaways

1. What are some takeaways based on the information available on cold plunge tanks?

The following are some key findings based on the information currently available on cold plunge tanks:

- The operating temperature of the tank is an important factor with respect to health and safety risks.
- Smaller tanks pose infection risks due to their higher bather load per unit volume. Water changes and bather hygiene practises can reduce these infection risks.
- Disinfectants are less efficient in cold water. Higher chlorine or bromine residuals can help to address this reduced efficiency.
- Clients should be made aware of safety features and health and safety risks related to cold water immersion.
- Facilities should have practises and design features to address potential injury risks and cold water hazards.
- Manufacturer instructions may help to identify whether there are specific instructions for cleaning, disinfection and water treatment. It should be possible to identify whether a cold plunge tank has a water recirculation and treatment system, or if it is intended to be operated as a fill and dump unit.

> In general, best practices related to recreational water operations can be found in the Ontario Public Health Standards and Protocols and the Recreational Water Reference Document .

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