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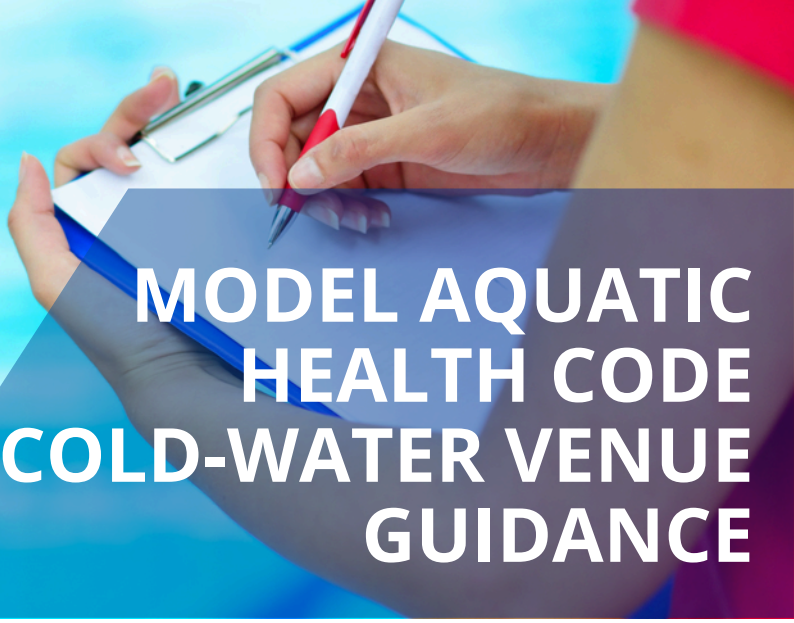

MODEL AQUATIC HEALTH CODE COLD-WATER VENUE GUIDANCE

Purpose

This guidance document provides recommendations for the design, construction, operation, maintenance, and inspection of public cold-water venues, including cold plunges, ice baths, and other cold-water immersion systems. It addresses public health and safety topics such as water quality, disinfection, circulation, injury prevention, signage, supervision, and safe operation practices to reduce the risk of illness and injury, including drowning. This document addresses both single-user, manufactured systems (also known as mobile or plug-and-play) and permanent (built-in-place) cold-water units.

This guidance provides public health agencies, facility operators, designers, builders, and other industry partners involved in public cold-water venues with a clear, practical framework for evaluating them. It reflects current science and best practices, aligns with the intent of the Model Aquatic Health Code (MAHC), and recognizes that cold-water applications present distinct operational and safety challenges. It offers recommendations for the design, construction, operation, and management of different types of cold-water venues.

This document is guidance only and does not create regulatory requirements. It does not provide medical advice or apply to private residential use, natural bodies of water, or temporary or inflatable portable systems unless otherwise regulated by the authority having jurisdiction (AHJ).

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What to Know

Cold-water venues, known also as cold plunges, ice baths, cold-soak tubs, and drain-and-fill pools, have emerged as a new type of public water venue. These venues are becoming increasingly popular at wellness and fitness clinics, and other locations across North America and internationally. Historically, cold-water immersion was used to treat various physical and mental health conditions and was typically performed in winter in outdoor bodies of water. This practice dates back centuries and is associated with numerous health claims, including improved physical and mental health, accelerated post-exercise recovery, and reduced inflammation. Many athletes and sports teams have adopted cold water immersion as a therapy for injury prevention and muscle recovery. Scientific evidence for these health claims is still emerging; however, as these cold-water venues are being used more frequently by celebrities and on social media, public health has seen an increase in wellness and fitness clinics offering cold-water venues in their jurisdictions. While interest in cold-water immersion continues to grow, these venues present unique public health considerations that differ from those of traditional aquatic facilities. This raises the question of whether these cold-water venues pose a public health concern warranting attention.

Definitions

- "Cold shock" is a potential risk from exposure to water below 70° Fahrenheit (21°C), which may cause an immediate, involuntary physical response due to the sudden lowering of the skin temperature. Symptoms of cold shock include a significant change in breathing, a sudden increase in heart rate and blood pressure, and cognitive impairment, and can increase the risk of drowning, slips, trips, and falls due to loss of coordination.
- "Cold-water" means water at a temperature between 32° and 70° Fahrenheit (0° and 21°C).
- "Hypothermia" or "hypothermic shock" is a condition in which the body loses heat faster than it can produce it, resulting in a core body temperature below 95 degrees Fahrenheit.
- "Cold-water venue" means a special-use aquatic venue that includes a pool, tub, or bath maintained at a temperature below 70° Fahrenheit, for the purpose of partially or fully submerging a person's body in a short-term (5 minutes or less) immersion (plunge). A cold-water venue may be used for a cold-plunge in contrast therapy, a cold-water lap swim, a sports-recovery therapy soak, or a social/sensory experience.

What is cold-water immersion?

Cold-water immersion refers to the act of partially or fully submerging one's body in cold water. This is typically a short-term activity, ranging from 30 seconds to 2 minutes, for casual bathers or those new to the practice. Some athletes, however, have reported using cold-water immersion for post-sport recovery, with immersion periods of up to 20 minutes.

Cold-water venues include indoor and outdoor tubs, baths, tanks, and pools. They could be as simple as a tub or a barrel, or as complex as a large recirculating pool. There are often variations in the temperature range, the volume of water, the number of bathers allowed in the water at one time, and the use of water recirculation systems. Often, they are used in contrast therapy, where a sauna or hot-water spa is followed immediately by cold-water immersion. Sometimes they are used as a stand-alone cold-water therapy, as in an athletic or fitness facility. When cold water immersion is done in a therapy setting, a trained medical attendant is often present to monitor the use of the pool and prevent health concerns such as hypothermia or emergencies such as drownings from occurring. With the addition of social media and celebrity use, these facilities are becoming increasingly social experiences.

Health benefits of cold water

Cold-water venues, also known as cold-water immersion tubs or ice baths, have become increasingly popular for their potential health benefits, ranging from physical recovery to mental well-being. Some users report benefits such as improved recovery and mental resilience, but the scientific evidence remains limited. At the same time, the risks—particularly cold shock response, cardiovascular stress, and waterborne illness—are well documented and must be addressed through design and operational controls.

Physical Health Benefits

- **Reduces Muscle Soreness and Inflammation:** A primary reason athletes use cold plunges is for recovery after workouts or sporting events. The cold temperature causes blood vessels to constrict, which helps reduce muscle swelling and inflammation. When a bather gets out of the cold water, the blood vessels dilate, increasing circulation, which helps flush out metabolic waste and deliver fresh, oxygenated blood to the muscles, aiding recovery.
- **Improves Circulation:** Repeated exposure to cold water can act as a workout for the bather's circulatory system. The process of vasoconstriction (vessels constricting in the cold) and vasodilation (vessels expanding as the bather warms up) may help improve blood flow and overall cardiovascular health over time.

Physical Health Benefits (cont.)

- **Boosts Metabolism and Brown Fat Activation:** To maintain core body temperature in the cold, the body must work harder, which can temporarily increase metabolic rate. Regular cold exposure may also stimulate the production of mitochondria in adipose tissue, causing it to appear brown (often called brown fat), which is a type of fat that burns calories to generate heat.
- **Supports the Immune System:** Some studies have found that regular cold exposure, such as through cold showers, can lead to a reduction in sick days. It is believed that the stress of cold exposure can activate the immune system, helping to strengthen its response to pathogens.

Mental Health Benefits

- **Enhances Mood and Focus:** The shock of cold water triggers a powerful release of "feel-good" hormones, including dopamine and norepinephrine. These neurotransmitters are associated with feelings of happiness, alertness, and motivation.
- **Increases Mental Resilience and Stress Management:** Voluntarily plunging into a cold pool is a controlled, short-term stressor. By learning to manage breathing and remain calm in the face of this discomfort, the bather may build mental fortitude. This practice can help one develop better coping mechanisms for managing everyday stress and anxiety.
- **Alleviates Symptoms of Depression:** While not a cure, some studies suggest that cold water immersion may help to ease symptoms of depression. The surge of mood-boosting hormones and the mental discipline required to endure the cold may contribute to a greater sense of well-being and reduced feelings of distress.
- **Improves Sleep Quality:** Some people report that regular cold plunges can lead to better sleep. The practice may help to regulate the body's circadian rhythm and promote a more restful state.

Health risks of cold-water immersion

While cold plunges may offer numerous health benefits, they also carry significant risks, particularly for certain individuals. The body's immediate response to extreme cold can be dangerous, and prolonged exposure can lead to severe medical conditions. Water cools the body 4 to 5 times faster than air of the same temperature.

Cold Shock Response

The most immediate and potentially life-threatening risk of cold plunging is the "cold shock response." This is the body's involuntary reaction to sudden immersion in cold water. It occurs within the first minute or so and can be fatal. The American Heart Association states, "Plunging the body into cold water triggers a sudden, rapid increase in breathing, heart rate, and blood pressure known as the cold shock response. That can cause a person to drown within seconds if they involuntarily gasp while their head is submerged. The shock also places stress on the heart and makes it work harder."

- **Drowning:** Cold shock triggers a powerful and uncontrollable gasp for air, followed by hyperventilation (rapid, shallow breathing). If a bather's head is submerged during this gasp, they can inhale water, which can lead to drowning. This risk is present even for strong swimmers.
- **Cardiovascular Stress:** The cold shock response causes a massive increase in heart rate and blood pressure as blood vessels constrict. This puts immense stress on the heart. For individuals with pre-existing heart conditions, high blood pressure, or other cardiovascular issues, this sudden stress can lead to a heart attack, stroke, or a dangerous heart rhythm (arrhythmia).
- **Autonomic Conflict:** Research suggests that competing signals to the heart—one to speed up (from the cold shock) and one to slow down (from the diving reflex)—can create a dangerous "autonomic conflict" that may be responsible for some cold-water immersion deaths.

Other Physical Risks

Beyond the immediate cold shock, other risks can develop with prolonged exposure or in specific situations.

- **Hypothermia:** While cold plunges are typically short, staying in the water for too long can cause core body temperature to drop dangerously low. This can lead to confusion, loss of coordination, and, in severe cases, unconsciousness and death.
- **Frostbite:** In extremely cold water or with direct contact with ice, there is a risk of frostbite, especially in the extremities, such as fingers and toes.
- **Infection:** In public or shared cold plunge pools, there is a risk of waterborne illnesses. If the water is not properly sanitized and maintained, bacteria (like MRSA) and viruses can be transmitted from person to person. Cold water temperatures result in slower inactivation of pathogens by chlorine-based disinfectants typically used in swimming pools and spas.

Other Physical Risks (cont.)

- **Disinfection chemicals and testing equipment:** Chemicals typically used to sanitize water in public pools do not respond the same in cold water, meaning the water may not have the correct concentration of disinfectant to eliminate pathogens that could cause illness, such as bacteria and viruses. Most poolside test kits do not give accurate results at low temperatures and require the operator to warm the sample before performing the test.
- **Entrapment:** Pool entrapment is when a person has a limb, digit, hair, or other body part entrapped (stuck) in a broken or missing drain cover. Entrapment can also result when a person's body is held to the drain (when drain covers are not large enough or spaced far enough apart) due to the powerful suction at the drain cover. The bather is closer to these suction outlets due to the smaller size of the cold-water vessel. Strict adherence to the Federal Virginia Graeme Baker Pool and Spa Safety Act (VGBA) should be required to prevent these incidents.
- **Injuries from slips and falls:** The combination of wet surfaces and cold, numb limbs can increase the risk of slips and falls in and around the cold-water venue, potentially leading to injuries.

Who Should Avoid Cold Plunges?

Due to the significant risks, certain individuals should avoid cold-water immersion or plunges or consult a licensed medical professional before attempting them. This includes people with:

- **Heart conditions:** This is the most critical risk group, including those with heart disease, arrhythmias, or a history of heart attacks.
- **High blood pressure:** A sudden increase in blood pressure can be dangerous.
- **Poor circulation:** Conditions like Raynaud's phenomenon (a vascular condition in which small arteries in the fingers, toes, and sometimes the ears or nose constrict excessively), where blood flow to the extremities is already compromised, can be exacerbated by the cold.
- **Diabetes:** Individuals with diabetes may have poor circulation and nerve damage, making them more vulnerable to the effects of cold.
- **Respiratory conditions:** The cold-shock gasp can be particularly dangerous for people with conditions such as asthma.
- **Pregnant women:** The effects of cold plunges during pregnancy have not been well studied, and it is best to exercise caution.

Who Should Avoid Cold Plunges? (cont.)

- **Age:** both over 60 years of age and under 14 years of age.
  - With age, the human body loses muscle mass and skin elasticity, making it more likely to feel the effects of low temperatures than a younger adult. Adults over age 60 are also more likely to have underlying health conditions that may be aggravated by sudden cold exposure.
  - The bodies of children under 14 are less able to regulate body temperature than those of adults. The surface area of a child's skin in comparison to their body size is very large, allowing the body to lose heat more rapidly.
- **Compromised immune systems:** The added stress of cold-water immersion may overwhelm an already weakened immune system. When the body's resources are focused on managing the shock from cold exposure, there is less energy available to fight off illness.

Design, Construction, and Plan Review Considerations

During the design and construction phase, all parties involved - from the designer to the operator and the AHJ or inspector- should evaluate whether the proposed cold-water venue meets the intent of MAHC design and construction standards, while also addressing the unique demands of cold-water operation. Lighting, indoor aquatic facility ventilation, electrical systems and components, first aid area, emergency exits, drinking fountains, garbage receptacles, and indoor aquatic facility acoustics should meet the minimum requirements outlined in the MAHC and should be evaluated as part of the plan review process.

Plans submitted to the AHJ should include sufficient detail to demonstrate how the facility will operate safely and effectively under cold-water conditions. In addition to the requirements outlined in the MAHC, a cold-water venue plan review should specifically include identifying the target operating temperature, the circulation and treatment system design, and the theoretical peak occupancy or bather load. When calculating the theoretical peak occupancy, the recommended design assumption is a bather density of 10 square feet per person. Indoor facilities should also address condensation control, as the temperature difference between cold water and warm air can create moisture issues that contribute to structural damage or microbial growth.

Materials used in construction should be smooth, durable, and easily cleanable, consistent with MAHC requirements. The AHJ should confirm, through submitted documentation, that the materials and equipment, including chemical controllers, chillers, filters, pumps, etc., can withstand both low temperatures and repeated exposure to disinfectants and temperature without degradation or loss of performance. Structural integrity is especially important, as cold-water vessels may experience thermal stress that differs from traditional pools or spas.

The design of the aquatic vessel should prioritize bather safety. Entry and exit points must be clearly defined and accessible, using stairs, ladders, or handholds as appropriate. Slip-resistant decking should be provided to reduce the risk of falls, particularly as cold exposure may impair coordination. A visible thermometer should be installed so bathers can make informed decisions before entering the water. There should also be a clock visible to all bathers so they can know the length of time they are spending in the cold water.

Design, Construction, and Plan Review Considerations (cont.)

Recirculation and filtration systems should be designed to maintain consistent water quality despite the challenges of cold temperatures. Continuous circulation and effective surface skimming are essential. In most cases, the expected turnover rates should match those required for spas, typically 30 minutes or less. Filtration systems should be certified to recognized standards, such as NSF/ANSI/CAN-50, and appropriately sized for the vessel.

Disinfection presents one of the most significant challenges in cold-water venues. Because chemical reactions occur more slowly at lower temperatures, maintaining effective disinfectant levels requires careful system design. Automated chemical controllers should be used to provide continuous dosing and should include interlock protection to prevent chemical feed when there is a low or no flow circulation condition. Free chlorine levels should be maintained at or above 3.0 ppm, or bromine at or above 4.0 ppm, and should not exceed the maximum concentration allowed by the manufacturer's instructions. The use of cyanuric acid is not recommended in cold-water systems.

There is limited literature on the use of in-line electrolytic chlorine or bromine generators in cold-water venues. It appears that these systems may produce disinfectants more slowly, and that water balance may be affected by increased Total Dissolved Solids. These systems are generally not recommended; however, if a manufacturer provides documentation demonstrating proper operation at low temperatures, the AHJ may consider approval on a case-by-case basis to ensure safety and compliance. Batch-type or side-stream electrolytic chlorine or bromine generators do not pose the same concerns because the disinfectant is generated outside the pool vessel at appropriate temperatures.

Cold-water venues are considered high-risk, as defined in the MAHC, due to slower disinfection reaction rates and higher organic loads. The designer should strongly consider incorporating a supplementary or secondary treatment system, such as ultraviolet light, ozone, or advanced oxidation processes certified to NSF/ANSI/CAN 50.

Decking, barriers, and support spaces should be evaluated for compliance with MAHC requirements. Adequate deck space should be provided where applicable, and access to the venue should be controlled to prevent unauthorized use. Accessibility requirements under the Americans with Disabilities Act must also be considered. Materials used in decking or wet suites should be slip-resistant, clean, and in good condition to prevent slips, trips, and falls.

Design, Construction, and Plan Review Considerations (cont.)

Hygiene facilities play an important role in reducing contamination. Rinse showers should be provided, particularly in facilities that use contrast therapy, to encourage bathers to remove contaminants before entering the cold water. Rinse showers shall be installed in accordance with MAHC Section 4.10.4.3. Water supply and wastewater disposal systems must comply with local regulations and be capable of supporting the operational needs of the facility. Mechanical and chemical storage areas should be separated from public access and designed to support safe operation.

Operations and Maintenance Considerations

Once a cold-water venue is operational, the operator and the AHJ should focus on ensuring the facility maintains water quality, safety, and compliance with established standards and procedures.

Permitting and inspection requirements should be clearly defined in coordination with the authority having jurisdiction. Inspectors should verify that the facility is operating within the scope of its approval, including any variances that may have been granted during the plan review process.

Water quality management is a critical component of cold-water venue operation. Because disinfectants are less effective at lower temperatures, maintaining proper residual levels is essential. Disinfectant concentrations, pH, and water clarity should always meet MAHC standards when the facility is open to bathers. Combined chlorine levels should also be monitored and controlled, as elevated levels may indicate inadequate treatment.

Water replacement is an important tool for maintaining water quality. Operators should recognize that cold-water venues, particularly those with small volumes or high usage, may require more frequent replacement than typical pools to maintain acceptable conditions.

Filtration and circulation systems should operate continuously. Turnover rates should be maintained and verified, and filters should be cleaned or backwashed in accordance with manufacturer recommendations and MAHC guidance. Any interruption in circulation or treatment should be addressed promptly.

Water testing procedures must account for the limitations of standard test equipment in cold conditions. Test kits used in these facilities should be designed for low temperatures, or the water samples should be warmed before testing. Testing frequency should meet MAHC requirements, and records should be maintained for review.

Routine cleaning and maintenance are essential to prevent the buildup of biofilm and organic material. The facility should follow a documented cleaning schedule, and all surfaces should be kept in good repair. Adequate ventilation is particularly important in indoor environments to prevent the accumulation of chloramines and moisture.

Safety measures should include controlled access to the venue, clear visibility of immersion time (such as a clock), and well-maintained slip-resistant walking surfaces. These controls help reduce the risk of injury and support safe use of the facility.

Policy and Management Considerations

Effective management practices are necessary to support safe operation and regulatory compliance.

Facilities should ensure that staff are properly trained to operate cold-water venues, including chemical handling, equipment use, and emergency response. A qualified operator should be available to oversee operations, and it is recommended that an attendant trained in CPR, first aid, and safely extricating a person from the vessel be present on-site during operating hours.

Standard operating procedures should be documented and consistently followed. These procedures should address preventive maintenance, water quality monitoring, bather load management, and response to contamination events.

Clear communication with bathers is essential. Signage should be prominently displayed in areas where bathers can make informed decisions before entering the water. These signs should describe the risks associated with cold-water immersion, including cold shock response and time limits for safe exposure. They should also identify populations that may be at increased risk, such as individuals with cardiovascular conditions, pregnant individuals, young children, older adults, and those who, upon the advice of their health care professional, should not use the cold-water venue.

Signage recommendations for cold water venues

- "Adverse health outcomes may result from intense and sudden changes in exposure temperature, which may include immediate impaired coordination, loss of control of breathing, muscle cramps, or a loss of consciousness."
- "Due to the risk of cold shock from total or partial immersion in cold water, any bather should consult a physician before using the cold-water venue."
- "Elderly persons, pregnant women, persons using prescription medications, and those suffering from heart disease, diabetes, or high blood pressure should consult a physician before using the cold-water venue."
- "Persons suffering from a communicable disease transmissible via water may not use the cold-water venue."
- "Individuals under the influence of alcohol or other impairing chemical substances should not use the cold-water venue."
- "Bathers should not use the cold-water venue alone."
- "Bathers should not spend more than 5 minutes in the cold-water venue in any one session."

Signage recommendations for cold water venues (cont.)

- "Children aged 14 years and younger are prohibited from bathing in a cold-water venue, unless under the direct supervision of a licensed medical professional."
- "Running or engaging in unsafe activities or horseplay in or around the cold-water venue is prohibited".

Facilities should establish policies to restrict or manage use by more sensitive populations. In some cases, medical clearance or supervision may be appropriate.

Single-Bather Cold-Water System Considerations

Single-bather cold-water systems present unique challenges that require additional scrutiny during design, construction, operation, and maintenance.

These systems are typically small-volume tubs or tanks designed for one user at a time. Many are originally manufactured for residential use and may not meet MAHC design and construction standards without modification. When installed in public settings, they must be evaluated to ensure they provide a level of safety and sanitation equivalent to other regulated aquatic venues.

The primary concern with single-bather systems is the limited water volume, which reduces dilution capacity and increases the impact of each bather on water quality. Many of these systems lack integrated recirculation, filtration, or automated chemical control systems. For systems without continuous recirculation, filtration, and automated chemical controllers, the most protective approach is to drain, clean, and refill the vessel between bathers. This process should include complete draining, thorough cleaning to remove biofilm, application of an appropriate disinfectant, and refilling with potable water. Inspectors should verify that this process is consistently followed on systems that are not recirculated and therefore not regulated.

For single-bather systems that allow multiple bathers to use the same water, these facilities must ensure that water quality is maintained through continuous treatment (recirculation, filtration, and automated chemical controllers) that meet the standards outlined in the MAHC. This often requires frequent water replacement. At a minimum, water should be replaced at a rate of 4 gallons per bather per day in systems, but in practice, more frequent replacement is often necessary due to the small volume of these systems. Often, these small, single-bather systems rely on manual filling and draining with clean water (not hard-plumbed to a refill or drain system). This presents an extra challenge for the facility when the water must be drained and replaced frequently. Replacement water should meet the requirements found in the MAHC for source water. Drained water from the cold-water vessel should be disposed of properly in accordance with AHJ requirements.

Inspectors should require plan review and approval for these systems, including detailed documentation of how water quality and temperature will be managed, surfaces cleaned, and safety risks controlled. Lighting, indoor aquatic facility ventilation, electrical systems and components, first aid area, emergency exits, drinking fountains, garbage receptacles, and indoor aquatic facility acoustics should meet the minimum requirements outlined in the MAHC and should be evaluated as part of the plan review process.

Single-Bather Cold-Water System Considerations (cont.)

Compared to multi-bather venues, single-bather systems concentrate risk in a smaller volume of water and rely more heavily on operational controls. As a result, inspectors should apply a performance-based approach, ensuring that the system provides safe and sanitary conditions even if it does not conform to traditional design models.

Conclusion

Cold-water venues represent an emerging category of aquatic facilities with unique benefits and risks. Several positions play a critical role in ensuring these venues are designed, operated, and managed to protect public health, including designers, engineers, builders, operators, and inspectors.

By applying the principles outlined in this guidance and aligning with the intent of the Model Aquatic Health Code, regulators can support innovation in cold-water therapy while maintaining consistent safety standards. Particular attention should be given to water quality management, risk communication, and the evaluation of non-traditional systems such as single-bather units.

A consistent, informed, and practical approach will help ensure that cold-water venues operate safely and effectively in public settings.

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