B.C. GUIDELINES FOR POOL DESIGN

INTERIM VERSION 3

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HEALTH PROTECTION BRANCH
MINISTRY OF HEALTH

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PREFACE

This document, *B.C. Guidelines for Pool Design*, is intended to help designers, operators and regulators interpret the B.C. Pool Regulation, B.C. Reg. 296/2010 (pursuant to the *Public Health Act*) with respect to pool design. The guidelines represent generally accepted standards of safe practice. Depending on the type of pool and the use to which it is put, higher design standards might be necessary. It is the responsibility of each pool owner to ensure optimum water quality and pool safety.

In this document, "should" indicates a generally accepted design standard, whereas "must" denotes a requirement of the Pool Regulation, B.C. Building Code, B.C. Plumbing Code, B.C. Electrical Code or other applicable regulation. Where there is a discrepancy between existing B.C. legislation and these guidelines, the legislation shall prevail. Note that these guidelines typically refer to the BC Building and Plumbing Codes except in instances where there are regional/municipal bylaws.

The guidelines may be reviewed and updated from time to time. Please visit the Ministry of Health's Recreational Water Quality website[1] for updates.

[1] http://www.health.gov.bc.ca/protect/ehp_recreational_water_quality.html

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1.1 CONSTRUCTION PERMIT APPLICATION PROCEDURE

Under Section 5 of the Pool Regulation, a person must not construct (install, repair, renovate, or alter) a pool unless the person holds a construction permit issued under the Regulation and complies with the terms and conditions, if any, of the permit.

An application for a construction permit must be completed, signed, and submitted to the local health officer. The person applying for the construction permit shall ensure that the pool information sheets are duly completed by the project design professionals.

Design professionals are design architects registered or licensed under the *Architects Act* and/or design engineers who are registered under the *Professional Governance Act* as professional engineers or professional engineering licensees. The pool information sheets will be considered as statements of fact to support the health officer's evaluation and decision to issue a construction permit under Pool Regulation section 5(3). Where the project involves more than one design professional, each design professional must initial the items pertaining to their respective design responsibilities.

As well as the application for a construction permit, all related plans and specifications for the construction as prepared, sealed and certified by an architect or engineer must be submitted to the health authority. The pool owner, or their authorized agent, must sign the declaration in the application for a construction permit, confirming that the pool will be constructed in accordance with the plans and specifications accompanying the application. The application for a construction permit, which includes pool information sheets, is available in Appendix C.

A preliminary version of the pool data sheet (Appendix B) should also be submitted with the Application for Construction Permit. It is recognized that at time of construction permit application, the pool data sheet would be based on preliminary estimates for flow rates, head, and other key operating parameters. If parameters change, the pool data sheet should be resubmitted with the updated actual operating information and recalculations if required.

Further information on the permitting process can be obtained from the local health authority. The applicant should directly contact the local health authority and its approving officer if there is any deviation from these guidelines in the plans for pool construction.

1.2 POOL REPAIRS AND ALTERATIONS

Pool repairs and alterations require a construction permit, unless a health officer waives the requirement for one under Pool Regulation section 5(6). The application procedure outlined in section 1.1 of this guideline document should be followed, including the completion of the pool information sheets. In these cases, only the health hazard related design parameters relevant to the pool repair or alteration need initialing on the pool information sheets from the design professional.

1.3 CONSTRUCTION PERMIT WAIVERS

The health authority must be notified of any proposed or planned construction and supplied with any information the health officer may require. Based on the information provided, the health officer can advise on whether a construction permit is required.

According to Section 5(6) of the Pool Regulation:

A health officer may waive the requirement for a construction permit

(a) on request of a person and after receiving any information the health officer may require, and

(b) if the proposed construction is a repair or alteration

(i) performed for emergency purposes, or

(ii) that is so minor that requiring a construction permit is not necessary to protect the public interest.

2 OPERATING PERMIT

A person must construct the pool in accordance with the plans and specifications submitted with the construction permit application, unless prior written approval is obtained from a health officer.

Once the pool is constructed, an annual operating permit will be required before pool operation can begin (with the exemption of certain spray pools[2]). As part of the information package supporting the application for an operating permit, a signed statement from an engineer or architect must be submitted. This signed statement must confirm that the pool has been constructed so as to substantially comply, in all material respects, with the plans and specifications submitted with the application for construction permit. A completed pool data sheet providing details of the pool as constructed must also be provided. The pool data sheet is available in Appendix B as part of the application for operating permit.

Where the project involves more than one design professional, each design professional may submit a signed statement and completed pool data sheet covering only their respective design responsibilities. These signed statements must be submitted together and cover all aspects of the pool construction.

As per section 6(2)(a)(ii) and section 13 of the BC Pool Regulation, a pool safety plan must also be prepared by an operator and submitted as part of the operating permit application process. The pool safety plan is a written plan that provides information and describes actions to protect the health and safety of pool users. It provides clear procedures for staff training, facility maintenance and upkeep, and incident response – reducing the chance of harmful events.

The pool safety plan should include information on the pool design. This information can be summarized in a pool data sheet for easy reference, in addition to operating manuals and record drawings. A pool safety plan template is provided in the *Guide and Pool Safety Plan for Pool Operators*, available on the Health Protection website.[3] For operation-related guidance, please refer to the *B.C. Guidelines for Pool Operations*.[4]

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[2] Spray pools that drain to a wastewater collection system and do not recirculate the pool water are exempt from the operating permit requirement.

[3] https://www2.gov.bc.ca/assets/gov/health/forms/guide_and_pool_safety_plan.pdf

[4] http://www.health.gov.bc.ca/protect/ehp_recreational_water_quality.html

PART TWO: POOL DESIGN

3 POOL SURROUND

3.1 POOL ENCLOSURE/FENCES

Fences or other controlled-access barriers around pools are required to restrict access, minimize contamination of water by foreign materials, and reduce the risk of drowning, especially for young children.

Fences are not required under the Pool Regulation for spray pools or wading pools that are drained when not in use. In the case of a spray pool that recirculates water, fencing should be in place to keep animals out of the spray pad area to help maintain pool water quality. Any building structure enclosed within the fenced area would be subject to the BC Building code (www.bccodes.ca). The Ashrae Handbook (chapter 6) also covers specific building provisions (heating/ventilation standards) for swimming pools and is available at www.ashrae.org.

FENCES

While fencing is required to minimize access to pools by unauthorized persons and animals, the main purpose of fencing is to prevent access to pools by unsupervised young children to minimize the risk of drowning. Even though some municipal building codes and bylaws may have different height requirements for pool fences, given the risk and liability, a minimum height of 1.5 m (5 ft) is strongly recommended for pool enclosures. The following design standards are intended to minimize unauthorized access to pools by young children and should be considered in the design and installation of a pool fence or barrier:

- The outside of the pool fence should be 1.5 m (5 ft) high all the way around the perimeter of the pool area.
- The design of the pool fence should be non-climbable with no indents or projections:
  - Fence details that could create a climbing hazard should be avoided.
  - Decorative fences and walls that provide toe and finger holds should also be avoided.
- The bottom of the pool fence should be less than 10 cm (4 in) above the ground all the way around the perimeter of the pool area so that a small child cannot get under it.
- Vertical or near vertical pickets should be less than 10 cm (4 in) apart so that a small child cannot slip between them.
- All horizontal or near-horizontal fence rails should be more than 115 cm (45 in) apart so that a small child cannot step from one rail to another.
- Decorative cut outs in fencing should be no more than 44 mm (1.75 inches) in width.
- Diagonal openings in chain-link and wood lattice types of fences should not have any openings that would allow the passage of a spherical object having a diameter exceeding 38 mm (1.5 inches).
- The top of the pool fence should be 1.5 m (5 ft) away from any objects that could help a small child climb over the fence (e.g., barbeques, trees, rocks, shrubs and deckchairs) (see Figures 1 and 2):
  - The length of the radius of the quadrant should be equal to the fence height or distance to the nearest climbable object.

- Avoid locating pool barriers so close to uphill slopes that a person could step or jump onto or over the pool barrier.

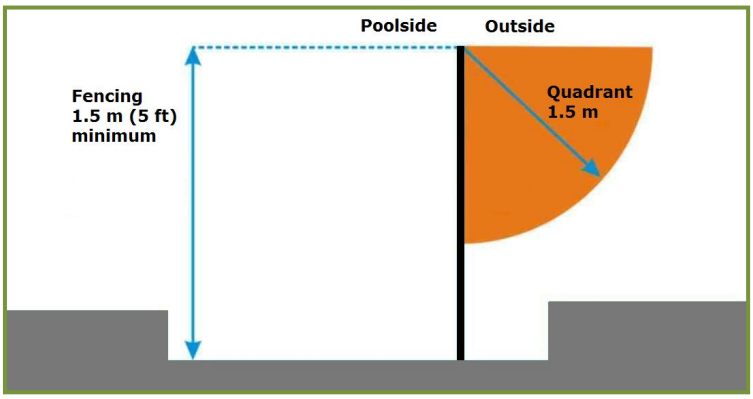

FIGURE 1: ACCEPTABLE DISTANCE FROM CLIMBABLE FEATURES

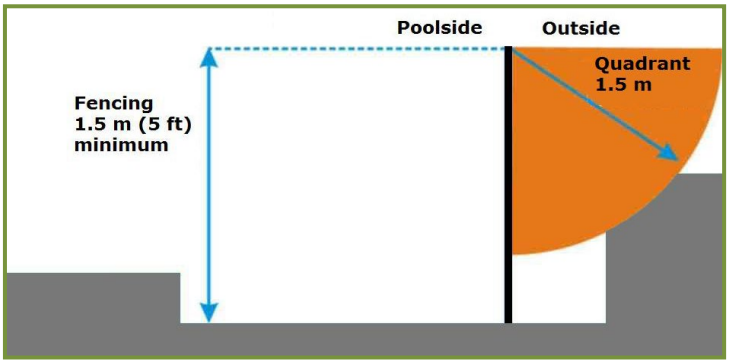

FIGURE 2: UNACCEPTABLE DISTANCE FROM CLIMBABLE FEATURES

- The enclosure and latches should be of a strength and rigidity to withstand a foreseeable impact from people.
- Direct access to the pool should be prevented from all buildings including rental units (hotel room, townhouses, etc.). Private courtyards should not be open to the pool deck: either the pool area is fenced, or each courtyard is equipped with a fence and gate (self-closing, self-latching).

SOLID BARRIERS

A solid barrier, such as brick, concrete or manufactured rock faces, may be considered in lieu of a fence. No indentations or protrusions should be present, other than normal construction tolerances and masonry joints. The Brick Industry Association's Guide Specifications for Brick Masonry has established a maximum vertical alignment tolerance of 0.64 cm (0.25 in) from plumb in 3.05 m (10 ft) for brick walls and other types of masonry construction such as manufactured rock walls.

HEDGES, BUSHES AND PLANTINGS

Hedges, or other plants, do not constitute a fence or solid barrier and are not acceptable in lieu of a fence.

GATES

Pool fence gates should:

- Be self-closing, self-latching; and as deemed necessary, lockable.
- Be supported on substantial hinges capable of supporting 90 kg (200 lb) of body weight.
- Have a latch operating mechanism that is:
  - At least 1.4 m (4.5 ft) above the ground.
  - Located on the inside of the pool enclosure.

Where entry gate latches are less than 1.4 m (4.5 ft) above the ground:

- Door and gate latches should be provided with a continually locked, key carded or other equivalent access control system.
- A solid material with a radius of at least 46 cm (18 in) should protect the latch in doors and gates that are constructed of materials that may allow children to reach through or over the top of the door or gate (see Figure 3).

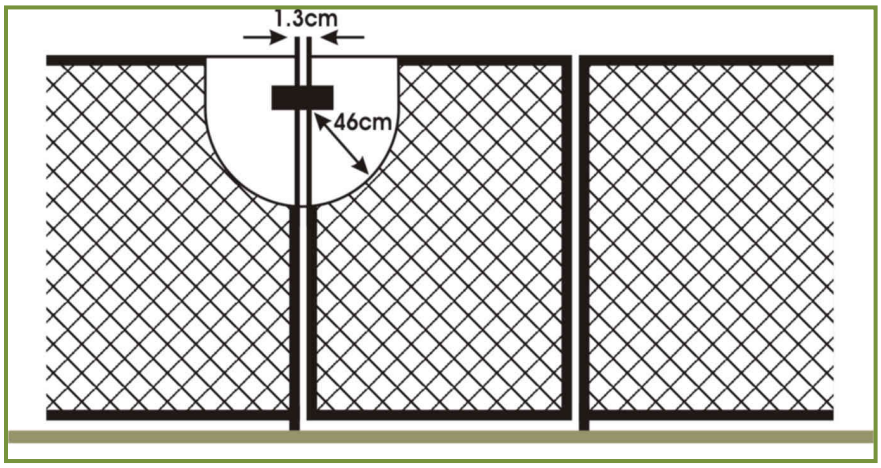

FIGURE 3: LATCH PROTECTION DETAIL FOR LATCHES LESS THAN 1.4 M ABOVE GROUND

INTERIOR POOL ENCLOSURES

Walls can serve as an access barrier for interior pools. Walls with windows that have a sill height of less than 1.2 m (4 ft) should not be used as part of the pool enclosure. Many drowning deaths of young children can be directly attributed to access from an open door onto a pool deck. Pools must be enclosed fully on all sides to minimize risks. Note, as well, that gates should be equipped with locking mechanisms or card swipe feature to prevent unauthorized entry (see also section 3.1 - Gates).

OTHER CONSIDERATIONS

- Fencing structures that provide a flexible opening should be evaluated to ensure the dimensions do not exceed standards when light forces, such as those a child could exert, are applied to the barrier (e.g., tempered glass that flexes on its supports). The opening cannot exceed 10 cm (4 in) when flexed.
- Additional fencing requirements may exist in local bylaws. Many local bylaws recommend a fence height of 1.5 m (5 ft) or greater for backyard (residential) pools. This height may be enforced by the local building department for commercial pools.
- A fence height of 1.5 m (5 ft) or greater should be used when a pool is located:
  - Near a (public) pedestrian walkway or thoroughfare.
  - Near a road or parking lot.
  - Adjacent to a bar, restaurant or patio, etc.

3.2 DECKS AND DECK DRAINS

Pools should have sufficient room surrounding them to allow patrons including those with disabilities to pass safely and allow staff and emergency workers access to all areas of the pool. There should be sufficient room for an ambulance gurney to pass easily.

POOL DECK

A continuous walkway should extend completely around the pool and should:

- Provide a minimum walkway width of 1.2 m (4 ft) beyond the edge of the pool and gutter. (see Appendix D for pandemic considerations).
- Maintain a minimum 1.2 m (4 ft) wide deck around obstructions; such as pool features (e.g., slides, columns and play features); and other possible obstructions (e.g., rolled up pool covers) to provide adequate emergency access.
- Provide drainage to mitigate deck water from entering the pool and deck level gutter (where provided) in a manner that will not create muddy, hazardous or objectionable conditions within the pool enclosure, and will facilitate washing and drainage without obstructions to the drains.
- Slope to drain with a minimum uniform slope of 2% (1 in 50) and a maximum slope of 4% (1 in 25), except for wheelchair (accessible) ramps.
- Have decorative features, where used, (such as those used to direct foot traffic) that are slip-resistant, and do not interfere with deck drainage or impede emergency access.

Linear drains generally result in fewer irregular deck slopes than point drains. Where practical, linear drains should be considered.

Internal pool walls are walls that divide a pool into two or more sections but are not intended to be walked on. Such walls may be less than 1.2 m (4 ft) wide. Signage should be placed indicating “no bather access,” as appropriate. Such dividing walls should be capped with a finish that discourages patrons from standing or walking on these surfaces (e.g., decorative rocks).

ABOVE GRADE RAISED POOL WALLS

Generally, the following objectives should be followed regarding above grade raised pool walls:

- Raised pool walls are normally not allowed for swimming pools but may be considered for hot tubs.
- If a raised wall is present, there must be an alternative accessible rescue route available. For example, if a pool has a raised wall, the pool edge (adjacent or opposite to the raised wall) must be flush to the deck to provide rescue access to the pool. Note that a raised pool wall is defined as any element within the pool water higher than the surrounding deck level and is narrower than 4 feet.
- A minimum deck width of 4' should be maintained for the adjacent pool deck.
- For hot tubs, raised walls should be less than 18" above the pool deck with a minimum 12" wide non-slip surface on the top.
- In all cases, adequate built-in steps or ladders are required.

INFINITY EDGES

Infinity edges should be designed according to the MAHC section 4.5.15 (which includes the provision of not more than 50% of the pool perimeter incorporating infinity edge detail unless an adjacent and patron-accessible deck space conforming to MAHC section 4.8.1 is provided).

DECK DRAINS

Deck drains should:

- Be at least 10 cm (4 in) across and covered with a grating with openings that do not cause toe entrapment (approximately 8 mm (0.3 in)).
- Be designed and installed to have no sharp edges that could cause injury.
- Retain a slip-resistant texture and cause no discomfort to bare feet.
- Be spaced no more than 7.6 m (25 ft) apart so that no more than 37.2 m^2 (400 ft^2) of walkway area is contributing to any one drain.
- Be connected to a drainage system that is designed in accordance with good engineering practice and the B.C. Building Code.

POOL COVERS

Pool covers, where used, should not impede emergency access to any point along the pool perimeter. This can be achieved using roll-away pool covers, recessed pool cover spools, or wall mounted pool cover spools. Pool covers may be installed on the pool deck provided that:

- A 1.2 m (4 ft) wide deck space is maintained around the perimeter of the pool so that adequate emergency access can be attained. Note that rolled up pool covers should not be within this 4 ft clearance around the pool basin.
- Deck drainage is not impeded.
- Cover hardware does not pose a slipping, tripping or stubbing hazard.

REDUCED WALKWAYS

Pools that are less than 10 m^2 (108 ft^2) in area may have a reduced walkway width of 60 cm (2 ft) for up to 75% of the pool perimeter. Such pools may include hot tubs and therapeutic pools. The access to the pool should be from a walkway 1.2 m (4 ft) or greater in width (see Appendix D for pandemic considerations).

ACCESSIBILITY

See section 3.9 for information on deck design for accessibility.

3.3 FLOORING

Flooring within the pool area – including floors in dressing rooms, shower stalls, toilet areas, decks, stairs, and other walking areas, as well as flooring cove joints – should:

- Be made of durable material that is impervious to moisture and designed to minimize bacterial growth.
- Allow for easy and thorough cleaning and disinfection.
- Retain a nonslip (slip-resistant) texture and cause no discomfort to bare feet.
- Be free of tripping hazards such as uneven surfaces or changes in elevation.
- Wherever practical and for pool areas exposed to direct sunlight, be of a surface material and colour that does not cause the deck surface to become too hot (e.g. to cause burns to bare feet).
- Be free from physical hazards that could cause injury to bare feet.
- Be designated by the manufacturer as suitable for walking surfaces in wet areas or for use in pool areas.
- Be covered at the wall juncture for ease of cleaning and disinfection.
- Allow free drainage over the deck surface (stamped concrete is not acceptable).

TILE SLIP RESISTANCE TREATMENTS

Use of chemical treatments to enhance the slip resistance of existing tiles should be discussed with a health officer prior to application. In some cases, these treatments can affect the tile's integrity and lead to maintenance difficulties.

TILE SIZE

Smaller tiles, less than 10 cm x 10 cm (4 in x 4 in) on pool decks and 5 cm x 5 cm (2 in x 2 in) in pool basins – help reduce slip hazard. Since smaller tiles have a greater density of grout lines than larger tiles, smaller tiles provide more slip resistance than larger tiles of the same material. Tiles greater than 15 cm x 15 cm (6 in x 6 in) – are not recommended due to potential slip hazards and difficulty in maintaining pool deck slope.

CONTRASTING COLOURS

The use of contrasting colours or textures should be limited to the delineation of edges such as those on stairs, ledges, and drop-offs. Also, the use of contrasts on floors and deck surfaces for reasons other than delineation may pose challenges to those with impaired cognition or limited vision.

HOSE BIBS

Hose bibs should be provided in a sufficient number to allow for cleaning throughout the pool area. They should be equipped with a CSA or equivalent hose bib vacuum breaker for cross-connection control.

DOORS AND WINDOWS

Doors and windows within the pool area should have frames, glazing and materials that:

- Minimize uncontrolled condensation.
- Withstand humid and corrosive environments.
- Minimize or do not contribute to bacterial growth.

3.4 LIFEGUARD STANDS

Lifeguard stands (including lifeguard chairs) are not required by regulation. Owners and operators are encouraged to include lifeguard stands where the facility size and light (whether natural or artificial) significantly impact the lifeguard's ability to see an unobstructed view of the pool bottom and all patrons within the area of surveillance. The need for lifeguard stands should be based on factors such as facility size, design, bather load, patron age and activity. Where deemed appropriate for use, an elevated platform or chair not less than 1.8 m above the water surface should be included.

Where the pool area is greater than 150 m^2 but not greater than 230 m^2, at least one lifeguard control station should be included; and where the pool area is greater than 230 m^2 at least two lifeguard control stations. The important outcome is that the pool is under complete and vigilant surveillance at all times. Whether that is best done from the pool deck, a lifeguard stand, or a combination of the two, is a matter of best judgment by an experienced lifeguard, supervisor and/or pool manager at the pool facility.

Where installed, the number, location and use of lifeguard stands should be included in the pool safety plan. Lifeguard stands may be secured to the pool deck, or moveable stands may be used. Lifeguard stands should be built specifically for lifeguarding use, such as those available from pool equipment suppliers, with considerations for visibility, chair stability and ease of entry/exit.

3.5 DIVING BOARDS AND PLATFORMS

DEPTHS AND CLEARANCES

Pools where diving is permitted should have adequate clearances and a water depth greater than 2 m (6.5 ft) for safe deck-level diving.

Clearances and water depths for pools with springboards, diving platforms, starter blocks, and pools used for sanctioned aquatic competitions or training for competitions involving shallow entry dives are outlined in Sections 2, 3, 5, and 6 of the Fédération Internationale de Natation (FINA) Facilities Rules.[5]

[5] https://www.fina.org/rules/facility-rules

See the *B.C. Guidelines for Pool Operation* for details on portable diving stands.

In a conspicuous location, where a pool has a maximum water depth of less than 2.5 meters, in letters not less than 140 mm high, the words CAUTION – AVIOD DEEP DIVES or the words SHALLOW WATER – NO DIVING should be included.

Ensure that where the springboards are provided with movable fulcrums, the mechanism is locked into the forward position. Warning signage restricting use - and moving the fulcrum should be posted adjacent to the diving board or platform.

Other references on these subjects include FINA CDC- MAHC Ontario Reg. 565, s. 10 and Quebec Public Baths. Lifeguards Zones.

SURFACES

Diving boards and steps leading to diving boards are to have slip-resistant surfaces.

There should be at least 1.2 m (4 ft) of clear deck space surrounding all diving equipment, including stairs and ladders (see Appendix D for pandemic considerations).

POOL BASIN MARKINGS

Wall fittings and any other necessary fittings should be installed so that a lifeline can be placed at the 2 m (6.5 ft) depth to designate the boundary between the swimming area and the diving area of the pool.

Alternatively, a 10 cm (4 in) wide marking strip of contrasting colour may be placed down the sides and across the floor of the pool at the 2 m (6.5 ft) depth to designate the boundary between the two areas. Note that pool wall fittings for lane ropes shall be recessed and not protrude into the basin.

3.6 DECORATIVE ROCKS

Decorative rock features should:

- If located adjacent to shallow pool water:
  - Be next to a “no diving” sign and set back from the pool edge so patrons cannot jump from the decorative rock features into the pool, or
  - Be placed at the pool edge if the feature is less than 30 cm (12 in) in height and occupies no more than 5% of the pool perimeter.
- If located at or adjacent to deep pool water:
  - Be considered a diving platform. Therefore, the adjacent pool area should conform to diving envelope design specified in this document.
- Have a nonslip surface without sharp or cutting edges in any areas that provide a potential foothold, stepping or standing access.
- Have an easily cleaned and maintained surface that does not encourage bacterial growth.
- Not allow water to pool.
- Slope to drain water away from the pool.

3.7 LANDSCAPING

Landscaping should be designed with drainage that drains away from the pool deck. For interior pools, planters should be watertight and fitted with a drainage system. There should be sufficient surrounding barrier width to prevent soil or water from the planters or landscaping to discharge onto the deck area. Barriers should be slightly raised or inclined to prevent floor-cleaning water from entering the planter.

Select plantings and planting locations so that the pool areas remain visible to lifeguard staff and no deep shadows are developed when plants have fully matured. Consider barriers such as pickets or hedges at the landscape edge of the pool deck to discourage bather traffic onto the landscaped areas.

SOIL

Soil can contain bacteria, such as *Pseudomonas aeruginosa*, which could contaminate the pool water if allowed to drain onto the pool deck.

3.8 SPECTATOR SEATING

Spectator seating should allow for at least 1.2 m (4 ft) between the edge of the pool and the seating.

Spectators should not have direct access to the pool area, and a physical barrier (wall, railing, etc.) should be in place. Spectator traffic should not go through the swimming area. Consideration should be given to accessibility for spectators. Refer to the B.C. Building Code for details on assembly seating (see Appendix D for pandemic considerations).

3.9 ACCESSIBILITY

According to the B.C. Building Code, access for persons with disabilities must be provided for all public facilities rated as Group A, Division 3, including pools. Public facilities should be designed such that a person with disabilities is able to access and circulate within the pool facility. Where pool facilities are to be designed for accessibility, the design shall be in accordance with the B.C. Building Code. Areas where design for accessibility is required include external access, changing and toilet facilities, and means of pool and spa entry and exit.

Signage ideograms are useful to communicate risk to those with limited English or literacy and can be used to advise the public of safe practices in, on, and around water. Emergency alarms need to have an audible and visual signal when alarms are activated.

Special considerations specific to pool accessibility that may not be covered in the B.C. Building Code should be designed following good design practices, such as the use of the ADA Accessibility Standards[6] (Section 1009 — Swimming Pools, Wading Pools, and Spas) or the U.S. Access Board's Accessibility Guidelines for Accessible Swimming Pools & Spas.[7] Where there is a conflict between the ADA Accessibility Guidelines and the B.C. Building Code, the Building Code requirements shall prevail.

[6] https://www.access-board.gov/ada/#ada-1009

[7] https://www.access-board.gov/files/ada/guides/pools.pdf

DECK DESIGN

Deck design for accessibility should include:

- Wheelchair access to pool and change facilities.
- Storage space for mobility aids near pool entrance (areas where walkers, canes and wheelchairs can be stored without creating a trip hazard).
- Seating areas along stretches of walkways for those who may easily tire when walking long distances.

LIFTS AND HOISTS

Where used, lifts and hoists for accessibility should:

- Be removable when not in use or designed in such a way that they do not project in the pool and pose a hazard to swimmers.
- Maintain a 1.2 m (4 ft) deck around the lift or hoist except along the pool edge.
- Provide sufficient clear deck space for a lift user to position a wheelchair next to the lift (e.g., an area extending relative to the back of the lift chair or sling, 30 cm behind, 1.2 m in front, and 0.9 m away from the pool deck).
- Be positioned according to the manufacturer's requirements.
- Be certified to UL 60335-2-1000 and installed in accordance with the manufacturer's installation instructions and to the current ICC/ANSI A117.1 standard (Model Aquatic Health code section 4.5.10.2).

4 POOL BASIN

4.1 POOL BASIN SURFACES AND FINISHES

POOL BASIN SURFACES

A pool basin should:

- Have a slip-resistant bottom surface where the water depth is less than 1.5 m (5 ft) including lane markers, patterns, and other design features.
- Have a smooth bottom surface where the water depth is greater than or equal to 1.5 m (5 ft).
- Have a surface made of durable material that:
  - Is impervious to moisture.
  - Allows for easy and thorough cleaning.
  - Causes no discomfort to bare hands and feet.
- Be free of tripping hazards such as uneven surfaces.
- Be free of physical hazards that could injure bare feet.
- For pools with skimmers, have smooth tiles along the water's surface to allow cleaning of scum line.

Junctions between pool walls and floors should be coved with a radius of curvature of no less than 2.5 cm (1 in) and no more than 15 cm (6 in).

Hot tub walls should have smooth vertical surfaces to promote ease of cleaning.

POOL BASIN FINISHES

Pool basin finishes can include tile, glass, and both plain and painted concrete. The pool basin finish should have the following properties:

- Nontoxic and nonhazardous.
- Does not pose a cutting, pinching or abrasive hazard.
- Easy to clean.
- Durable and watertight.
- No cracks or open joints.
- Able to withstand design stresses.

4.2 UNDERWATER PROJECTIONS

There should be no submerged projections in a pool other than properly marked stairs, steps, safety ledges, seats or benches.

Underwater ledges may be provided on vertical walls at the deep end of a pool. They should:

- Be a maximum of 15 cm (6 in) wide.
- Be at least 1.2 m (4 ft) below the water surface.
- Have ledge noses rounded and marked in a contrasting colour.

Seats and benches may be installed in a pool basin. Seats and benches should:

- Have a slip-resistant surface.
- Have edges marked in a contrasting colour.
- Be located outside of water slide landing areas and other high-use locations that could cause a safety hazard to bathers.

4.3 POOL BASIN FLOOR SLOPE

Pool floor slopes should be uniform and not greater than:

- 1 in 12 where the water depth is less than 1.5 m (5 ft).
- 1 in 2 where the water depth is greater than 1.5 m (5 ft).

Wading pools and spray pools floors should have a maximum slope of 1 in 15 and a minimum slope of 1 in 50. Wading pool floor slopes should be uniform. There should be no abrupt drop-offs in a pool.

FLOOR SLOPES
Maintaining safe floor slopes lets patrons move safely into deeper water.

4.4 POOL BASIN COLOUR AND PATTERNS

POOL BASIN COLOUR

Light reflectance value (LRV) is a measure of the amount of light reflected by a colour and may be used to determine the suitability of a pool basin colour. For ceramic tiles, the LRV is measured using the ASTM

C609 – 07: Standard Test Method for Measurement of Light Reflectance Value and Small Color Differences between Pieces of Ceramic Tile. Not all manufacturers have LRV data for their finishing materials. In these situations, the finishing material may be compared to the LRV of an equivalent paint colour.

Pool basin colour should:

- Be white or light in colour. If a mix of colours is used, no single colour should have a light reflectance value of less than 60:
    - An International Lifesaving Society study (2007) found that white pool walls and bottom provided greatly improved visibility over light blue colours.[8]
    - Light-green tiles can make detection of algae or water quality problems difficult.
- Not obscure steps, changes in depth, underwater patrons, objects or debris.
- Limit darker areas (LRV of less than 60) to lane lines, accents on patterns, stair noses, etc., as long as the darker areas will not unreasonably interfere with the visibility of patrons in the water.

POOL BASIN PATTERNS

Pool basin patterns and designs should not be of a size and shape that could be mistaken for a human body.

If there is question as to whether a final finish colour, or pattern of colours, is acceptable, a 150 mm (6 in) diameter black disk at the deepest point of the pool or spa should be clearly and immediately seen by an observer standing on the pool deck at a point closest to the disk.

If the pool basin incorporates a number of different colours, designs or patterns, then a drawing of the pool floor area with the proposed colours, designs or patterns should be submitted with the application for a construction permit.

4.5 DEPTH MARKINGS

Depth markings for pools should:

- Be non-slip.
- Be visible to swimmers in the pool.
- Clearly indicate the numerical depth of water in Arabic numerals with a minimum height of 10 cm (4 in) for each numeral.
- Be of a colour contrasting with the background.
- Be located:
    - For gutter pools, above the water surface on the pool wall and on the walkway at the pool edge.
    - For deck level pools, overhead or on another structure, as long as the markers are in full view from all locations in the pool and along the pool edge.
- Be located at:
    - Maximum and minimum depths.
    - 30 cm (1 ft) depth increments between the shallow depth and the point of break inclusive.

[8] http://www.ilsf.org/drowning-prevention/library/factors-affecting-lifeguard-recognition-submerged-victim-implications

- Intervals of no more than 7.6 m (25 ft) measured on the periphery of the pool.

Depth markings may be omitted for hot tubs with a surface area of under 10 m^2 (108 ft^2) where health hazards are managed through other signage, such as “no diving” signs.

UNITS FOR DEPTH MARKINGS

Section 11(2)(f) of the Pool Regulation requires that the numerical depth of water be clearly marked in a pool. While metric units should be used for new pools, the use of imperial units, or both imperial and metric units, is considered acceptable for existing pools. For pools with only one type of depth marking unit, signage may be provided by the operator showing equivalent values in other units.

4.6 STEPS, STAIRS AND LADDERS

A suitable means of entry and exit should be provided for all patrons. Access to a pool can be achieved using stairs, recessed and semi-recessed steps, ramps and/or ladders. Where stairs and ramps cannot be used for access, lifts may be acceptable.

GENERAL REQUIREMENTS

Stairs, steps (recessed and semi-recessed), and/or ladders should be:

- Provided at the shallow end of the pool if the vertical distance from the bottom of the pool to the deck or walkway exceeds 1.2 m (4 ft).
- Provided at the deep portion of the pool (steps and ladders only):
  - If the pool is over 10 m (32 ft) wide at the deep end, steps or ladders should be installed on each side of the pool.
- Installed so as not to interfere with competitive events.
- Secure and of slip-resistant design.
- Resistant to corrosion by pool water.

STEPS AND LADDERS

Steps (recessed and semi-recessed) and ladders should:

- Have at least four rungs/steps when placed in water depths greater than 1.5 m (5 ft).
- Be provided with suitable handrails on both sides to allow safe use.
- Have handrails not more than 61 cm (2 ft) apart.
- Have a uniform distance between ladder treads or steps of between 18 cm (7 in) and 30.5 cm (12 in).

STEPS

Steps leading into a pool may be semi-recessed or fully recessed into the pool basin. These steps should:

- Be at least 13 cm (5 in) wide and 30 cm (12 in) long.
- Where semi-recessed, protrude no more than 6.4 cm (2.5 in) from the pool wall.
- Have drainage towards the pool.

LADDERS

Ladders leading into a pool should have:

- Treads at least 7.6 cm (3 in) wide and 33 cm (13 in) long.
- A clearance distance from the pool wall of less than 9 cm (3.5 in) or greater than 23 cm (9 in).

STAIRS

Stairs leading into a pool should have:

- A minimum tread depth of 31 cm (12 in) and a maximum rise or height of 26 mm (10 in).
- The nose marked in a contrasting colour.
- A handrail within reach from all areas of the stair – i.e., no more than 75 cm (2.5 ft) away from a handrail.
- Risers, runs, and treads meeting the uniformity and tolerances of the BC Building Code.

Stairs leading into hot tubs with a surface area less than 10 m^2 (108 ft^2) – whether prefabricated and cast in place, should have a minimum tread of 23 cm (9 in) and a maximum rise or height of 32 cm (12.5 in). Risers, runs, and treads for hot tub stairs should meet the uniformity and tolerances of the BC Building Code.

4.7 HANDRAILS AND GUARDRAILS

This section should be read in conjunction with Section 4.6.

Handrails and guardrails should:

- In accessible pools, be designed according to best practices, such as those outlined in the ADA Accessibility Standards.[9]
- For diving boards, be designed with reference to the FINA Facilities Rules (current edition, Section FR5).[10]
- Have vertical rails on diving platform guardrails to prevent swimmers from falling and becoming entrapped.
- Serve all treads.
- Be made of corrosion-resistant materials to allow for gripping in a wet environment.
- Be inset in the walls or have a clearance distance of less than 9 cm (3.5 in) or greater than 23 cm (9 in) from walls to reduce the risk of entrapment.

Consideration should also be given to installing handrails or grab bars in strategic locations where falls are most likely to occur – e.g., on stairs and ramps.

Where a piece of equipment is designed to be used by those under the age of 12, additional considerations should be given to the following:

- The size of the handrails should be of reduced diameter to accommodate smaller hands.

[9] https://www.access-board.gov/ada/#ada-1009

[10] https://www.fina.org/rules/facility-rules

- Additional guardrails should be provided to prevent falling or becoming entrapped.
- Designers can reference CSA Standard CSA-Z614: Children's Playspaces and Equipment for guidance.

4.8 HANDHOLDS AND POOL COPING

Where perimeter gutter systems are not provided (refer to Section 8.2), unsupervised pools should be provided with coping or cantilevered decking, or other handholds, around the perimeter of the pool.

COPING OR CANTILEVERED DECKING

Pool coping or cantilevered decking should:

- Be constructed of reinforced concrete or material equivalent in strength and durability, with rounded, slip-resistant edges.
- Be installed no more than 23 cm (9 inches) above the minimum water level.
- Include an overhang between 2.5 – 5.0 cm from the vertical plane of the pool wall, with a thickness not exceeding 5.1 cm (2 inches).

OTHER HANDHOLDS

Handholds may be constructed as horizontal bars of recessed handholds. Considerations include:

- Handholds should be installed no more than 23 cm (9 inches) above, or 7.6 cm (3 inches) below, the minimum water level.
- Handholds should be separated by no more than 30.5 cm of pool wall.
- Recessed handholds should be at least 61.0 cm long, at least 10.2 cm high, and between 5.1 – 7.6 cm deep.

5 POOL FACILITIES

5.1 CHANGE ROOMS

GENERAL CHANGE ROOM CONSIDERATIONS

Change room facilities should be constructed in accordance with the B.C. Building Code and should include the following:

- Change rooms, toilets and showers should be located no more than 60 m (197 ft) walking distance on hard surfaces (i.e., avoiding grassed and dirt areas) from the pool.
- Showers should conform with Section 19.6 of the current ANSI/APSP/ICC-1 standard: "a minimum of 2 shower heads shall be provided for the first 100 users of each sex. One additional shower head for each sex shall be added for each additional 50 male or female users or fraction thereof."

- Change rooms, toilets and showers should be arranged so that bathers pass from the toilet or dressing room area through the shower area and then directly to the pool area.
    - It is recommended that traffic diversion (such as a railing) be added to prevent patrons from running directly from the change room and into the pool.
- Lockers and cubby holes and privacy screens, if supplied, should be raised at least 10 cm (4 in) off the floor, and readily cleanable.
- Floors in change rooms, shower rooms and toilet areas should:
    - Be made of durable material that is impervious to moisture.
    - Retain a texture that is slip-resistant to bare feet.
    - Cause no discomfort to bare feet.
    - Have a minimum uniform slope to drain of 1 in 50.
- Walls and partitions should be of smooth, durable, impervious material, free from cracks or open joints.
- Junctions between walls and floors should be coved to facilitate easy cleaning.
- Hose bibs should be easily accessible for cleaning.
- Change rooms should include appropriate waste receptacles (see Appendix D for pandemic considerations).

UNIVERSAL CHANGE ROOMS (FAMILY CHANGE ROOM, CHANGING VILLAGES)

The B.C. Building Code provides details on universal/accessible washroom design and prescribes water closet requirements for assembly occupancies. Refer to “General Change Room Considerations” above for recommendations on showers and change room design.

5.2 PLUMBING FIXTURES

Plumbing fixtures requirements for pool facilities are outlined in the B.C. Building Code.

ACCESSIBLE AMENITIES

Accessible amenities (including universal washrooms, water closets, urinals, lavatories, and showers, including fixtures such as hand-held shower heads) are to be designed in accordance with the requirements set out in the B.C. Building Code.

DRINKING WATER

There should be at least one drinking water fountain/water dispensing unit in the pool area for each 250 bathers, or portion thereof. For outdoor pools, drinking water fountains/water dispensing units may also be located indoors in the access hallways to the pool.

5.3 TEMPERATURE OF SHOWER WATER

Both the Pool Regulation and the B.C. Building Code require that hot water provided in pool facilities not exceed 49°C (120°F). Hot water provided in pool facilities should also:

- Be provided in the recommended range of 32°C (90°F) and 43°C (109°C).

- Minimize the risk of scalding through the use of thermostatic tempering or mixing valves.
- Where manual valves are used, be suitably marked to differentiate between the hot and cold water supply.

6 UTILITIES

6.1 NATURAL AND ARTIFICIAL LIGHTING

Under Section 11(2)(a) of the Pool Regulation, lighting must be sufficient to illuminate all portions of the pool to ensure all areas are visible to patrons, lifeguards and operators. In addition to the Pool Regulation, there are lighting requirements in the Occupational Health and Safety Regulation (Sections 4.64 to 4.69) and, where applicable, the B.C. Building Code (Section 3.2.7: Lighting and Emergency Power Systems). See section 9.34.2.7 for public spaces, and section 9.34.3. for emergency lighting.

Underwater lights may be used to help achieve sufficient illumination and must follow the B.C. Electrical Code. Lighting, whether natural or artificial, should:

- Be designed to minimize glare and reflectance from the pool.
- Be arranged to provide up lighting, which is preferred over direct lighting as it provides even light distribution across the pool area and minimizes glare.
- Meet section 4.6.1. of the Model Aquatic Health Code, which covers general lighting requirements, overhead lighting, underwater lighting, and emergency lighting level requirements.

For venues used for competitive events, it is recommended that the illumination levels listed in the current ANSI/IES RP-6 (*Recommended Practice: Lighting Sports and Recreational Areas*) are followed.

EMERGENCY LIGHTING

The B.C. Building Code provides details on the requirements for emergency lighting. Emergency lighting should also be provided for outdoor pools used at night.

Design illumination levels should be indicated at the time of application for a construction permit. Once the construction is complete, the illumination levels should be confirmed and signed-off by the project electrical engineer.

6.2 ELECTRICAL REQUIREMENTS

All electrical devices, including ground fault circuit interrupters (GFCIs), must be installed in pools in accordance with the B.C. Electrical Code to reduce the risk of injury due to electrocution. Existing pools that are unable to comply with the B.C. Electrical Code should discontinue use of the equipment.

6.3 AIR QUALITY, HUMIDITY, HVAC SYSTEMS, AND BUILDING MECHANICAL REQUIREMENTS

Pool HVAC systems must be designed in accordance with the B.C. Building Code. The designer should also refer to other relevant codes and standards (such as ASHRAE standards) as part of good engineering

practice. ASHRAE Standard 62.1: Ventilation for Acceptable Indoor Air Quality has specific provisions on indoor pool air quality. As well, see Appendix D for additional requirements to consider around pandemic.

Pool HVAC systems should:

- Provide an air exchange rate adequate to protect public health and prevent the accumulation of condensation, odours, or hazardous or toxic substances. (The *ASHRAE 2011 Handbook of HVAC Applications* recommends 4-8 air changes per hour).
- Maintain a relative humidity level between 50% and 60% in the pool area during all seasons. This range balances bather comfort, ventilation, and prevention of mold growth and condensation on the building envelope.

CHLORAMINES

HVAC systems should be designed in conjunction with water treatment systems (including disinfection) to minimize indoor air quality issues associated with disinfection byproducts such as chloramines (the smell normally associated with pools) at the pool level. Chloramines are formed when free chlorine reacts with nitrogen in the pool (e.g., ammonia from sweat, urine or perfume). Due to their density, chloramines tend to accumulate at the pool surface.

Currently there are no WorkSafeBC occupational exposure limits for chloramines; however, WorkSafeBC's *Chloramines: Safe Work Practices*[11] recommends that the airborne concentration of chloramines in indoor water recreation facilities be kept below 0.35 mg/m^3. Provision of deck-level ventilation can help manage chloramine levels near the pool surface. Designers and operators should be aware that adjustments to ventilation rates, often to save on heating and energy costs, may create air quality issues at the pool level.

Note that additional building requirements related to ventilation are captured in the ASHRAE handbook (chapter 6) for indoor swimming pools. Access to the Handbook can be obtained at https://www.ashrae.org/about/news/2019/ashrae-releases-new-hvac-applications-handbook

PART THREE: CIRCULATION SYSTEM

7 GENERAL

7.1 WATER QUALITY

Source water and water quality in pools must be acceptable to the health authority and meet the requirements outlined in the Pool Regulation. The health authority may require that potable water as defined in the *Drinking Water Protection Act* be used in wading or spray pools, and to fill a pool.

[11] https://www.worksafebc.com/en/resources/health-safety/books-guides/chloramines-safe-work-practices?lang=en

7.2 WATER CIRCULATION

DESIGN FLOW RATE

All pools, except flow-through pools, should be designed to circulate water continuously. The design flow rate for pools should be as follows:

- Public pools should have a maximum turnover period of six hours (rate of four or more per 24 hours).
- Commercial pools should have a maximum turnover period of 12 hours (rate of two or more per 24 hours).
- A pool should have a maximum turnover period of two hours (rate of 12 or more per 24 hours) if it:
  - Is designed exclusively for play or leisure (i.e., wave pool, waterfall or lazy river).
  - Is equipped to generate moving water features such as waves, rapid currents, sprays or water jets.
  - Has a maximum water depth of 122 cm (48 in) or less.
- For spray pools, a 30-minute turnover is recommended.
- Hot tubs or other therapeutic pools should have a maximum turnover period of 30 minutes (rate of 48 or more per 24 hours).

Where a pool serves a combination of uses (e.g., a water slide catch pool, leisure pool and training pool), the maximum turnover period should be adjusted accordingly to account for changes in the expected bathing and associated pollution loadings.

FLOW-THROUGH POOLS

Flow-through pools (including hot springs and natural spas covered under the regulation) should have water added continuously at a design flow rate that would achieve the same turnover period as a recirculating pool (see the “Design Flow Rate” section above). The quality of water added must be approved by the health authority and maintained to meet requirements of the regulations.

MULTIPLE POOLS

All pools should be on separate and independent circulation systems. This prevents cross-contamination between pools, reduces the likelihood of rapid water-level fluctuations when bather loads in adjacent pools suddenly change, and allows individual pools to be isolated, closed and maintained without affecting the operation of other pools in the complex. Independent recirculation systems are also beneficial for the control and maintenance of pool water quality and chemistry.

Where the piping configuration enables water from one pool to be used to fill another, the piping should:

- Enable pool water to fill a hot tub, but not vice versa.
- Not interfere with the ability of the independent recirculation systems to function continuously.

WATER VELOCITY

The maximum velocity of water through any individual drain or suction fitting must be 46 cm/sec (1.5 ft/sec) or less at the design flow rate, in accordance with Section 10(2)(k) of the Pool Regulation.

7.3 CIRCULATION EQUIPMENT

PIPING

All piping should be designed to minimize friction losses and to carry the required quantity of water at a velocity not to exceed:

- 3 m/sec (10 ft/sec) in supply pipes.
- 1.82 m/sec (6 ft/sec) in suction pipes.

Piping must conform to the requirements of the B.C. Plumbing Code and should be of nontoxic material, resistant to corrosion by pool water, able to withstand operating pressures and installed according to the manufacturer's recommendations. Piping should be securely mounted and routed away from high-traffic areas to minimize the risk of breakage.

Piping related to pool operation should be properly identified through a standard system of colour coding, flow directional arrows and function labeling. Pipes may also have labeling requirements as part of a WHMIS program. Refer to the Occupational Health and Safety Regulation for details.

Colour coding should be applied to exposed piping within the pool enclosure, inside the structure of the pool and inside appurtenant structures to the pool. Coding should be based on coloured bands at least 25 mm wide spaced along the piping at intervals not greater than 1.20 m, or painting the entire outer surface of the piping in accordance with the following code: chlorine — yellow, potable water — green.

PUMPS

Pumps should be either self-priming or located below the level of the pool. The pump should be protected from damage and securely mounted on a housekeeping pad. It is recommended that an emergency shut-off button for pool pumps be included in every pool.

Accordingly, every owner of a public pool and spa should ensure that all pumps used in the operation of the spa or pool are capable of being deactivated by an emergency stop button (MAHC section 4.12.1.11.1). Owners/operators should also ensure that the following notice, in letters at least 25 mm high with a minimum 5 mm stroke, is posted above the emergency stop button: IN THE EVENT OF AN EMERGENCY PUSH EMERGENCY STOP BUTTON AND USE EMERGENCY PHONE. AUDIBLE AND VISUAL SIGNAL WILL ACTIVATE.

The emergency stop button should be tested and recorded in a log once within each period of 30 operating days. The written record of each inspection under this section should be retained by the owner or operator for at least one year from the date the record is made.

7.4 CROSS-CONNECTION CONTROL

Cross-connection control ensures that potential contamination in a pool does not impact the potable water supply or water quality in another pool. Cross-connection control measures in a pool should include:

- Approved backflow preventers on connections to a potable water supply, including:
    - Pool fill lines, including automatic pool fillers.

    - Hose bibs.
- The ability to isolate a pool's circulation system from another pool's circulation system.
- The pool filter backwash pipe should discharge to waste through an air gap that is at least twice the inside diameter of the backwash pipe.

Notwithstanding any of the above, the pool must comply with any other requirements of the *Drinking Water Protection Act* and the B.C. Building Code.

EQUIPMENT ROOM WATER SUPPLY

The water supply into the equipment room should be equipped with a Reduced Pressure Backflow Prevention Assembly (RPBA). The Canadian AWWA Cross Connection Control Manual[12] assigns pools a moderate hazard rating. The Manual notes that where a higher hazard exists (due to toxicity or health hazard), additional area protection with an RPBA is required. The potential for a health hazard exists should there be a fecal accident in the pool basin. Such a situation would increase the hazard rating for this application; therefore, an RPBA is strongly advised.

7.5 WINTER HAZARDS

Pools operating in conditions where there is a possibility of water freezing on the deck or edge of the pool should provide an effective method of heating the deck, access walkways and stairs to prevent ice formation and maintain an ice-free condition. Heated deck paths are to be clearly delineated with respect to unheated decks (MAHC section 4.8.1.8.2).

Consideration should be given to preventing ice formation on pool features to which pool users have access, such as water slides.

Pools that are shut down in the winter may require special design consideration and maintenance procedures to prevent damage to the pool during the winter.

7.6 RAINWATER FOR MAKEUP WATER

Water quality and treatment objectives for rainwater used as makeup water in a pool recirculation system should conform to the Ministry of Health's *Guidance for Treatment of Rainwater Harvested for Potable Use in British Columbia*. Furthermore, designers should refer to the CSA B805-18/ICC 805-2018 standard (*Rainwater Harvesting Systems*) for additional design criteria, in particular for rainwater collection surfaces (section 7.1).

[12] https://www.wcsawwa.net/index.php/cross-connection-control/resources-contacts

8 POOL BASIN EQUIPMENT

8.1 POOL INLETS

Pool inlets should be:

- Submerged at least 61 cm (2 ft) below the average operating level.
- Placed as near to the pool floor as possible if the pool water depth is less than 61 cm (2 ft).
- Floor-level type if the pool is a beach entry or zero-depth pool.
- Located to produce, in so far as possible, a uniform circulation of water and maintain a uniform disinfectant concentration throughout the entire pool.
- Spaced at least 1.5 m (5 ft) away from any skimmer, where possible.

INLET FITTINGS

Inlet fittings should:

- Be of a type whereby the rate of flow and directional angle can be adjusted to improve circulation.
- Be placed in the pool wall and spaced no more than 9 m (30 ft) apart measured from the perimeter of the pool or one fitting for each 45,460 L (12,000 U.S. gallons) of pool volume, whichever is more.

FLOOR INLETS

Where pool sidewalls are more than 13.4 m (44 ft) apart, floor inlets should be used. If floor inlets are used, the inlets should be:

- At least equal in quantity to the number of wall inlets calculated.
- Arranged to carry surface water to the gutters or skimmers.

8.2 GUTTERS AND SKIMMERS

Pool gutters and skimmers should be designed to collect 100% of the pool design flow rate. Section 10(2)(j) of the Pool Regulation requires that at least 50% of the design flow rate passes through the gutters or skimmers while the pool is in use to increase the cleansing action on the water surface and reduce suction at the main drain(s).

At least two flow meters should be installed:

- in the main drain line and gutter/skimmer line; or
- in the main drain line or gutter/skimmer line and the main recirculation line after the recirculation pump(s).

The two flow meters can be used to determine the proportion of recirculation flow through the gutters/skimmers and to confirm whether pool water is being recirculated at the design flow rate.

GUTTERS

Gutters commonly used in pools include raised-edge (conventional), deck-level and roll-out gutters. Generally, gutters should extend along the entire perimeter of pools having a surface area of more than 170 m^2 (1,830 ft^2).

Gutters should be designed:

- To rapidly remove surface water at a rate equal to or greater than the pool design flow rate.
- To prevent the gutters from becoming flooded.
- With an interior of not less than 7.6 cm (3 in) wide and 7.6 cm (3 in) deep.
- To prevent entrance or entrapment of bathers' arms or legs.
- To provide easy access for cleaning.
- Such that water in the gutter is removed at a rate as to not allow the gutter to flood (see MAHC section 4.7.1.4.2 and annex 4.7.1.4.2).
- With a fingerhold (bull nose at the pool edge) or handhold so patrons can grab the pool edge.

Raised edge gutters should be designed:

- So that the opening into the gutter beneath the coping or deck is not less than 10 cm (4 in) and the interior of the gutter is not less than 7.6 cm (3 in) wide and 7.6 cm (3 in) deep.
- To serve as a handhold so that their edges or lips are rounded and not thicker than 6.4 cm (2½ in) for the top 5 cm (2 in).
- To extend along the entire perimeter of the pool except at steps and recessed ladders.

SKIMMERS

Skimmers may be used in place of gutters to remove surface water from a pool if the pool has a surface area of 170 m^2 (1,830 ft^2) or less.

The number of skimmers a pool should have is the greater of:

- The number calculated at the rate of one skimmer for each 42 m^2 (452 ft^2) of pool surface area or portion thereof.
- The equivalent number calculated based on 4.5 to 7.5 litres/min of design flow per cm of weir (3 to 5 U.S. gallons per minute design flow per inch).
- One skimmer if the design flow rate is less than 114 litres/min (30 U.S. gallons per minute).

Each skimmer should:

- Have a means to regulate the flow of water through it.
- Have a weir.
- Have a lid vented to the pool deck.
- Be positioned to remove surface water from the pool.
- Have valves separate from the rest of the circulation system in the mechanical room.
- Have equalizer lines that connect to the main drain piping, rather than terminating in the pool basin (suction hazard).

BEACH-LIKE EDGE POOLS

For beach-like edge pools with a continuous gutter along the entire length of the beach-like edge and flush with the pool floor, skimmers can be used instead of gutters between the continuous floor gutter

and the point where the water reaches a depth of 91 cm (3 ft). Enough skimmers should be provided to achieve a theoretical turnover period of less than one hour in the area to which the skimmers relate.

8.3 MAIN DRAIN AND SUCTION ENTRAPMENT HAZARDS

The main drain induces water circulation in the deeper part of a pool, draws water into the circulation system for filtration, and is used to empty a pool. A poorly or inadequately designed, installed or maintained main drain and/or drain cover are potential suction hazards. Note that drain covers are to be certified to ANSI/APSP-16-2011 or successor standards (e.g. ANSI/APSP-16-2017, which in place of "drain covers" uses the term "suction outlet fitting assemblies" or SOFAs).

Suction hazards in pools have led to cases of fatal limb entrapment, hair entanglement, and/or evisceration. Poorly designed or malfunctioning main drain outlets can cause suction strong enough to entrap body parts or hair, causing a bather's head to be held under water, potentially causing serious injury and/or death. Drowning deaths have also occurred after the body or a limb has been held against a drain by suction of the circulation pump. Any open drain or flat grating that the body can cover completely, combined with a plumbing layout that allows a build-up of suction if the drain (or multiple drains) is blocked, can result in this kind of hazard.

Strategies to prevent accidents from suction entrapment should address five areas:

- Pool design (see *Guideline for Mitigating Suction Hazards in Pools*)[13].
- Pool maintenance (see *B.C. Guidelines for Pool Operation*).
- Training of pool personnel (see *B.C. Guidelines for Pool Operation*).
- Emergency procedures (see *Guide and Pool Safety Plan for Pool Operators)*.
- Facility signage for public awareness (see *Guide and Pool Safety Plan for Pool Operators).*

This section of the guidelines addresses pool design aspects for minimizing suction entrapment risks, including pool main drain, main drain cover, piping, and equalization fittings. For spray pools and other zero-depth aquatic areas, refer to the spray pool guidelines in section 11.4. Operational aspects are covered in the *B.C. Guidelines for Pool Operation*.

POOL MAIN DRAIN

The pool main drain should:

- Be at the deepest point in the pool to permit the pool to be completely and easily emptied.
- Have a sump depth of at least 1½ pipe diameters (complying with ANSI/APSP-16-2011 section 2.3.1 and 2.3.4 or Figure 2) to create equal suction velocity across the drain for frame-type and grate-type main drains with site fabricated sumps unless the covers are certified differently.
    - For SOFAs certified to ANSI/APSP-16-2017, covers/grates must be installed only in sump configurations authorized by the manufacturer's installation instructions and sump specifications, or for Registered Design Professional (RDP) SOFAs, in accordance with the certified plans of the registered design professional. The sump configuration includes the flow path zone, minimum suction pipe(s) opening depth below or behind the finish

[13] https://www.northernhealth.ca/sites/northern_health/files/services/environmental-health/documents/guidelines-on-mitigating-suction-hazards-in-swimming-pools.pdf

surface of the pool, pipe size, pipe orientation, and minimum suction pipe opening length before any reduction in pipe size (refer to standard Figures 5 and 6).

- Have each opening covered by a grating that is not readily removable by bathers and precludes the possibility of a body forming a seal against the cover. Fasteners should meet with general requirements of ANSI/APSP-16 2011 or successor standards.

For new pools: To minimize suction and entrapment hazards, it is strongly recommended as an engineering best practice that a minimum of two drains be installed in the pool. The drains should be spaced at least 92 cm (36 in) apart so that a body could not cover both simultaneously to create a vacuum. The installation of a second drain splits the suction induced by the pump between two outlets, reducing the suction at a blocked drain. The ANSI/APSP-16-2017 standard requires SOFAs to be categorized into “blockable” or “unblockable” designations and stipulates additional requirements for installation depending on the designation; consult the standard for details if ANSI/APSP-16-2017-certified products are specified.

For old or retrofit pools (not new pools): If it is not possible to install two drains, all outlet and discharge pipes should be adequately guarded to prevent an adverse suction hazard. Design considerations to minimize suction hazards where two drains are not feasible include:

- Installing a side/vertical mounted suction fitting, as long as the main drain line and suction fitting are interconnected and the velocity through the suction fitting is less than 46 cm/sec (1.5 ft/sec) at the design flow rate.
- Installing onto the main drain line an air line (anti-suction system), supplemental vacuum relief system, or automatic pump shutoff that will relieve the suction if the intake gets blocked.
- Converting the drain plumbing into a gravity drainage system.

These devices will only minimize suction risks, not the risk of hair entanglement. Hair entanglement risks are mitigated through proper drain cover design.

POOL MAIN DRAIN COVERS

New or replacement drain covers should have the following properties:

- A flat or low-profile design for pool areas less than 1.5 m (5 ft) in depth, to minimize tripping hazards.
- A grating opening that will not entrap toes, fingers, hair or limbs.
- No sharp corners.

POOL MAIN DRAIN PIPING

The pool main drain piping should:

- Be separately valved from the gutters or skimmers and discharge into the circulation pump suction, surge tank or an approved drain.
- Have a capacity equal to 100% of the design flow rate.

HYDROSTATIC RELIEF VALVE REQUIREMENT

Pools that are not designed to resist hydraulic uplift should be provided with a hydrostatic relief valve.

DRAIN CONNECTION TO CIRCULATION SYSTEM

All pools with overflow gutter systems should have all overflow gutters connected to the circulation system through a properly designed surge tank.

EQUALIZATION FITTINGS

Skimmer equalization fittings may also pose as suction hazards. Measures to minimize suction hazards from these fittings include the following:

- Excluding equalization fittings from the pool basin (below the water line) in new pool designs.
- In new construction, routing all skimmer equalizer lines through the main drain.
- Existing skimmer equalizer lines that end below the water line should be rendered inoperable to prevent an entrapment hazard. (Contact the health authority to discuss options.)

REFERENCES

Guidelines for Entrapment Hazards: Making Pools and Spas Safer, U.S. Consumer Product Safety Commission, March 2005. Washington, D.C. 2007

8.4 VACUUM CLEANING SYSTEMS

Where a pool vacuum-cleaning system is installed, it should be capable of cleaning the entire pool floor. Vacuum cleaning systems should be designed to not create a suction or entrapment hazard when not in use. In order to minimize suction and entrapment hazards, the use of portable systems or robotic cleaners is preferred.

If the vacuum cleaning system is an integral part of the circulation system, connections should be located in the walls of the pool at least 20 cm (8 in) below the water level. To minimize the risk of an entrapment or suction hazard to pool patrons, a cap or cover is required for the suction fitting to the vacuum cleaning system. The cap should be manufactured in compliance with IAPMO SPS 4 (current edition) or equivalent.

If the vacuum cleaning system is an on-deck pump, the outlet should go to the circulation system or to waste. If fecal matter is being vacuumed, however, the outlet should only go to waste.

Electrical outlets for vacuum cleaning systems shall be installed in accordance with the B.C. Electrical Code.

8.5 OTHER ENTRAPMENT HAZARDS

Entrapment is any condition that impedes withdrawal of a body or body part that has penetrated an opening. While suction may be a major cause of entrapment, there are other situations where a person may become trapped resulting in risk of injury, strangulation or drowning. This may happen where younger children may not have the necessary cognitive ability or motor skills to safely extricate themselves, especially if frightened or panicked.

Examples of features that may pose a risk of entrapment and require special attention:

- Moveable bulkheads

- Movable floors
- Play equipment
- Water features
- Portable stairs
- Lifts
- Skimmers in lazy rivers that may trap hands
- Exits of slides/water slides

Much of this risk can be eliminated through careful design to minimize entrapment hazards. The equipment should be used only for the purpose for which it is designed.

8.6 SURGE CAPACITY

Surge capacity in a pool is achieved through free board in pools with skimmers. In pools using gutters, the gutter, transit piping and the surge tank all contribute to the volume of surge capacity in the pool. Surge capacity increases the pool's ability to maintain a steady water level in response to sudden changes in pool use. This ensures that gutters, skimmers, and water intakes remain below the surface of the water to prevent loss of effective filtration or other circulation problems.

The surge capacity of pools should be designed for the maximum bathing load. For all pools equipped with gutters, 84 L (3 ft^3) of surge capacity per bather should be provided.

SURGE TANKS

A surge tank should be installed in pools using gutters. The surge tank should have:

- A working capacity of at least 57 L (2 ft^3) per bather, based on the maximum bathing load.
- A working capacity exclusive of pipe or channel capacity required for recirculation rates. The balance of the surge capacity may be provided by pool gutters and piping capacity.
- "T" fittings vented to the atmosphere on suction pipes to reduce the risk of a suction hazard to workers conducting surge tank maintenance.
- Hatches with a locking mechanism to prevent bather entry, if located in bathing areas.
- Hatches that are slip-resistant and not a tripping hazard, if located on the pool deck.
- Designed to reduce the risk of accidental entry.

For more information on confined spaces in surge tanks, contact WorkSafeBC.

8.7 MAXIMUM BATHING LOAD

Post signage indicating the maximum bather load of each basin.

POOLS

The following formulas can be used to calculate maximum bathing load. Pool depths of less than 60 cm (2 ft) need not be considered in the calculations. See Appendix D for pandemic considerations.

Imperial: Maximum Bathing Load = (D/27) + (S/10)

Where D = area of pool in ft^2 where the water depth is greater than or equal to 5 ft, and

Where S = area of pool in ft^2 where the water depth is less than 5 ft.

Metric: Maximum Bathing Load = (D/2.5) + (S/0.93)
Where D = area of pool in m^2 where the water depth is greater than or equal to 1.5 m, and
Where S = area of pool in m^2 where the water depth is less than 1.5 m.

HOT TUBS

Bather load for hot tubs may be determined based on increments of 60 cm (2 ft) of bench seating per person. See appendix D for covid-19 considerations.

SPRAY POOLS

The bather load for spray pools should be 1 person per m^2 of spray pad surface. See Appendix D for pandemic considerations.

9 POOL WATER TREATMENT

9.1 FILTRATION

CERTIFICATION
All pool and filter room equipment, and components, should be NSF- or CSA-certified.

Filtration is an essential part of the circulation system as it removes dirt, oils and debris from the water, which helps maintain safe and desirable water quality. Effective filtration will also reduce chlorine demand, helping to maintain low levels of combined chlorine in the pool water. Where alternate filter systems not listed below are being considered, filtration rates and effectiveness should be equal to or better than industry standard technologies, and should be capable of maintaining water quality as required in the Pool Regulation and the Guidelines for Pool Operations.

FILTER PIPING

The filter piping arrangement should be as simple as possible to accomplish filtration and backwashing or cleaning.

The pool filter backwash pipe should discharge to waste through an air gap that is at least twice the inside diameter of the backwash pipe.

FILTER UNITS

The filter units should be:

- Capable of operating at continuous design flow rate.
- Equipped with pressure, vacuum or compound gauges as required to indicate the condition of the filter.

In vacuum-type filter installations where the circulating pump is 2 horsepower or more, an adequate automatic high vacuum shut off should be provided to prevent damage to the pump by cavitation.

SAND FILTERS

Sand filters should be designed for a maximum flow rate of approximately 600 L/min/m^2 (15 US gpm/ft^2) of filter area.

DIATOMACEOUS EARTH FILTERS

Diatomaceous earth (DE) filters should be designed for a maximum flow rate of 60 L/min/m^2 (1.5 US gpm/ft^2) of filter area. For regenerative-type DE filters, the flow rate should follow the manufacturer's recommendations. DE filters should be certified to NSF/ANSI 50 standards.

On nonregenerative-type DE filters, backwashing releases the DE into the backwash water. The facility receiving the backwash water, whether through a permit or not, should be notified of the presence of DE in the wastewater, as it may affect downstream treatment.

CARTRIDGE FILTERS

Cartridge-type filters should not be used in public or commercial pools.

9.2 DISINFECTION AND OTHER CHEMICALS

POOL DISINFECTION EQUIPMENT

Pool disinfection equipment should:

- Be automatic.
- Be easily adjustable to maintain recommended disinfectant residual levels during periods of both high and low use.
- Be properly sized for the pool and design flow rate.
- Have sufficient capacity to continuously feed free chlorine (or equivalent) into the circulation system at levels of up to (based on the design flow rate):
  - 3 mg/L for indoor pools
  - 8 mg/L for outdoor pools
  - 5 mg/L for indoor hot tubs
  - 8 mg/L for outdoor hot tubs

DISINFECTANTS

Disinfectants inactivate pathogens in the recirculated water, provide a disinfectant residual in the pool water (required under the Pool Regulation) and minimize the buildup of organic matter.

USING REGISTERED OR SCHEDULED PRODUCTS

All pool and spa products (chemicals and devices) used to control microorganisms and algae must be registered or scheduled under the Pest Control Products Act. This includes disinfectant chemicals and onsite chlorine generation systems (see Section 9.4). Other pool and spa products that do not control disease-causing microorganisms or algae (like pH adjusters, chlorine neutralizers, and devices used only to dispense pool and spa chemicals) do not have to be registered.

Health Canada reviews registration applications for possible risks to human health and the environment, and to ensure the product is effective.

Registered or scheduled products have labels with directions and information on how to use them properly. Registered products are easy to spot as they have a five-digit registration number on the front of the package in one of these formats:

- Registration No. 00000 Pest Control Products Act
- Reg. No. 00000 P.C.P Act

Scheduled product labels will say "Scheduled under The Pest Control Products Act."

For more information on pool products subject to the Pest Control Products Act, as well as general information about the regulation of pesticides in Canada, contact the Health Canada Pest Management Information Service or refer to the Health Canada website.[14]

AUTOMATIC DISINFECTION

Acceptable forms of automatic disinfection include:

- Chlorine gas injection.
- Sodium hypochlorite injection.
- Adjustable erosion feeders.

Automatic injectors for either gas or liquid chemicals must have an automatic shut off when the recirculation system is turned off. This will prevent buildup of chemicals in the pipes that will get pushed into the pool when the system is turned back on (MAHC 4.7.3.2.1.3).

MAHC 5.7.3.5.1.2.2 recommends that bathers should not be permitted to reenter a pool during the first 5 minutes after the recirculation system is turned back on.

Disinfection methods that are not considered to be automatic include:

- Disinfection pucks in skimmer baskets and recirculation pump prefilters.
- Manual application.
- Floating erosion feeders common in residential hot tubs.

Erosion feeders utilizing trichloroisocyanuric acid (Tri-chlor) tablets should only be used for outdoor pools because the tablets contain cyanuric acid. Cyanuric acid reduces the loss of free chlorine in water exposed to the sun's ultraviolet rays and therefore provides no benefit in indoor pools. Operators should proceed with caution when considering the use of Tri-chlor tablets in indoor pools, as it will often lead to excess cyanuric acid in the water resulting in a reduction in disinfection effectiveness. Make-up water can be used to dilute the concentration of cyanuric acid.

It is recommended that operators of erosion feeders have supplementary forms of chlorine (e.g., calcium hypochlorite, sodium hypochlorite, lithium hypochlorite or dichloroisocyanurate) available to use in the event that a rapid increase in the chlorine concentration is necessary.

[14] https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management.html

OTHER CHEMICALS

Automatic feeders that add other chemicals should be sized to provide an appropriate rate of feed for the demand of the facility.

9.3 GAS CHLORINATION

Chlorine disinfectant is available in several forms, including chlorine gas, liquid sodium hypochlorite, and onsite-generated sodium hypochlorite. Many pools use chlorine gas as a disinfectant. When used as intended, this provides an effective disinfectant; however, a chlorine gas leak can cause serious injury or death.

Proper design of chlorine gas facilities is crucial to managing the potential health and safety risks inherent in the use of this highly reactive gas. Chlorine gas leaks have the potential to harm public health as well as worker safety. The oversight for chlorine gas facilities is a shared responsibility between WorkSafeBC, the Ministry of Health and health authorities.

The WorkSafeBC Occupational Health and Safety Regulation contains a number of requirements for chlorine gas facilities that must be followed. Many of these requirements are outlined in WorkSafeBC's *Safe Work Practices for Chlorine*[15], the bulletin *Preventing Chlorine Gas Exposure at Municipal pools*[16] and the PoolSafeBC *Best Practices Guide*.[17] The local health authority will also review the design from a public health protection perspective.

9.4 ONSITE CHLORINE GENERATION SYSTEMS (SALTWATER POOLS)

In pools using saltwater disinfection systems, salt is added to the pool water. When the saltwater passes through an electrolytic cell as part of the circulation treatment system, the salt is converted into sodium hypochlorite. Consequently, saltwater systems are still chlorination systems. They should be designed with the same considerations as with more conventional forms of chlorine (gas, liquid sodium hypochlorite, etc.), in addition to technology specific considerations. By the same token, other types of on-site chlorine generation may be considered.

Note that if hard water is used to provide either the water or brine solution for an electrochemical cell, the electrode surfaces should be monitored for scale buildup to avoid a reduction in the cell's chlorine-producing efficiency or possible failure. Similarly, the temperature of the water entering the electrolytic cell should be maintained within a range of 40 to 80 degrees Fahrenheit (4.4 – 26.7°C) or per manufacturer recommendations, to avoid damaging the electrolytic cell.

Onsite chlorine generation systems should:

- Be certified to NSF 50: Equipment for Swimming Pools, Spas, Hot Tubs and Other Recreational Water Facilities.

[15] www.worksafebc.com/resources/health-safety/books-guides/safe-work-practices-chlorine?lang=en

[16] https://www.worksafebc.com/en/resources/health-safety/hazard-alerts/preventing-chlorine-gas-exposure-municipal-pools

[17] https://www.worksafebc.com/en/resources/health-safety/books-guides/poolsafebc-best-practice-guide?lang=en

- Have provisions to ensure continued disinfection (operational controls, equipment spares, back-up chemical dosing system, etc.) in the event of saltwater system malfunction (electronic malfunction, low salt levels, etc.)
- Be adequately sized to maintain the required chlorine residual in the pool at all times.
- Have adequate protection for all equipment components and surfaces in contact with the saltwater.
- Meet the manufacturer's requirements for pool water quality parameters, including hardness and temperature.
- Be placed in a location with suitable ventilation to prevent hydrogen gas build-up.

It is recommended that operators of saltwater systems have supplementary forms of chlorine (e.g., calcium hypochlorite, sodium hypochlorite, lithium hypochlorite or dichloroisocyanurate) available to use in the event that a rapid increase in the chlorine concentration is necessary.

Due to its salt content, the discharge of pool water should also be considered during the design stage. Consult with local authorities early in design to determine if the discharge of saltwater into the local sewer or receiving environment is permissible or if pretreatment/onsite wastewater treatment is required.

9.5 UV TREATMENT

Ultraviolet light treatment is often used in pools as a supplementary form of disinfection to reduce chlorine consumption and disinfection byproduct formation or as a means of destroying chloramines. Reduction in the formation of disinfection byproducts can improve indoor air quality within the pool area.

Since UV disinfection cannot impart a residual disinfectant in the water, UV disinfection cannot replace chlorine, chlorine cyanurate, or bromine as primary disinfectants.

All UV systems should be certified to NSF Standard 50: Equipment for Swimming Pools, Spas, Hot Tubs and Other Recreational Water Facilities. Large flow devices evaluated in accordance with other validation or certification protocols may also be considered.

FOR SUPPLEMENTARY DISINFECTION

UV treatment used as a supplemental form of disinfection should be certified to NSF Standard 50 for either:

- 3 log reduction of *Enterococcus faecium* and *Pseudomonas aeruginosa*; or
- 3 log reduction of *Cryptosporidium*.

FOR CHLORAMINE DESTRUCTION

UV light is effective at destroying chloramines in pool water. The optimal dosage for chloramine destruction is 60 mJ/cm^2 at 280 nm. This wavelength can only be achieved through medium-pressure UV lamps.

9.6 OZONE SYSTEMS

Ozone is commonly used in pools to oxidize organic matter, leading to a reduction in chlorine demand and therefore a reduction in the formation of chlorine disinfection byproducts (including chloramines). Reduction in the formation of disinfection byproducts can improve indoor air quality in the pool area.

Since ozone dissipates rapidly, it is unable to maintain a residual in the water. For this reason, it cannot replace chlorine, chlorine cyanurate, or bromine as the primary disinfectant.

Protection of workers from ozone-related hazards falls under the jurisdiction of the WorkSafeBC, and designs must consider WorkSafeBC requirements. Further information on WorkSafeBC requirements can be found on the WorkSafeBC website.[18]

Ozone systems should be certified to NSF 50 and must conform to WorkSafeBC requirements found in the *Ozone Safe Work Practices Manual* (BK 47)[19] including:

- Ventilation considerations.
- Destruction of ozone off-gas from contact tanks.
- Ozone room design requirements.

9.7 MEASUREMENT OF CIRCULATION

Recommendations for flow meter installation are also listed in Section 8.2.

RATE OF FLOW INDICATOR

A rate of flow indicator should be provided and maintained for each pool to show the rate of pool water circulation. This allows for verification of velocities through drains. The indicator should:

- Be conveniently located for ease of viewing.
- Be calibrated in either litres per minute or U.S. gallons per minute.
- Provide at least 90% accuracy.
- Be capable of flows measuring from 50% to 150% of the design flow rate.
- Not be at risk of plugging.

Rate of flow indicators should be installed on all return lines – including recirculation, water feature, skimmer/gutter, and water slide lines. Where a whirlpool jet pump system is in place, a rate of flow indicator should be located on the jet pump circulation system.

All flow indicators should be installed in accordance with the manufacturer's specifications. The required number of pipe lengths of straight pipe upstream and downstream of the flow indicator should be provided to achieve the stated flow reading precision and accuracy levels.

[18] http://www.worksafebc.com

[19] https://www.worksafebc.com/en/resources/health-safety/books-guides/ozone-safe-work-practices?lang=en

9.8 EQUIPMENT ROOMS

Equipment rooms must be designed to the B.C. Building Code. Additionally, equipment rooms should be designed to:

- Permit equipment to be easily installed, inspected, and maintained.
- Allow equipment to be mounted at or above floor level. For example, pumps and/or other electrical equipment should be installed on a minimum 75 mm (3 in) housekeeping pad.
- Provide the manufacturer's recommended maintenance area around equipment (height and floor area). Where the manufacturer does not specify a recommended maintenance area, sufficient space should be provided to dismantle equipment, remove components or contents, perform routine maintenance, and, in some cases, replace equipment.
- Include floors sloped to drains.
- Allow sufficient space for safe storage of auxiliary equipment.

Only pool-related equipment should be stored in Equipment Rooms.

9.9 CHEMICAL STORAGE AREAS

Proper design of chemical storage areas is essential to minimize the risks associated with storing dangerous goods. The BC Fire Code details chemical storage room design requirements including clearance, storage of liquids and compressed gasses, separation distances, ventilation, and spill containment.

In addition to the storage separation minimums required in the BC Fire Code, adequate separation should be provided to minimize the risk of accidental chemical mixing during tank filling and chemical mixing/dilution.

INDIVIDUAL STORAGE REQUIREMENTS

Protection of workers from chemical hazards falls under the jurisdiction of WorkSafeBC, and designs must follow WorkSafeBC requirements. Section 5.24: Incompatible Substances, in the *Occupational Health and Safety Regulation* states:

> *Substances which are incompatible must not be stored in a manner that would allow them to mix in the event of container leakage, breakage or other such circumstance.*

Consult the Safety Data Sheets (SDS) for each of the chemicals to be stored to determine incompatible chemicals and individual storage requirements. Further information on WorkSafeBC requirements can be found on the WorkSafeBC website.[20] Spaces must be designed to accommodate the required chemical needs for the facility. An additional ventilated room to store other chemicals used in pool operations (aside from chemical which require separate rooms - chlorine, acid, etc) should also be included. There should be a wall between these rooms to keep chemicals separate.

[20] http://www.worksafebc.com

RESERVE CONTAINERS

When sizing chemical storage rooms, consideration should be given to providing sufficient storage space for reserve containers of chemicals, especially in remote locations where chemical delivery may be infrequent. Adequate clearance should also be provided for chemical transporting equipment, such as forklifts, where applicable.

SPILL CONTAINMENT

In addition to the spill containment requirements of the BC Fire Code, chemical storage tanks should be double walled or separated by concrete enclosures, spill pallets or other spill containment system surrounding each tank. Each spill containment system should have an enclosure capable of containing 110% of the contents of each tank stored within the system.

Where possible, piping containing incompatible chemicals should be routed separately to minimize the potential for chemical reactions due to drips and leaks.

PART FOUR: SPECIAL DESIGN FEATURES

10 POOL EQUIPMENT

10.1 POOL SLIDES

POOL SLIDES EXEMPT UNDER THE ELEVATING DEVICES SAFETY REGULATION

Slides used in a pool environment can include dry slides and water slides. Some dry slides and water slides are regulated under the *Safety Standards Act* – Elevating Devices Safety Regulation (EDSR) by Technical Safety BC (Section 17 and Schedule of the EDSR). Slides exempt from the EDSR are outlined in Section 18(2) as being:

(a) waterslides that meet any one of the following criteria:

(i) the height of the slide from the specified water level in the receiving pool to the top of the loading platform sill is 3.05 m or less;

(ii) the length of the flume is 30.5 m or less, with height/run ratio of 0.1 (6°) or less;

(iii) the maximum rider velocity is not greater than 3.6 m/s;

(b) dry slides that do not exceed a height of 4 m;

Pool slides that are exempt from the EDSR fall under the Pool Regulation. For further information on EDSR regulated water slides, refer to section 11.1.

GENERAL REQUIREMENTS

The design and location of slides not regulated by the Elevating Devices Safety Regulation should take into consideration:

- The size and weight of the people who will use the slide.
- The trajectory upon sliding into the water.
- The depth of the water, including the slope of the pool basin floor.
- Manufacturer recommended plunge depths.
- Lifeguard visibility/access.
- Proximity of pool sides.
- Slide setbacks

Design consideration may also be given to CSA Z267: *Safety Code for Amusement Rides and Devices* (current edition) and ASTM F2376: *Standard Practice for Classification, Design, Manufacture, Construction, and Operation of Water Slide Systems* (current edition). Slides are to be installed and maintained according to the manufacturer's specifications.

SIGNAGE

Slide side signage should be provided indicating:

- One rider at a time.
- Wait until the landing area is clear before entering the slide.
- Slide in the sitting position or on the back only.
- Do not attempt to stop on the slide.
- Leave the plunge area immediately.
- Users of the slide should be of an age and size to manage the slide.

10.2 PLAY EQUIPMENT

Play equipment, such as climbing walls and rope swings, has become a popular part of contemporary recreation facilities. While each piece of play equipment must be evaluated on its own merit, these guidelines outline basic requirements for all play equipment. Play equipment must meet the health authority's approval on the design and location prior to installation. Operational measures to ensure patron safety should be outlined in the pool safety plan (refer to the *B.C. Guidelines for Pool Operations*).

All play equipment should be designed and manufactured according to ASTM F2461 (current edition): *Standard Practice for Manufacture, Construction, Operation, and Maintenance of Aquatic Play Equipment*, or equivalent. Placement of play equipment should ensure that the water depths specified by the manufacturer are met.

ROPE SWINGS AND CLIMBING WALLS

The design and location of rope swings or climbing walls should take into consideration safety and structural concerns. These features should:

- Be certified by a structural engineer (both product and installation). When a rope swing is in use, it can create considerable torsional stress on beams above, and the effect of the swing on the structure of the building should be considered. Similar concerns exist for the anchoring of climbing walls to the deck and/or adjacent walls.
- Consider the rope trajectory, splash (landing) zone, pool depth, and potential impact with the pool basin, facility walls, and deck.
- When in use, not conflict with other pool activities (e.g., diving, slides), through the provision of sufficient lateral clearance between the rope swing and other pool use areas.

SELF-INFLATING POOL FEATURES

Self-inflating pool features that have continuous air flow are managed by Technical Safety BC. Self-inflating pool features that do not have continuous air flow should follow the design guidelines outlined below in "Other Play Equipment."

OTHER PLAY EQUIPMENT

There are many variations on play equipment that may be proposed. Examples include zip lines, rolling logs, climbing nets and sealed air inflatables. Play equipment should be designed so that it:

- Does not have hard edges or unnecessary protrusions.
- Does not pose an entrapment risk to patrons.
- Is constructed of materials that are easily cleanable, impervious to water and unlikely to promote bacterial growth.
- Does not exert excessive water pressure.
- Is unlikely to result in injury from falling from it.
- Does not interfere with lifeguard visibility or access.

10.3 MOVEABLE BULKHEADS

MOVEABLE BULKHEADS
Moveable bulkheads split a pool's water area into two or more sections, giving a pool operator the flexibility to program different activities in the separate pools. They are also used to adjust pools to the correct lane length for competitive events and provide a platform for starting blocks.

BULKHEAD DESIGN

Bulkheads should be designed to:

- Sustain design loads.
- Provide a safe and stable platform.
- Not move under the force of tensioned lane lines or swimmers diving off the bulkhead.
- Not interfere with pool circulation (through the provision of gaps on the side of the bulkhead, flow through the bulkhead, gaps in the bottom, etc.).
- Be fabricated of materials tolerant to exposure to a pool environment.
- Provide a continuous handhold or finger grip on both sides of the bulkhead.
- Be of sufficient width for the intended use, typically at least 1.2 m (4 ft) in width.
- Have no sharp edges on the structure.
- Have slip-resistant gratings on deck and side walls that meet the pool basin colour and pattern guidelines.

Designers of bulkheads intended for use in competitive events should refer to Section FR 2.15 of the FINA Facility Rules[21] for additional design considerations.

ENTRAPMENT HAZARDS

As moveable structures, bulkheads can pose as an entrapment hazard. Bulkheads should have:

- No opening that constitutes a tripping or entrapment hazard.
- A fully encased exterior that prevents swimmer entry into the structure.

BULKHEAD LOCATION

Bulkheads should be designed to maintain entrances and exits to the reduced pools.

[21] https://www.fina.org/sites/default/files/finafacilities_rules.pdf

ERGONOMIC DESIGN

Moving bulkheads pose ergonomic hazards to pool staff. Bulkhead design must meet the requirements for control of ergonomic hazards as outlined in Part 4 of the Occupational Health and Safety Regulation. Contact WorkSafeBC for more information on ergonomic design.

10.4 MOVEABLE FLOORS

MOVEABLE FLOOR DESIGN

Moveable floors should be designed to:

- Span the entire width of the pool.
- Eliminate the possibility of entrapment hazards by preventing pool patron access to the underside of the pool floor through the use of a tight-fitting barrier between the moveable floor and pool floor.
- Sustain design loads including land-based activities (if applicable).
- Allow for pool circulation (through the provision of gaps in the floor, sides, configuration of gutters, etc.).
- Have pool inlet fittings installed under the moveable floor to allow for circulation of water.
- Be made of enduring materials tolerant to exposure to a pool environment.
- Have a slip-resistant surface that meets the guidelines on pool basin surfaces and finishes. See section 4.1.
- Have floor openings and gratings that do not pose a suction or entrapment hazard. See section 8.3.
- Have floor positions and openings that do not cause toe or finger entrapment (approximately 8 mm (3/8 in)) between the floor and pool wall or any pool steps, stairs or installed pool features.
- Not sink or float during a control system failure or power outage.
- Maintain the use of required pool entrance and exits without causing pinching and entrapment hazards.
- Have floor drives that are fully enclosed and do not pose an entrapment hazard to pool patrons.

MOVEABLE FLOORS

Moveable floors allow for a pool, or section of pool, to have an alterable depth, giving the pool operator the flexibility to change the pool depth to accommodate a variety of programming uses. In some cases, moveable floors can cover the pool entirely, allowing the pool space to be used for land-based activities.

MOVEABLE FLOOR CONTROLS

Moveable floors should be adjusted through a control panel that:

- Provides an audible alarm in emergency situations.
- Is tamper proof.
- Is certified for use in wet areas per the BC Electrical Code.
- Is adequately enclosed for a pool environment.
- Is located in an area that provides the operator a full view of the movable floor.
- Automatically adjusts pool depth displays.

VARIABLE DEPTH CONSIDERATIONS

Since pool depths change depending on the position of the moveable floor, depth-related design aspects that are likely to be affected include:

- Pool depth displays, which should follow the depth marking guidelines in section 4.5.
- Provisions to prevent diving, water slide, play equipment, and slide usage when the pool depth is less than the safe depths for these activities.

11 SPECIALTY POOLS

11.1 WATER SLIDES

WATER SLIDES UNDER THE EDSR

Water slides are regulated under the *Safety Standards Act* – Elevating Devices Safety Regulation (EDSR) by Technical Safety BC (section 17 and Schedule of the EDSR). Technical Safety BC accepts design filings and issues permits for installation and operation of water slides regulated by the EDSR. For further information, visit the Technical Safety BC website at https://www.technicalsafetybc.ca/about.

Water slides that do not discharge into a pool (such as slides with flumes) fall under the EDSR. A review and inspection of the circulation systems should still be completed for these types of slides. Health authorities may be able, through a letter of understanding, to assist in this capacity.

Water slide landing pools must meet the water quality requirements of the Pool Regulation. Water slide circulation systems fall under the jurisdiction of the Pool Regulation with respect to suction and entrapment hazards. All water slides and landing pools should meet the ASTM international standards F2376-17a and F2461-18. ASTM standards can be found at www.astm.org/building-and-construction-standards.html.

GENERAL

The following should be considered in the design of water slides:

- The bottom of the slide should be visible from the slider's entry point at the top of the slide. The use of cameras or controlled access may be considered in achieving this objective.
- Where two deceleration flumes are side by side, there should be at least 1.2 m (4 ft) of deck space between flumes so bathers may exit the pool in an emergency.
- Water drawn from the pool circulation system for the water slide should be accounted for in the pool recirculation design. Also, in built-in wall drains, a full vault design that can be vented to the pool deck and surrounding pool environment (to break any suction) should be considered.

11.2 WAVE POOLS

Wave pools should have:

- A warning mechanism providing an audible and visual warning prior to wave generation to allow bathers an opportunity to leave the pool or move to shallower water.
- A beach or zero-depth end to diminish the wave and allow for safe exit.
- Wave chamber bars constructed of stainless steel or similar acceptable material. Rotating wave chamber bars should be spaced to reduce the risk of entrapment.
- Where there is a wave chamber in a pool basin, a rope, lane line or other measures located 1.5 m (5 ft) from the wave chamber bars to discourage public access and prevent entrapment.
- Guard rails on decks at the deep end around wave chamber walls that should extend 1 m (3.3 ft) beyond the wave generator and may be extended until the free board is less than 500 mm (20 in) at mean water level.
- Air blowers (where used) contained in a separate room that is constructed of acoustic limiting material to reduce noise levels.
- Regular inspections of wave chamber bars for structural integrity.
- Ladders or steps in the deep end for exiting the pool. The ladders or steps should be recessed into the wall.
- An emergency shut-off in the immediate area of the pool.
- A maximum turnover period of two hours or less.
- A wave amplitude not exceeding the pool freeboard or flood decks.

SURFING RIDES

Surfing rides are not considered to be a subset of wave pools. Contact Technical Safety BC (also notify your health authority) for information on design considerations.

11.3 WADING POOLS

To be considered a wading pool in the Pool Regulation, the maximum depth of water must be less than 61 cm.

POOL AREA

Wading pools should:

- Be free of obstructions.
- Have a uniform floor with a maximum slope of 1 in 15 and a minimum slope of 1 in 50.
- Be entirely surrounded by a walkway at least 1.2 m (4 ft) wide that falls away from the pool or basin edge at a uniform slope of not less than 1 in 50.

WATER QUALITY

Wading pools must meet the water quality requirements in the Pool Regulation. Turnover rates for recirculating wading pools should not exceed two hours. The health authority may require potable water as defined in the *Drinking Water Protection Act* be used in a wading pool.

SWIM DIAPERS

While swim diapers can minimize the release of fecal matter into the pool, none are leak proof.

FITTINGS

Fittings in wading pools using circulation systems should be located to produce uniform water circulation throughout the pool. They should be secured to provide protection from suction and pressure hazards.

NO CROSS-CONNECTIONS

There should be no cross-connections between a wading pool and any potable water supply, water circulation system of any pool, or sewer.

WADING POOL FENCING

Wading pools must have a fence or other barrier with controlled access surrounding the pool and the walkways to prevent the easy access of nonusers and pets. This requirement does not apply to wading pools that are drained and left empty overnight.

WADING POOL FILLING

New wading pools should have recirculation systems that include automatic disinfection. These pools may be left filled overnight but must have a security fence and lockable gate.

Existing fill-and-draw-style wading pools should be filled with potable water each day that they are used, operated to maintain the water quality requirements of the Pool Regulation, drained before dark and left empty overnight. The requirement for a pool enclosure (i.e. a fence or barrier with lockable gate) does not apply to this type of wading pool as per Section 7 (2) of the Regulation. However, the operator must ensure that, when the pool is open to bathers and no lifeguard is on duty, a clearly visible notice is posted at each entrance to the pool stating that no lifeguard or attendant is on duty and that children must be supervised by an adult (see Sec. 18 (1) of the Pool Regulation).

11.4 SPRAY POOLS

The following design guidelines (except fittings and cross-connection guidelines) apply to zero-depth spray pools only. Where spray features are incorporated into a wading pool, refer to the wading pool design guidelines in section 11.3.

SPRAY DECK

The spray deck should:

- Be made of a durable material that is impervious to moisture and retains a texture that is slip-resistant and causes no discomfort to bare feet.
- Not allow for the accumulation of standing water.
- Drain by gravity into flat or low-profile drains.
- Be free of obstructions.
- Have a floor with a maximum slope of 1 in 15 and a minimum slope of 1 in 50.
- Be entirely surrounded by:

  - An overspray area suitably sized for the spray equipment and local wind conditions (2.4 m (8 ft) to 3.0 m (10 ft) recommended).
  - A walkway at least 1.20 m (4 ft) wide that falls away from the spray pad edge at a minimum uniform slope of 1 in 50.
- Be able to meet the NSF-50 standard requirements for toxicity if water is recirculated.
- Allow free drainage over the deck surface.

WATER SOURCE AND QUALITY

Spray pools may be designed to use a continuous supply of potable water that drains to waste or designed as a recirculating system. The Pool Regulation requires water used in drain-to-waste-type spray parks to be of a quality acceptable to a health officer. Recirculating spray pool water quality considerations are outlined below:

- Where spray features are located within a pool of water, such as a wading pool, the guidelines for wading pools should be followed.
- In cases where there is reuse of spray park runoff, the reclaimed water should be monitored for *E. coli*, with an allowable limit of no more than 1 CFU/100 mL or 2 MPN/100 mL. The water quality also needs to conform to tables 13 and 14 of the Municipal Wastewater Regulation (greater exposure potential) or to a standard acceptable to the health officer.
- Spray parks may draw directly from surface and/or groundwater sources if authorized via a water licence under the *Water Sustainability Act*.

Details of the source water, as well as the disposal of wastewater, should be included with the application for a construction permit.

OUTBREAKS

Spray pools that collect water and recirculate it have been associated with large communicable disease outbreaks from poor water quality. In the absence of using only a continuous supply of potable water, there should be full water treatment, including filtration, UV disinfection, and chemical disinfection.

RECIRCULATING SPRAY POOLS

Recirculating spray pools must meet all of the requirements outlined in the Pool Regulation and should adhere to the *BC Guidelines for Pool Design* as best practices. Health authorities require potable water as defined in the *Drinking Water Protection Act* be used as makeup water in a recirculating spray pool. Additional water quality and design considerations are outlined below.

SPRAY PAD WATER COLLECTION TANK

A collection tank acts as the reservoir of water that supplies both the spray features and the recirculating system. The tank should:

- Be constructed of corrosion-resistant, inert, nontoxic and watertight material.
- Be as large as possible to allow for more effective disinfection, improve dilution effects and improve operational stability. The effective volume of the tank should meet the following criteria:
  - Be a minimum volume of three times the flow rate per minute of all pumps (e.g. if the total flow rate for the pumps is 800 L/min, then the tank should be at least 2,400 L).

  - Provide adequate chlorination contact time for a minimum 4-log reduction of enteric viruses (refer to the *Guidelines for Pathogen Log Reduction Credit Assignment* for additional details).

- Have an automated potable water make-up connection through a suitable air gap to preclude the possibility of water backflow into the potable water system.
- Be accessible for inspection and safe cleaning.
- Have overflows and bottom drains connected to wastewater piping through suitable air gaps.
- Be capable of being completely drained with at least one main drain at the deepest point.
- Have a means of preventing debris from collecting in the tank, such as an upstream screen or trash tank.
- Have an adequate number of collection tank inlets and outlets spaced in a manner that encourages complete mixing and circulation in the tank. Baffling may help to achieve this.
- Provide a smooth/tiled scum line at the standing water level to facilitate cleaning.
- Have access and vent openings that are flood- and vermin-proofed.

ULTRAVIOLET LIGHT

Ultraviolet (UV) light disinfection should be provided to manage risks due to enteric protozoa (*Cryptosporidium and Giardia)*. The UV system should:

- Be validated or certified to achieve 3 log reduction of *Cryptosporidium* and *Giardia* using an accepted protocol or standard.
  - Acceptable UV validation protocols include the USEPA UVDGM, DVGW W294, and ÖNORM M 5873.
  - Acceptable certification standard is NSF/ANSI Standard 55 Class A.
- Be located between the collection tank and the spray features. The UV system may either:
  - Be located between the filtration system and the chlorination system such that all water fed to the spray features is fully treated. When the spray features are not fully operational, excess treated water would return to the collection tank (e.g. full flow filtration system), or
  - Be located such that UV disinfected water is fed directly from the collection tank to the spray pad/features. In this case, water in the collection tank is continuously filtered in a separate loop (e.g. partial flow filtration system).
- In either case, a minimum flow (Q) must be maintained through the UV unit(s) during spray pool shutdown to ensure adequate water treatment, according to the following equation[22]:

$$Q\ (in\ gpm) = V\ \times \left(\frac{14.8 - \ln V}{0.999\ \times 60 \times T}\right)$$

  - Where:
    - Q = minimum flow rate, in gallons/minute
    - V = total water volume of the spray pool system (collection tank, piping, equipment, etc.), in gallons
    - T = dilution time (hrs).
      - For spray pools which are shut down for less than 12 hours consecutively, this is calculated as 0.75 × (shut down time, in hours).

[22] Refer to MAHC 4.7.3.3.2.5.

        - For spray pools which are shut down for 12 hours or more consecutively, 9 hours should be used for the dilution time.
    - A flow meter would be required to measure the flow, Q, through the UV unit(s).
- Have a UV intensity sensor that will sound an alarm and shut down the UV reactor when the validated dosage cannot be delivered.
- Be linked (interlocked) with the spray feature pump such that the spray features do not operate when the validated UV dosage cannot be delivered.

Refer to the *Ministry of Health's Guidelines for UV Disinfection of Drinking Water* for additional considerations.

RECIRCULATION SYSTEM

Other components of the recirculation system include the recirculation pumps, filters, and chlorination system. Design considerations for this equipment are provided elsewhere in the *Guidelines for Pool Design*. Additional considerations for the recirculation system include:

- The system should allow for the constant recirculation and treatment of water, even when the spray park is not in operation. If desired, this recirculation rate may be reduced by no more than 25% when the spray pool is not in operation.
- Be linked (interlocked) with the spray feature pump such that the spray features do not operate when the recirculation system is not working.
- The recirculation system design flow rate (rate of water going through the filtration system) should be at least 1/3 of the spray feature design rate.
    - Note that some jurisdictions recommend a design flow rate of 50% to 100% of the spray feature design rate.
- A bypass-to-waste valve that allows drainage collected from the spray pad outside operating hours and during daily cleaning and flushing, to drain to waste.
- Flow meters should be installed to measure flows to the filter and spray features.
- Chlorination should provide a free chlorine residual level of no less than 2 ppm going into the spray features. Chlorination should be linked (interlocked) with the spray feature pump such that the spray features do not operate when the free chlorine residual level is not met.
- Chlorinator should be capable of providing a free chlorine residual level of 10 ppm in the collection tank.
- An automatic chemical controller is required for monitoring and adjusting the level of free chlorine residual and pH in the spray pad collection tank.

USER FACILITIES

User facilities help discourage the use of spray pool features for activities that could pose health hazards, especially for spray pools using recirculated water. Spray pools should include user facilities near the pool that consist of:

- Drinking water fountains to discourage patrons from drinking water from the spray features.
- Washrooms, including diaper-changing facilities.
- Hose bibs with anti-siphonage devices to facilitate flushing of the spray pad.

Other facilities that could keep recirculating water from the spray pad as clean as possible may be considered, these include:

- Fencing of the spray pool area to keep out animals and pets when not in operation.
- Showers for use before and after using the spray features.
- Foot washes that drain directly to waste.

NO CROSS-CONNECTIONS

Air gaps should be provided such that there are no cross-connections between any part of a spray pool system and any potable water supply, the water circulation system of any pool, or any sewer.

WATER QUALITY MONITORING AND DAILY CHECKS

The following water quality monitoring and daily checks should be performed:

- Water quality as per the Pool Regulation.
- Water flow rate (to be continuously monitored).
- Free chlorine residual level in water going out to the spray features (to be continuously monitored and to be more than 2 ppm and not greater than 10 ppm).
- Turbidity of water going into the UV system to be monitored and to be less than 3 NTU (continuous monitoring and alarm are highly recommended to better safeguard the effectiveness of UV treatment and chlorination).
- Temperature of water going out to the spray features to be continuously monitored and to be kept below 20^0C, replacing water in the collection tank with makeup water from the mains as needed to control the temperature.

All water quality and flow data to be logged at least twice daily by the operator.

REFERENCES

1. BC National Collaborating Centre for Environmental Health. Identifying and Addressing the Public Health Risks of Splash Parks. August 2017.
2. New York Department of Health. New York State Sanitary Code Subpart 6.3, Recreational Aquatic Spray Grounds. Revised June 2010.
3. Province of Alberta. Alberta Health Pool Standards. Amended January 2018.
4. US Centers for Disease Control and Prevention. Model Aquatic Health Code (3rd Ed.). July 2018.
5. US Centers for Disease Control and Prevention. Annex to Model Aquatic Health Code (3rd Ed.). July 2018.

11.5 VANISHING-EDGE POOLS

GEOTECHNICAL ASSESSMENT

Although not included in the construction permit review completed by the health authority, vanishing-edge pool designs should be reviewed by an individual competent in geotechnical engineering, to assess site suitability in cases where slope stability could be an issue.

GENERAL

Vanishing-edge pool designs should include:

- Treatment equipment that will condition water from the main pool to meet the water quality requirements outlined in the regulation.
- A separate recirculation system for the vanishing edge independent of the pool recirculation system.
- Back-siphoning protection between the main pool and catch basin.

WEIR EDGE

The weir edge creates the dramatic look characteristic of vanishing-edge pools, but also can create health hazards if not properly designed. Weir edges should:

- Have a minimum width of 25 cm (10 in).
- Have no more than 1.5 m (5 ft) of water depth on the pool side of the edge.
- Be no more than 50% of the perimeter of the pool
- Be constructed with a level tolerance of 1/16 of an inch.
- Have a slip-resistant surface with the nose-edging in a contrasting colour.
- Have a “no walking” inscription in a contrasting colour at least 10 cm (4 in) high.

CATCH BASINS/GUTTERS

Water cascading over the weir edge is collected in a catch basin (also called a gutter). Careful design of the catch basin is necessary to prevent overflows. Catch basins should:

- Be set a maximum of 0.46 m (18 in) below the elevation of the weir.
- Be grated to allow for emergency access to the pool.
- Have a minimum of two outlets that follow the guidelines on main drain and suction entrapment. See section 8.3.
- Have dimensions, drain openings and piping of sufficient size to prevent the catch basin from flooding.
- Have an overflow line if the catch basin volume contributes to the surge capacity of the pool.

PERIMETER DECK

Vanishing-edge pools, like all pools, should have a deck around the perimeter of the pool to allow for emergency access. To accommodate the vanishing edge, these pools should provide a minimum of:

- 1.2 m (4 ft) of decking around the pool, except at the weir edge.
- 1.2 m (4 ft) of decking at the catch basin level.

SURGE TANK VOLUME

The surge tank captures water that is sent over the weir edge due to bather displacement, water from water features and edge walls (transient volume), rainfall, wind-blown water and such. Appropriate sizing of the surge tank and vanishing-edge recirculation pump are crucial in achieving the vanishing-edge effect. Improperly sized surge tanks can lead to catch basin overflows and the loss of the vanishing-edge effect until the lost water is replenished.

Vanishing-edge pool surge tanks should:

- Provide a minimum surge capacity of 85 L (3 ft^3) per bather.
- Provide the entire surge capacity alone, or in combination with the catch basin.
- Have a surge tank overflow line that is below the flood rim on the catch basin.

POOL ENCLOSURE

To prevent accidental falls and unauthorized entry in the pool area, vanishing-edge pools should have an enclosure around the entire pool (main pool and catch basin), following the design guidelines outlined in section 3.1.

APPENDIX A: GLOSSARY OF TERMS

Backflow: The backing up of water through a pipe in the direction opposite to normal flow.

Backwash: A method of cleaning sand or diatomaceous earth filters. It involves reversal of water flow through the filter, with the collected dirt and debris being sent to the waste port.

BC Building Code: Provides the minimum requirements for a safe building environment. It is the product of a partnership of industry practitioners, construction technology experts and provincial regulators. The requirements include construction, plumbing and fire codes that each building in B.C. must meet before occupancy.

Canadian Electrical Code: A standard published by the Canadian Standards Association pertaining to the installation and maintenance of electrical equipment in Canada.

Canadian Standards Association (CSA): Develops standards that enhance public safety and health, advance the quality of life, and help to preserve the environment.

Construction: Includes the design, installation, repair, renovation and alteration of a pool.

Cove: The curving transition from the vertical wall to the horizontal floor, at the bottom of a pool wall.

Decks: Walkways surrounding a pool. Outdoor facilities often have concrete decks, while indoor facilities may have concrete or tile decks. Pool operators are responsible for sanitation and upkeep of the decks.

Design Flow Rate: The quantity of water flowing past a designated point within a specified time, such as the number of litres flowing past a point in one minute.

Diatomaceous Earth Filter: A filter tank containing fabric-covered grids that hold the diatomaceous earth powder up against the flow of the water.

Entrapment Hazard: A fixture that can hold a body or body part (e.g., hands, feet, hair, and torso) against it in a manner that a person cannot easily extricate them self.

Filter: Equipment used for filtering dirt and other fine debris from the pool water. Filtering agents include diatomaceous earth filters, silica sand and cloth cartridges.

Filtration: The process of passing pool water through the filter medium to remove dirt and debris particles.

Ground Fault Circuit Interrupter: A device that protects a circuit from branching off by de-energizing the path of electricity very quickly when it senses current loss.

Gutter: An overflow trough at the edge of a pool through which floating debris, oil and other "lighter-than-water" substances flow. Pools with gutters usually do not have skimmers.

Heating, Ventilation and Air Conditioning (HVAC) System: Technology designed for indoor environmental comfort. It is important in the design of indoor pools – where safe and healthy building conditions are regulated with respect to temperature and humidity, as well as "fresh air" from the outdoors.

Hose Bib: The valve in a water line where a hose is connected.

Hydrostatic Relief Valve: A spring-loaded plug normally situated in the main-drain sump. It is designed to open if the water pressure under the pool is greater than the water pressure within the pool. A relief valve reduces the possibility of an empty pool lifting out of the ground.

Internal Pool Wall: An element within the pool water area at or below the static water level that is narrower than 1.2 m and surrounded on at least 3 sides by water.

Internal Raised Pool Wall: An element within the swimming area higher than the static water level that is narrower than 1.2m and surrounded on at least 3 sides by water.

Lap Pool: Pool for people swimming laps. Lap pools tend to be long and narrow, usually over 15 metres long.

Ozone: The molecule containing three atoms of oxygen; known to be a very powerful sanitizer. Ozone-producing equipment creates this molecule by UV radiation or corona discharge generators.

Main Drain: A plumbing fitting installed at the deepest part of the pool. It is not a drain, such as a drain on a kitchen sink, but usually connects to the pump for circulation and filtration.

Maximum Bather Load: The maximum number of bathers allowed in a pool at one time for health, safety and engineering reasons. The bather load will be specified on the pool's operating permit and/or data sheet.

Perimeter Raised Pool Wall: An element along the swimming edge that is higher than the pool deck and narrower than 1.2m.

Pool Inlets: Inlets that return filtered, heated, and chemically treated water back to the pool. Inlets provide strong jets of water and are most often located on pool walls, although in some pools they are located on the bottom.

Pump: A mechanical device that causes hydraulic flow and pressure for filtration, heating and circulation of pool/spa water. Typically, a centrifugal pump is used for pools, spas and hot tubs.

Rate of Flow Indicator: A device that measures pressure differential across a calibrated orifice and indicates the rate of flow at that point.

Sand Filter: A filter that operates on the basis of depth filtration: dirt is driven through a sand bed and trapped in minute spaces between particles of sand.

Skimmer: A box-like device installed through the wall of the pool or spa connected to the suction line of the pump that draws water and floating debris into the skimmer from the water surface.

Skimmer Basket: A removable, slotted basket or strainer placed in the skimmer on the suction side of the pump, which is designed to trap floating debris in the water flow from the surface without causing much flow restriction.

Static Water Level: The designated water level that the pool is intended to hold while in operation without bathers in the pool.

Suction Hazard: Any fixture that can impart a suction pressure strong enough to draw or hold a body or body part (e.g. hands and feet) against an opening. In pools, a suction hazard is also an entrapment hazard.

Suction Line: A pipe that brings water from the pool or spa to the pump. Suction lines are under vacuum when the pump is running. A suction line can be referred to by the system it operates on. For example, “spa suction” means a suction line associated with a spa.

Surge Capacity (of a Surge Tank): The volume of water that can be stored in the space between the normal water level in the surge tank and the pool water level.

Surge Tank: A large tank used to either replenish or withdraw pool water automatically. It is activated using a float valve to sense the level of the water and adjust the flow.

Turnover: The amount of time it takes a pump to move all of the water in a pool through the filter and back again.

Underwater Lighting: A fixture designed to illuminate a pool or spa from beneath the water’s surface.

Vacuums: Devices that use suction to collect dirt from the bottom and sides of a pool or spa. Most common is a vacuum head with wheels that attaches to a pole and is connected to the suction line, usually via the opening in a skimmer. It is normally moved about by a person, and debris is collected in the skimmer basket and filter.

Wave Pool: A pool in which there are artificially generated, reasonably large waves, similar to the ocean. Wave pools are often a major feature of water parks.

Water Feature: A decorative element using flowing water, such as a fountain or waterfall.

WorkSafeBC: Promotes workplace health and safety for the workers and employers through education, consultation and enforcement. In the event of work-related injuries or diseases, WorkSafeBC works with the affected parties to provide return-to-work rehabilitation, compensation, healthcare benefits, and a range of other services.

APPENDIX B: APPLICATION FOR OPERATING PERMIT: POOL DATA SHEET

SEE NEXT PAGE

Application for Operating Permit

Pool Data Sheet

General Pool Information			
Name of Pool:			
Civic Address:			
Pool Type: ☐ public ☐ commercial ☐ hot tub ☐ spray pool ☐ wading pool			Location: ☐ indoor ☐ outdoor

Owner Information	
Name (Legal):	
Address:	
Phone Number:	Email Address:

General Pool Design Parameters			
Water Depth Minimum (m):	Water Depth Maximum (m):	Pool Area (m^2):	Deck Area (m^2):
Pool Volume (m^3):	Pool Basin Colour:	Design Flow Rate (L/min):	Turnover Rate (hours):
Maximum Bathing Load (persons): Shallow:	Deep:	Total:	

Recirculation Pumps		
RECIRCULATION PUMP	Make and Model:	Flow (L/min): at m TDH
HOT TUB JET PUMP	Make and Model:	Flow (L/min): at m TDH
PUMP (specify):	Make and Model:	Flow (L/min): at m TDH
PUMP (specify):	Make and Model:	Flow (L/min): at m TDH
PUMP (specify):	Make and Model:	Flow (L/min): at m TDH

Application for Operating Permit

Pool Data Sheet

Filtration System

Filter Type: ☐ sand ☐ diatomaceous earth ☐ pressure ☐ vacuum ☐ gravity		NSF Approved: ☐ yes ☐ no	NSF Standard:
Filter Make and Model:		Number of Filters:	Number of Elements:
Surface Area of Each Filter (m^2):	Total Area of All Filters (m^2):	Surface Area of Each Element (m^2):	Total Area of All Elements (m^2):
Rate of Filtration (L/min/m^2):		Total Filter Capacity (L/min) (*Rate of filtration x total area*):	

FILTER BACKWASH	Filter Backwash Pump Make and Model:		
	Flow (L/min): at m TDH	Backwash Rate (L/min/m^2):	Backwash Rate per Filter (L/min):

Gauges

Pressure Gauges (#):	Vacuum Gauges (#):	Temperature Gauges (#):
Flow Meter Make and Model:		Flow Meter Range (L/min): to

Disinfection

Primary Disinfectant: ☐ hypochlorite ☐ chlorine gas ☐ stabilized chlorine ☐ saltwater chlorination ☐ bromine ☐ other:		
Disinfectant Feeder Make and Model:		
Disinfectant Feeder Capacity (kg/24 hrs):	Point of Injection: ☐ filter influent ☐ filter effluent	Maximum Dosing Rate (mg/L):

Chemical Feeders

FEEDER #1	Make and Model:		
	Chemical/Slurry Fed:	Capacity (kg/24 hrs):	Injection Point:
FEEDER #2	Make and Model:		
	Chemical/Slurry Fed:	Capacity (kg/24 hrs):	Injection Point:

Application for Operating Permit

Pool Data Sheet

Pool Inlets			
Inlet Type:	Inlet Size (cm):	Number of Inlets: at m spacing	Depth Below Water Level (cm):

Drains			
Total Number of Drains:			
MAIN DRAIN	Make and Model:		
	Number:	Size of Free Opening (cm^2):	Velocity through Grate Opening (m/sec):
JET PUMP DRAIN (if separate from main drain)	Make and Model:		
	Number:	Size of Free Opening (cm^2):	Velocity through Grate Opening (m/sec):
OTHER DRAIN (specify)	Make and Model:		
	Number:	Size of Free Opening (cm^2):	Velocity through Grate Opening (m/sec):
OTHER DRAIN (specify)	Make and Model:		
	Number:	Size of Free Opening (cm^2):	Velocity through Grate Opening (m/sec):
OTHER DRAIN (specify)	Make and Model:		
	Number:	Size of Free Opening (cm^2):	Velocity through Grate Opening (m/sec):

Overflow (Skimmers/Gutters)					
Overflow Type: ☐ skimmer ☐ raised-edge gutter ☐ roll-out gutter ☐ deck-level gutter ☐ other:					
GUTTERS	Number of Gutter Drains (m spacing):	Gutter Drain Size (cm):			
SKIMMERS	Make and Model:				
	Quantity:	NSF Approved: ☐ yes ☐ no	Total Weir Length (cm):	Maximum Overflow Capacity (L/min):	Normal Flow Through Capacity (L/min):

Application for Operating Permit

Pool Data Sheet

Make Up Water Source			
Source: ☐ public ☐ private	Size of Makeup Line (cm):	Control: ☐ manual ☐ automatic	Air Gap: ☐ yes ☐ no
Backflow Preventer: ☐ yes ☐ no	Backflow Preventer Make and Model:		

Piping (Add extra pages if needed)		
SYSTEM #1	System/Liquid Carried:	Material: ☐ copper ☐ carbon steel ☐ PVC ☐ HDPE ☐ other:
	Maximum Velocity (m/sec): Return piping to pool: Supply piping to pool:	
SYSTEM #2	System/Liquid Carried:	Material: ☐ copper ☐ carbon steel ☐ PVC ☐ HDPE ☐ other:
	Maximum Velocity (m/sec): Return piping to pool: Supply piping to pool:	
SYSTEM #3	System/Liquid Carried:	Material: ☐ copper ☐ carbon steel ☐ PVC ☐ HDPE ☐ other:
	Maximum Velocity (m/sec): Return piping to pool: Supply piping to pool:	

Data Sheet Revision History				
Version	Prepared By	Company	Date	Revision Details

APPENDIX C: APPLICATION FOR CONSTRUCTION PERMIT

SEE NEXT PAGE

Information Requirements supporting the Application for Construction Permit

Pursuant to the Pool Regulation, the person applying for the construction permit shall ensure the attached Pool Information Sheets are duly completed by the project design professionals. Design professionals are design architects who are registered or licensed under the *Architects Act* and/or the design engineers who are registered or licensed as a professional engineer under the *Engineers and Geoscientists Act*. The Pool Information Sheets will be considered as statements of fact to support the health officer's evaluation and decision to issue a construction permit under the Pool Regulation s.5(3).

The person applying for the construction permit shall ensure that all related plans and specifications for the construction as prepared, sealed and certified by an architect or engineer are submitted with this application package. A person must not construct the pool other than in accordance with the plans and specifications submitted with this application, unless prior written approval is obtained from a health officer.

The Pool Owner, or their authorized agent, must sign the declaration in this Application for Construction Permit, confirming the pool will be constructed in accordance with the plans and specifications accompanying this Application for Construction Permit.

A preliminary version of the pool data sheet should also be submitted with the Application for Construction Permit. It is recognized that at time of construction permit application, the pool data sheet would be based on preliminary estimates for flow rates, head, and other key operating parameters. If parameters change, the pool data sheet should be resubmitted with the updated actual operating information and recalculations if required.

Additional Note: Operating Permit Requirements

Once the pool is constructed, an operating permit will be required prior to operating the pool. As part of the information package supporting the application for an operating permit, a signed statement from an engineer or architect must be submitted confirming that the pool has been constructed so as to substantially comply, in all material respects, with the plans and specifications submitted in support of this Application for Construction Permit.

Application for Construction Permit

Application Form

Application To
☐ fraserhealth Better health. Best in health care. ☐ Interior Health ☐ Vancouver CoastalHealth Promoting wellness. Ensuring care. ☐ island health ☐ northern health the northern way of caring

Name of Pool:	Date (dd/mm/yyyy):
Street Address:	

Contact Information

OWNER OR AGENT	Name:	
	Address:	
	Phone Number:	Email Address:
PERSON APPLYING FOR PERMIT (if different from owner)	Name:	
	Address:	
	Phone Number:	Email Address:

Owner's Confirmation of Commitment

I, _____ as owner of the above noted pool, confirm that it will be constructed in accordance with the information contained herein and according to the plans and specifications submitted with this Application for Construction Permit. No changes to the pool plans and specifications will be made unless they have been authorized in writing by the design professional and with written approval from a health officer.

Furthermore, I understand that upon completion of the pool's construction, I must provide the _____ Health Authority with the following documentation before an Operating Permit for the pool can be considered:

- A signed statement from an engineer or architect that the pool has been constructed so as to substantially comply, in all material respects, with the plans and specifications submitted under this Application for Construction Permit.
- A copy of a completed Swimming Pool Data Sheet providing detail of the pool as constructed.
- A copy of the Pool Safety Plan prepared in accordance with s.13 of the Pool Regulation.

Signature of Owner or Authorized Agent:	Date (dd/mm/yyyy):

Application for Operating Permit
Pool Inf Sheets

General Information		
Name of Pool:		
Civic Address:		
Pool Type: ☐ public ☐ commercial ☐ hot tub ☐ spray pool ☐ wading pool		☐ indoor ☐ outdoor

Owner Information	
Name (Legal):	
Address:	
Phone Number:	Email Address:

Designer Information (Append additional information for multiple designers):	
Name:	☐ PEng ☐ Architect
Company (Legal Corporate):	
Address:	
Phone Number:	Email Address:

General Pool Design Parameters (Append additional information for multiple pools):			
Pool Volume (m^3):	Pool Area (m^2): pool: deck:	Water Depth (m): min: max:	
Maximum Bathing Load (persons): Shallow: Deep: Total:		Pool Basin Colour:	Color Complies with Pool Reg ☐ yes ☐ no
Turnover (hrs):	Design Flow Rate (L/min):	Gauges (qty): pressure: vacuum: temperature:	
Flow Meter Make and Model:		Range (L/min): from: to:	
Filters: ☐ sand ☐ diatomaceous earth ☐ pressure ☐ vacuum ☐ gravity			NSF Approved: ☐ yes ☐ no
Disinfection: ☐ hypochlorite ☐ chlorine gas ☐ stabilized chlorine ☐ bromine ☐ other:			

Health Hazard Related Design Parameter **Reference to Pool Regulation (PR) and B.C. Guidelines for Pool Design (GPD)**	**Design Parameter Met**	**Initials**
The plans include a fence or other barrier around the pool and its walkways with controlled access to prevent access by animals and persons who are not pool patrons. This provision does not apply to spray pools or wading pools that are planned to be drained before dark and left empty overnight. PR s.(7)	☐ yes ☐ no ☐ n/a	
The pool design provides for the pool water to be maintained at a temperature of no more than 37°C. PR s.10(2)(b)	☐ yes ☐ no	
Disinfection equipment is designed to be capable of maintaining disinfection levels in accordance with the Pool Regulation PR s.10(2)(f) & s.10(2)(g) & Schedule 3, s.1(2)	☐ yes ☐ no	
The pool circulation system is designed so that pool water will not pass through any drain grate at a speed greater than 46 cm per second when the pool is operating at the design flow rate. PR s.10(2)(k) or waiver obtained under s.10(3)	☐ yes ☐ no	
The pool design allows for water to be circulated through the skimmers or gutters at a rate of flow at least equal to 50% of the design flow rate. PR s.10(2)(j)	☐ yes ☐ no	
The pool circulation system is designed so the water circulation rate (pool turnover) will substantially comply with the GPD. GPD – Water Circulation	☐ yes ☐ no	
The pool design substantially complies with the Pool Regulation and the GPD for the prevention of entrapment or suction hazards. PR s.10(2)(k) or waiver obtained under s.10(3); GPD – Main Drain and Suction Entrapment Hazards & Other Entrapment Hazards.	☐ yes ☐ no	
The pool design allows for sufficient lighting so that all areas are visible to pool patrons, lifeguards, and operators. PR s.11(2)(a); GPD – Natural and Artificial Lighting	☐ yes ☐ no ☐ n/a	
All pool aprons, walkways and floors have a surface that is slip-resistant when wet, and slopes away from the pool such that, when the aprons, walkways and floors are wet, water does not accumulate or flow back into the pool PR s.11(2)(c) The friction coefficient of tiled surfaces specified for installation in and around the pool is _____ (static/dynamic), and will meet best practice guidelines referenced in the GPD with respect to being non-slip when wet. GPD – Flooring	☐ yes ☐ no	
The design requires that the nose of any step or ledge in the pool is marked in a contrasting colour to the remainder of the step or ledge PR s.11(2)d	☐ yes ☐ no	
The design provides for secure handrails at steps, ladders and diving boards. PR s.11(2)(e)	☐ yes ☐ no	
The design includes pool depth markings in accordance with the requirement of the Pool Regulation PR s.11(2)(f)	☐ yes ☐ no	
The design includes controls that will allow for regulating hot water temperature in pool facilities to no more than 49°C. PR s.11(2)(g)	☐ yes ☐ no	

Health Hazard Related Design Parameter Reference to Pool Regulation (PR) and B.C. Guidelines for Pool Design (GPD)	Design Parameter Met	Initials
The pool design provides for, where applicable, hot tub water to be maintained at a temperature of no more than 40°C. PR s.16(b)	☐ yes ☐ no ☐ n/a	
The filters are designed to provide proper filtration of the water at maximum flow rates as per the GPD. GPD - Filtration	☐ yes ☐ no	
The design incorporates a pool basin surface, that when filled with water, will be light in colour and have a light reflectance value of at least 60%, measured according to ASTM C609-07 standard to substantially comply with the Pool Regulation and the GPD. PR s.3(a); GPD – Pool Basin Colour and Patterns	☐ yes ☐ no	
All diving boards and poolside play equipment are designed and located in accordance with applicable standards referenced in the GPD. GPD – Play Equipment	☐ yes ☐ no	
Backflow preventers are provided in all areas necessary to prevent cross contamination between the potable water supply, pool water and wastewater lines. GPD – Cross Connection Control (AWWA Canadian Cross Connection Control Manual)	☐ yes ☐ no	

Design Professionals

The design professional responsible for each component noted in the Health Hazard Related Design Parameter Checklist above shall initial applicable row(s) as a confirmation to a statement of fact and fill in the information in the table below.

Design Professional Name	Engineer or Architect	Company	Initials

APPENDIX D: POOL DESIGN CONSIDERATIONS FOR COMMUNICABLE DISEASE PREVENTION

In light of the COVID-19 pandemic, there are additional considerations which can be incorporated into the design of pools and hot tubs to reduce the risk of communicable disease spread. Recommendations which should be considered alongside the remainder of the Guidelines for Pool Design are detailed below, with reference to the corresponding section of the Guidelines.

These recommendations are not mandatory, but may help pool facilities to maintain operational flexibility for both the short term of the COVID-19 pandemic, and in preparation against any future outbreaks of acute respiratory illness.

3.2 Decks and Deck Drains

Pool Deck

It may be advantageous to design walkways of an adequate size to allow for physical distancing (at least 2 m between patrons) where one-way food traffic cannot be implemented. If this is not possible, then it may have to be addressed in the Pool Safety Plan or Operating Plan.

Note that any markings for social distances/one-way traffic must not cause a slipping hazard, nor should they obstruct safety signs. Any signage designating 2 m distances should be implemented with care to not cause confusion with pool water depth.

Reduced Walkways

Physical distance requirements (at least 2 m between patrons) should also be considered. Refer to 3.2 Decks and Deck Drains – Pool Deck for more information.

3.3. Flooring

Flooring should allow for easy and thorough disinfection, in addition to cleaning.

3.5 Diving Boards and Platforms

Surfaces

Physical distance requirements (at least 2 m between patrons) should also be considered. Refer to 3.2 Decks and Deck Drains – Pool Deck for more information.

3.8 Spectator Seating

Physical distance requirements (at least 2 m between patrons) should also be considered. Where possible, directional markers should be provided for spectators such that walking routes are one-way only, and seaitng should be spaced or labelled/blocked to provide for adequate distancing.

5.1 Change rooms

Design of changerooms should take physical distancing requirements into consideration. Some examples:

- Where possible, design spaces such that foot traffic will proceed in one direction
- Where two-way foot traffic is unavoidable, adequate space for physical distancing (at least 2 m between patrons) should be provided
- Consider the layout of changing stalls, benches, etc. to allow for adequate personal space between patrons. Provisions for additional removable physical barriers (i.e. plexiglass) could be included to temporarily reduce interactions

5.2 Plumbing Fixtures

Drinking Water

Drinking water fountairs or water dispensing units should be easy to clean and disinfect regularly to prevent contamination. Consideration should be given to the provision of single-use disposable paper cup dispensers and a waste basket at fountains.

6.3 Air Quality, Humidity, HVAC Systems and Building Requirements

Additional Proposed Subsection: HVAC Design and Operational Considerations for Pandemic Safety

Engineering controls, specifically for changes to HVAC design and/or operation, may be considered to reduce airborne transmission of SARS-CoV-2 (the virus responsible for COVID-19) and other emerging pathogens of concern. This is supported by researchers and industry groups, including ASHRAE and AIHA (American Industrial Hygiene Association).

The most important initial consideration is to ensure that HVAC is designed and operating within its design parameters, per current ASHRAE protocol. This may require the assistance of an industrial hygiene professional.

Some specific HVAC design considerations to reduce airborne transmission of pathogens such as SARS-CoV-2 are included below. These suggestions should be considered based on risk assessments of each system, and can be added early in design, during retrofit, or in an emergency response scenario.

- Maintaining relative humidity between 40% and 60% indoors may help to limit the spread and survival of SARS-CoV-2, while minimizing the risk of mold growth, maintaining hydration and promoting healthy “mucosal clearance” of human occupants.
- Designs should promote cleaner airflow patterns which provide effective flow paths for airborne particulates to exit spaces to less clean zones and use appropriate air-cleaning systems.
- Actual air changes per hour (ACH) should be determined through on site testing (for example, using carbon dioxide meters). If ACH is inadequate (refer to ASHRAE Standard, 2019) or additional modifications are desired based on risk assessments, strategies to improve indoor air quality in the pool facility include:

- Increasing outdoor air by opening windows or setting mechanical ventilation/central air system to the maximum outdoor air ventilation rate for the system, with consideration of outdoor temperatures and conditions (for example, dampers may need to be closed during forest fires when air quality is poor).
- Use MERV13 filters (or better) on recirculated air. An HVAC designer or commissioning agent should be consulted to ensure the mechanical system can handle this filter.
- Portable air cleaner(s) with HEPA filters can be operated. The air cleaner must be appropriately sized for the room dimensions and clean air delivery rate target. An example calculator tool developed by Harvard and CU-Boulder can be found here: https://tinyurl.com/portableaircleanertool (https://docs.google.com/spreadsheets/d/1NEhk1IEdbEi_b3wa6gI_zNs8uBJjlSS-86d4b7bW098/)
- Duct- or air-handling-unit-mounted, upper room, and/or portable UVGI (ultraviolet germicidal irradiation) devices in connection to in-room fans can be installed, with appropriate shielding to prevent direct exposure to eyes. Note that UVGI systems and similar technology may require significant modification to mechanical equipment to ensure performance, and may be unreasonably complicated for many systems.

Finally, energy use should be considered when selecting mititgation strategies. Many preventative design considerations may result in increased energy usage, but control changes and energy recovery may be integrated to reduce or offset increases in energy and operating cost.

8.7 Maximum Bathing Load

For COVID-19 physical distancing, maximum bather loads may need to be reduced to allow for 2 m spacing between bathers.

Hot Tubs

Hot tubs must allow for 2 m distancing between bathers unless members of the same family/party. Therefore: bather load = total metres of linear seating space / (2 m/peson)

Tubs with diameters <4 m can only be occupied by one party at a time as they cannot provide adequate spacing for additional people.

9.2 Disinfection and Other Chemicals

As a note, there is no evidence that COVID-19 can be spread to humans through the pool water. Proper operation, maintenance, and disinfection of pools and hot tubs should inactivate the virus that causes COVID-19.

10.2 Play Equipment

Consideration should be given to the ability to disinfect play equipment, or ease of removal to prevent disease spread.

11.4 Spray Pools

Spray Deck

Physical distance requirements (at least 2 m between patrons) should also be considered. Refer to 3.2 Decks and Deck Drains – Pool Deck for more information.

11.5 Vanishing-edge Pools

Perimeter Deck

Physical distance requirements (at least 2 m between patrons) should also be considered. Refer to 3.2 Decks and Deck Drains – Pool Deck for more information.

Sources consulted:

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