Nova Scotia Operational Guidelines for Aquatic Facilities

Reducing Risk and
Promoting Healthy Recreational Water Experiences
2014

NOVA SCOTIA

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Approved by the Chief Medical Officer of Health
Nova Scotia Department of Health and Wellness
Public Health Branch
Environmental Health Division
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Background

A well-managed and constructed aquatic facility can be a great community asset for many reasons. The use of pools and the resulting social interaction, relaxation, and exercise produces health benefits, reduces chronic health issues, and increases well-being. Furthermore, they offer economic advantages including spin-offs from the tourism industry and employment opportunities across a variety of age groups. They can also be utilized as an emergency measures tool during times of extreme heat.[1]

However, improperly built, maintained and/or misused aquatic facilities can pose serious biological, chemical, and physical health hazards. Lack of operator knowledge, expertise and the development of chlorine-tolerant microorganisms have been influential in the rise in recreational waterborne illness and injury (RWII) outbreaks in the United States and Canada. RWII associated with aquatic facilities include skin, respiratory, and gastrointestinal illnesses; impact injury; drowning and near-drowning; and organ damage or loss including the bowels, both in the pool and around the pool.

The last set of full Nova Scotia Operational Guidelines for Aquatic Facilities was published in 1987. Much advancement has been made in the aquatic industry since 1987 and this guideline is intended to bridge the information gap.

Purpose and Objective

The purpose of the Nova Scotia Operational Guidelines for Aquatic Facilities is to set minimum industry operational standards for the Nova Scotia Aquatic Industry and to provide guidance to aquatic facilities' operational Aquatic Safety Plans. It is intended to assist facility owners, operators and staff to identify facility-specific hazards, and to understand roles, responsibilities and standard operating procedures that will encourage safe effective pool operation. The overall objective is to reduce and prevent patron illness, injury, and death.

The guidelines will be the standard used by the Department of Health and Wellness in an inspection of a health hazard complaint under the authority of the Health Protection Act.

The guidelines assume that the pool is designed and constructed in accordance with accepted best practice and with national and local building, fire, and electrical codes and standards and should be used in collaboration with these other codes and standards.

These guidelines are intended to be used by all owners and operators of aquatic facilities and pools (as defined in this guideline) that serve the public and include

- those connected to hotels and motels
- campground operations
- water parks
- splash pads
- municipal pools
- other recreational pool operations that are open to the public
- apartment and condominium complexes, and any other group, residential facility, or membership organization that offers the use of pools (i.g., daycare, recreation camps)

[1] http://www.cdc.gov/healthywater/swimming/health_benefits_water_exercise.html, retrieved on May 11, 2014

Background

How to use this document

Due to the variety and age of aquatic facilities in Nova Scotia and the variety of programming and features offered to the public, not all aspects of this guideline will apply to all pool operations.

Furthermore, it is understood that some pools may not be able to meet all minimum operational standards immediately. Facilities should develop a short-term and long-term plan using a risk assessment approach to upgrade facilities. Major structural changes may require a long-term plan and there may be other ways to mitigate any potential hazards until upgrades can be accomplished. Consultation with aquatic consultants and the Nova Scotia Department of Health and Wellness is recommended.

The guideline is accompanied by an Aquatic Safety Plan template. The template is a guide only; there may be a need to hire risk assessment experts to assist in identifying pool-specific hazards. A facility may choose to use another aquatic safety template that will create a similar outcome. The goal of the chosen Aquatic Safety Plan template is to assist facility owners, operators and staff in identifying pool-specific hazards, to understand staff roles, responsibilities, and standard operating procedures to ensure safe, effective pool operation.

Owners/operators of aquatic facilities can use this guideline and an Aquatic Safety Plan template to

- develop a facility-specific Aquatic Safety Plan
- ensure that staff are appropriately educated and trained
- maintain the facility in a clean and sanitary state
- maintain the water chemistry, and the circulation and filtration systems in a manner that reduces the potential for the development and spread of disease
- ensure equipment is maintained and checks are in place to prevent physical hazards, such as suction entrapment and effective operation
- educate the facility users on their role in reducing RWII
- be prepared and respond appropriately to adverse incidents including emergencies that may affect the health of facility users and the surrounding community

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Definitions

Agitated Water	An aquatic venue with mechanical means (aquatic features) to discharge, spray, or move the water surface above and/or below the venue's resting water line or, where there is no static water line, above the deck plane.
Aquatic Facility	A physical place that contains one or more aquatic venues and support infrastructure under common management.
Aquatic Feature	An individual recreational component within an aquatic venue. Examples include water mushrooms, slides, buckets, and spray guns/nozzles (see also Drop Slide, Flume, Flume Valleys or Dips, Water Slide).
Aquatic Venue	An artificially constructed or modified natural structure intended for recreation or therapy. The venue may or may not contain standing water. Water exposure may be by contact, ingestion, or aerosolization. Examples include swimming pools, wave pools, rivers, spas (including spa pools and hot tubs), interactive fountains, therapeutic pools, and spray pads.
Assistant Lifeguard	A person holding specific certifications hired by the pool owner/manager to assist (but not replace) the qualified lifeguard in the safety supervision of a swimming area e.g., slide attendant.
Authority Having Jurisdiction	An agency, organization, office, or individual that is responsible for enforcing the requirements of a code or standard, and/or for approving equipment, materials, an installation, or a procedure.
Automated Controller	A system comprised of at least one chemical probe, a controller, and an auxiliary integrated component. An automated controller senses the level of one or more water parameters and provides a signal to other equipment to maintain the parameter(s) within a user-established range.
Backflow	A hydraulic condition caused by a difference in water pressure that causes water that is not of drinking water quality (non-potable) or other liquid to enter the potable water system by either pressure against the desired flow (backpressure) or a partial vacuum (back siphonage).
Barrier	An obstacle preventing direct access from one point to another. An **enclosure barrier** is constructed to deter, prevent, or control access (by children) to an aquatic facility or aquatic venue, such as a swimming pool, wading pool, or spa. An effective barrier prevents passage over, under, or through. A **separation barrier** is constructed to control and limit, but not prevent, direct access from one area to another area within a pool enclosure. It may be permanently installed or moveable.

Definitions

Bather	A person (including staff) at an aquatic venue who has contact with water either through spray or partial/total immersion.
Bather Load	The maximum number of people allowed in the water of an aquatic venue. Bather load is not the same as occupant load, which refers to the maximum number of people that an aquatic facility can accommodate at any one time.
Bromine	An alternative disinfectant to chlorine. Chemically, both chlorine and bromine are effective for neutralizing disease causing microorganisms. *Free bromine* is bromine is not combined with ammonia, nitrogen, or other organic compounds. *Total bromine* is the sum of all active bromine.
Cleansing Shower	A shower located within a hygiene facility using warm water and soap. These showers remove fecal material, sweat, skin cells, personal care products, and dirt before bathers enter the pool.
Chlorine	A chemical that works as a sanitizer or disinfectant in pool and spa water to kill bacteria and algae, and to oxidize ammonia and nitrogen compounds that can enter the pool/spa from swimmer body wastes and other sources.
Chlorine Demand	The amount of free chlorine that is used up by contaminants as they are oxidized by chlorine.
Chlorine Lock	The inability of chlorine to act as a sanitizer or oxidant.
Code	A type of legislation that covers a body of law, and which can be an enforceable rule.
Combined Chlorine	Chlorine that existed as free available chlorine, but which has reacted by combining with organic matter and bacteria during the disinfection process. Combined chlorine is also termed combined available chlorine or chloramines. Total chlorine – free chlorine = combined chlorine.
Contaminant	A substance that soils, stains, alters, or infects another substance that it contacts or is near.
Contamination Response Plan	A plan for handling contamination from solid or diarrheal stool, vomit, and contamination involving blood.
CT Value	Representation of the concentration of the disinfectant (C) multiplied by time in minutes (T) needed to inactivate a particular contaminant. The higher the concentration of the disinfectant, the shorter the contact time required for inactivation.
Deck	Surface areas beyond the perimeter deck of the pool that are regularly trafficked and made wet by pool users.

Definitions

Diaper-aged Children	Children under 5 years of age or those that still wear diapers.
Diaper-changing Station	A hygiene station that includes a safe and approved diaper changing unit, adjacent hand-washing sink, soap and dispenser, hand-drying device or paper towels and dispenser, trash container, and disinfectant products to clean the changing surface after use.
Diaper-changing Unit	The surface of a diaper-changing station that is specifically designed and approved for diaper changing.
Disinfection	Killing of microorganisms including bacteria, viruses, and parasites. In water treatment, disinfection is achieved using a chemical (commonly chlorine, bromine, or ozone) alone or in combination with a physical process like ultraviolet radiation.
Disinfection By-product	A chemical compound formed by the reaction of a disinfectant, such as chlorine, with material, such as natural organic matter or nitrogen-containing waste from bathers in a water system, such as a pool or water supply.
Drug Identification Number (D.I.N.)	A number provided by Health Canada that ensures labeling and supporting data have been provided and the product has undergone and passed a review of its formulation, labeling, and instructions for use.
Drop Slides	Slides of various configurations that drop the rider into the water from some height above the water rather than entering at pool water level.
Evisceration/Disembowelment	When suction draws out the intestines and organs.
Filtration Rate	The flow rate of water through a filter. Flow rate is expressed in litres/minute/square metre or gallons/minute/square foot of effective filter area.
Flat Water	An aquatic venue in which the water line is still except for movement created by users.
Flow Meter	A device that measures the rate of flow of a substance through a conduit.
Flume	Deep riding channels and vertical / lateral curves of a water slide with high water flows that accommodate riders using or not using mats, tubes, rafts, and other means of transport.
Flume Valleys or Dips	A specific part of a water slide designed to create an external force to propel the rider to a higher elevation prior to continuing down the flume.
Free Available Chlorine (FAC)	The portion of total chlorine that has not combined with ammonia, nitrogen, or other organic compounds and is available as the effective disinfectant.

Definitions

Hand Wash Station	A sink equipped with soap dispenser, hand drying device or paper towels and dispenser, and trash receptacle.
Hygiene Facility	A structure or part of a structure that contains a toilet, shower, diaper change table, hand wash station, and dressing capabilities serving users at an aquatic facility.
Hygiene Fixtures	All components necessary for hygiene facilities including plumbing fixtures, diaper-changing stations, hand wash stations, trashcans, soap dispensers, paper towel dispensers or hand dryers, and toilet paper dispensers.
Hydrochlorous Acid	A compound (HOCl) formed when any chlorinating product is dissolved in water. This is the most active sanitizing from of chlorine. Its dissociation in water into H+ and OCI- depends on the pH of the water.
Hypochlorite Ion (OCI)	The anion formed from the ionization of hyperchlorous acid.
Hyperbromous Acid	A chemical compound (HOBr) that acts as a sanitizer in water. It also kills algae.
Increased Risk Aquatic Venue	An aquatic venue whose intrinsic characteristics and intended use increases the risk to the health and safety of users because of increased risk for fecal contamination from diaper-aged children in venues including wading pools or the use of a venue, such as a therapy pool/spa, by people that may be more susceptible to infection, such as therapy patients with open wounds.
Inlets	Wall or floor fittings where treated water is returned to the pool.
Lifeguard	A professional person, with specific training and certification, hired to supervise people in an aquatic environment.
Lifesaver	A non-professional person with training and skills to assist another in an emergency.
Lifeguard Supervision	The deliberate and conscious act of observing facility users to ensure the lifeguard is immediately aware of any life-threatening behaviour or injury.
Lockdown	Refers to circumstances where workers shall not put themselves in conditions where a piece of equipment could be inadvertently started or where there is possible release of electrical, kinetic, or stored energy, chemicals or hazardous substances, risk of engulfment by water or other means, or other dangerous situations. The requirement in these circumstances is that the worker has effectively de-energized or locked-out the equipment and placed a physical lock on the control point.

Definitions

Manual Disinfectant Feed System	Disinfectant delivered by a flow-through erosion feeder or metering pump without the use of an automated controller.
Mg/L	Milligrams per litre, the equivalent metric measure to parts per million (ppm).
Monitoring	The regular and purposeful observation and checking of systems or facilities and recording of data, including system alerts, excursions from acceptable ranges, and other facility issues. Monitoring includes human and electronic means.
Movable Floors	A pool floor whose depth can be varied in a controlled way.
Occupant Load	The total numbers of the users in the water and on the dry deck, pool deck, and perimeter deck of the aquatic venue. Occupant load is used to determine the number of toilets, sinks, and diaper-changing stations.
Oocyst	A thick-walled, environmentally resistant form of sporozoan parasites, such as Cryptosporidium, that is released in the feces of infected animals, which allows the transfer of the parasite to a new host to establish another infection.
Oxidation	The process of changing the chemical structure of water contaminants by increasing the number of oxygen atoms or reducing the number of electrons of the contaminant. Oxidation can alter or inactivate the contaminant, or remove it from the water. Essentially, it is a chemical cleaning of pool water. Oxidation can be achieved by common disinfectants, such as chlorine, bromine, and ozone, and by oxidants like potassium monopersulfate.
Oxidation-Reduction Potential	The measure of the tendency for a solution to gain or lose electrons. A higher (more positive) reduction potential indicates a more oxidative solution, but is not a measure of disinfectant concentration.
Oxidizer	A substance capable of increasing the number of oxygen atoms or reducing the number of electrons in another chemical.
Ozone	A gas consisting of three oxygen atoms (O_3).
Ozone Generator	A device that produces ozone.
Patron	A bather or person at an aquatic facility who may or may not have contact with venue water either through partial or total immersion. Patrons may not have contact with venue water, but could still be exposed to potential contamination from the aquatic facility.

Definitions

pH

An abbreviation for 'potential of hydrogen'. pH is a numerical measure of the acidity or alkalinity of a solution, measured on a scale of 0 to 14, with each increment representing a 10-times change in concentration of hydrogen ions (protons). Neutral solutions (such as pure water) have a pH of 7. If pH is higher than 7.0, the water is basic, or alkaline. If the pH is lower than 7.0, the water is acidic. As pH is raised, the effectiveness of chlorine-based disinfectants decreases.

Plumbing Fixtures

Fixture or devices for the distribution and use of water. Examples include toilets, urinals, showers, and hose bibs.

Potassium Monopersulfate ($KHSO_5$)

A solid oxidizer used to prevent the accumulation of contaminants in pool and spa water.

Pool

A subset of aquatic venues designed to house water for the total or partial immersion of bathers. Pools can further be characterized as follows.

Swimming Pool is a structure containing a pool of water greater than 60 centimetres (24 inches) at its greatest depth, which is used for recreation (including receiving pools), healing, therapy, or other similar purposes. A swimming pool includes all buildings and equipment used in connection with the actual water enclosure. The following are not included in the guideline definition of swimming pool:

- a pool constructed for the use of a single family dwelling unit and used only by the owners and their guests, unless the structure is operated as a business
- a pool that is drained, cleaned, and filled after each use by each individual

Flow through pool is an aquatic venue in which water cleanliness is maintained by introducing a continuous flow of fresh, clean, and treated water to the pool and discarding the out-flowing water.

Portable Pool is a swimming pool that can be moved to various locations for temporary public use.

Wading Pool is a structure containing a pool of water that is 60 centimetres (24 inches) or less in depth throughout, which is used for recreation or similar purposes. The definition does not include a wading pool that is constructed for the use of a single family dwelling unit and used only by the owners and their guests.

Water Spray Ground, Pad, or Splash Pad is a stand-alone structure onto which water is sprayed and recirculated or released, but does not accumulate as standing water, and all building and equipment used in connection with it. The structure is used for recreation or other similar purpose. It means no standing water; features include those that spray bathers with recirculating water.

Water Park is an aquatic facility that consists of recreational water slides, flumes, other water features, and associated receiving pools.

Whirlpool/Spa/Therapeutic is a swimming pool that contains water at a temperature above 30°C that is designed primarily for therapeutic or recreational use. This swimming pool

- is not drained, cleaned, and refilled before use by each individual
- utilizes hydro jet circulation and/or air induction bubbles
- may include, but is not limited to, hydrotherapy, air induction bubbles, and recirculation

Leisure Rivers are manufactured streams in which the water is moved by pumps or other means of propulsion to provide a river-like flow that transports bathers over a defined path that may include water aquatic features and play devices.

Perimeter Deck The hardscape surface area immediately adjacent to and within 4 feet (1.22 m) of the edge of the swimming pool.

Perimeter Gutter System An alternative to skimmers for the removal of surface water. The gutter provides a level structure along the pool perimeter versus the intermittent skimmers.

Pool Deck Surface areas serving the aquatic venue, beyond perimeter deck, which is expected to be regularly trafficked and made wet by bathers.

Qualified Lifeguard A person who has a completed a lifeguard training course offered by a training agency and who has met the pre-service and continuing in-service requirements of the aquatic venue and the training agency.

Qualified Operator A person who meets the requirements specified in the Nova Scotia Operational Pool Guidelines.

Receiving Pool A pool or designated section of a pool located at the exit of one or more water slide or flumes. The body of water allows termination of the slide motion and provides an exit to a deck or walkway area.

Recirculation System The combination of the main drain, gutter or skimmer, inlets, piping, pumps, controls, and surge tank or balance tank, which recirculates pool water between the pool and the treatment systems.

Responsible Supervisor An individual responsible for water treatment operations when a Qualified Operator is not on-site at an aquatic facility.

Definitions

Rinse Shower	A shower typically located in the pool deck area with ambient temperature water that serves to remove dirt, sand, or organic material prior to entry to the aquatic venue.
Sanitize	Reducing the number of microbes to a level considered safe by public health standards. This may be achieved through a variety of chemical or physical means including chemical treatment, cleaning, and drying.
Saturation Index	A mathematical representation or scale representing the ability of water to deposit calcium carbonate, or dissolve metal, concrete, or grout.
Secondary Disinfection Systems	Disinfection processes or systems that are optional and not required at an aquatic venue for health and safety reasons. They may be used to enhance overall system performance and improve water quality.
Skimmer System	A device located at periodic locations along the top of the pool wall for removal of water from the pool surface for treatment.
Spray Ground	Also commonly referred to as spray pads or splash pads, these are specific areas consisting of the play surface, spray features, and drains that patrons stand on and are sprayed with water.
Surge Capacity	The storage volume in a surge tank, gutters, and plumbing lines.
Surge Tank	A storage vessel within the pool recirculation system used to contain the water displaced by bathers.
Total Chlorine	The sum of free and combined chlorine.
Turnover Rate	The period of time (usually in hours) required to circulate a volume of water equal to the pool or spa capacity.
Water Slides	An attraction having a configuration that enables users to slide from an elevated height to a pool. A water slide must consist of one or more flumes, landing areas, receiving pools or slide run-outs, and facilities for the disinfection and chemical treatment of the water
Water Quality Testing Device	A product designed to measure the level of a parameter in water, which comprises a device or method to provide a visual indication of a parameter level, and which may include one or more reagents and accessory items.
Water Replenishment System	A way to remove water from the pool as needed and replace with make-up water to maintain water quality.

Section 1: Community Benefits and Hazards of Aquatic Facilities

1.1 Community Benefits of Aquatic Facilities [2,3]

Evidence clearly indicates that the benefits of accessible aquatic programs that target all age groups, socioeconomic populations, and at risk populations including those with chronic illness will and can be a major tool for a healthy community. Swimming pools, spas, and therapeutic pools contribute greatly to the physical, mental, social, and rehabilitation wellbeing of the individual and therefore the community.

Pools, pool features, and water parks also offer employment opportunities across a variety of age groups for both the local and tourism industry. Providing a professional, safe and positive aquatic experiences for our visitors is a key component of a robust tourism industry.

As Canada's Ocean Playground, our province is rich in accessible water in the form of the ocean, lakes, streams, and rivers. We spend much professional and leisure time enjoying these bodies of water. Many Nova Scotians are also keenly aware of the dangers water may present and the need for accessible learn-to-swim programs that are often delivered in our community pools.

2 http://www.cdc.gov/healthywater/swimming/health_benefits_water_exercise.html#seven
3 European Conference on Evidence Based Aquatic Therapy-Bringing Research to Practice
Ben Waller, MSc, University presentation at the 2013 World Aquatic Health Conference

Section 1: Community Benefits and Hazards of Aquatic Facilities

Aquatic facilities can also offer a variety of other features and programs to individuals of all ages. Additional programming include competitive swim and diving opportunities, fitness classes including maternity aqua classes, rehabilitation classes for sport and other injuries, and classes specifically geared for the very young, seniors, and those that suffer from chronic illness. These programs contribute to the physical and emotional well-being of the community by decreasing depression and anxiety, improving overall mood, as well as encouraging family and social connections. Doctors Nova Scotia has stressed the role physical activity plays in healthy development, increased bone density, and chronic disease prevention including cancer, type 2 diabetes mellitus, and heart disease. Physical activity provides an increase in energy and leads to a more productive life. It decreases stress, promotes social interaction, and extends independence with advancing age..[4,5]

A 2003 aquatic study compared water exercise with other forms of exercise and found swimmers had lower mortality rates than those who were sedentary, walkers, or runners. It also noted that swimming, water jogging, and aqua aerobics are lifetime physical activities that provide many health benefits comparable to those of walking and running.[6]

A recent report for Recreation Nova Scotia and Sport Nova Scotia entitled *The Cost of Inactivity in Nova Scotia*, chronicled the cost of physical inactivity including medical intervention and premature death.[7] Inactivity costs the Nova Scotia health system an estimated $107 million in direct health care expenditures and costs the Nova Scotia economy an additional $247 million each year in indirect productivity losses due to premature death and disability. The report provides support that living a physically fit life extends the lifespan and allows for a healthier and fuller life. As summarized in the report, "regular physical activity also protects against obesity and assists weight control; fosters development of healthy muscles, bones, and joints; increases strength and endurance; improves behavioral development in children and adolescents; and helps maintain function and preserve independence in older adults."

Understanding the benefits of physical activity and the costs of physical inactivity, the Government of Nova Scotia has committed to healthy public policy through a variety of healthy living initiatives including those dedicated to developing a childhood obesity prevention strategy that focuses on healthy eating and physical activity for our youth, with the goal of a healthier and happier population, leading to a reduction in chronic illness.[8] Included in this program is the encouragement of youth access to a variety of physical activities and facilities including those associated with aquatics.

Pool owners, operators, and recreational facility program developers should be supported and encouraged to promote the health benefits of aquatic activity.

> Equally important, swimming and other water activities are fun! Linking fun with long-term health benefits can only be a win.

4 Doctors Nova Scotia. Retrieved from the www on Dec. 12, 2013 at http://www.doctorsns.com/en/home/issuesadvocacy/healthpromotion/physicalactivity.aspx

5 PHAC, http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/pa-ap/02paap-eng.php

6 Chase, Nancy L; Sui, Xuemei; Blair, Steven, *Swimming and All-Cause Mortality Risk Compared With Running, Walking and Sedentary Habits in Men.* International Journal of Aquatic Research and Education, 2008, 2, 213-223 retrieved from the www on December 6, 2013 at http://journals.humankinetics.com/AcuCustom/Sitename/Documents/DocumentItem/16059.pdf

7 Colman, Ronald PHD GPI Atlantic, *The Cost of Physical Inactivity in Nova Scotia* retrieved from the www on December 6, 2013 at http://www.recreationns.ns.ca/wp-content/uploadhere/2012/05/Physical-Inactivity-Report1.pdf

8 Thrive! A plan for a healthier Nova Scotia retrieved from the www on December 6, 2013 at https://thrive.novascotia.ca/files/Thrive-May30-2012-Web.pdf

1.2 Aquatic Hazards and Risks

Aquatic-related hazards include physical, chemical, and microbiological hazards and their associated effects, which are collectively termed recreational water illnesses and injuries (RWII). These hazards and any potential risks depend on many factors including pool type, pool design, special play features, pool operation, maintenance, pool supervision, dose or introduction of microbial contamination, patron behavior, and patron susceptibility.

Table 1 (below) outlines the adverse outcomes as a result of exposure to pool-related hazards. The resulting physical impacts and RWII can be mild to severe, and include death.[9]

Table 1. Adverse Health Outcomes Associated With Hazards Encountered in Swimming Pools and Similar Water Facilities.

Types of Adverse Health Outcomes	Examples of Associated Hazards
Drowning/ Near-Drowning	Swimmers under the influence of alcohol, poor swimming ability, no supervision, poor pool design and maintenance (including entrapment)
Impact Injuries	Impact against hard surfaces (e.g., diving, use of water slides, collision), treading on broken glass and jagged metal, especially in outdoor pools
Physiological	Heat exposure in hot tubs or natural spas (using thermal water) or exposure in plunge pools.
Infection	Ingestion, inhalation, or physical contact with pathogenic (disease causing) bacteria, viruses, fungi, and protozoa present in water and pool surroundings as a result of a fecal contamination, carried by patrons, animals in or near the water, or the make-up water
Poisoning and other conditions that arise from long-term exposure.	Contact, inhalation, or ingestion of chemically contaminated water, ingestion of algal toxins, and inhalation of chemically contaminated air

Preventing recreational waterborne illness and injuries requires an understanding of the potential aquatic hazards and risks, followed by development of standard operating procedures, staff training, an audit system, and patron education that will encourage safe, enjoyable aquatic experiences.

9 Guidelines for safe recreational waters. Retrieved February 2011, from WHO Water Sanitation and Health: http://www.who.int/water_sanitation_health/bathing/bathing2/en/index.html

1.2.1 Microbiological hazards

Microbial illnesses and infections are caused by bacteria, viruses, or parasites. They cause an illness or infection when patrons ingest, inhale, or physically come in contact with contaminated water. Good pool operational management includes an understanding of how these microorganisms get in the water, what conditions will promote their growth, and how to prevent either from happening. [10,11]

Table 2 (below) summarizes three different ways to consider and understand microbial hazards of recreational illness. This is not a conclusive list of microbial hazards but is intended to be illustrative.

Table 2. Microbial Hazards of Recreational Illnesses.

Fecal and Non-Fecal Microbes in Water or on Surfaces	Route of Patron Exposure	Chlorine Tolerant and Chlorine Sensitive Microbes
Spread in feces *Escherichia coli* Shigella Norovirus Giardia Cryptosporidium **Not associated with feces** Pseudomonas Legionella	**Ingestion** *E. coli* Shigella Norovirus Giardia Cryptosporidium **Contact with water** Pseudomonas **Inhalation** Legionella, Disinfection by-products	**Chlorine tolerant** Cryptosporidium Giardia **Chlorine Sensitive** *E. coli* Shigella Norovirus Giardia Pseudomonas Legionella

Non-fecal derived organisms

Organisms that do not originate from feces can enter pool water through the source water, by contamination with environmental sources like soil, plants, and leaves, or by the shedding of skin and hair from bathers. Non-fecal derived microbes have been implicated in causing dermal and respiratory illnesses. Legionella and *Pseudomonas aeruginosa* are two non-fecal derived organisms more commonly associated with hot tub or warm water venue outbreaks.[12] Ensuring a constant and minimum concentration of primary disinfectant is important in preventing the formation of populations of bacteria and algae that adhere to surfaces and grow (these are termed biofilms, and are also described as scum lines and slime layers). Effective operational management is essential in prevention of recreational water illnesses from these organisms.

[10] Yoder, H. L. (2008, Sept. 12). Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water Use and Other Aquatic Facility-Associated Health Events --- United States, 2005--2006. Retrieved Feb 24, 2011, from CDC: http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5709a1.htm

[11] Vore, Roy, PhD, National Swimming Pool Foundation, Recreational Water Illnesses, 2012

[12] Guidelines for Safe Recreational Waters. Retrieved February 2011, from WHO Water Sanitation and Health: http://www.who.int/water_sanitation_health/bathing/bathing2/en/index.html

Pseudomonas aeruginosa

Pseudomonas aeruginosa is a bacterium that is associated with untreated or poorly treated pools, fountains, splash pads, and especially hot tubs. The bacterium can cause skin rashes (hot tub itch) and ear infections. The warm water of hot tubs can be an ideal environment for this bacterium to thrive and multiply. *P. aeruginosa* is very common on skin, hair, and in soil, plants, water and leaves. If disinfection is insufficient or absent, *P. aeruginosa* can grow rapidly in a hot tub. It readily adheres to the hot tub surface and forms a slimy coating. Within the biofilm the bacteria are very resistant to chemical disinfectants. Many bacteria form biofilms. In an environment like a hot tub or pool, elimination of biofilms requires scrubbing of the surface followed by disinfection. An estimated 65% of human bacterial infections in aquatic facilities involve biofilms.[13]

Pseudomonas infection via contact with contaminated water causes a rash that can take a few days to show up and can last up to 8 days. The delay in appearance can prevent the infection from being linked to the pool water. *P. aeruginosa* also causes a painful ear infection known as swimmer's ear (otitis externa). *P. aeroginosa* is an opportunistic pathogen, meaning it can cause illness in someone who is more susceptible, such as someone with an undeveloped or weakened immune system. Infants, the elderly and those already ill can be at increased risk.

Legionella

Legionella is a naturally found bacterium that also thrives in warm water, such as hot tubs. Hot tubs that are not cleaned and disinfected effectively may become contaminated with Legionella. A person can become infected by inhaling Legionella-laden water droplets in the mist from steam of a contaminated hot tub. The infection will present as Legionnaire's disease, a serious and sometimes lethal pneumonia, or Pontiac Fever, an influenza-like illness.[14] Legionella can also be found in cooling towers, plumbing systems, and decorative pools or fountains.[15]

"The conditions in hot tubs are optimal for Legionella growth, especially when compared to the lower temperature of pools. The vigorous aeration in hot tubs, coupled with the proximity of the head to the mist zone, facilitates the efficient transfer of infective droplets into the lower respiratory tract via inhalation".[16]

[13] National Swimming Pool Foundation, Pool & Spa Operator Handbook, p. 84.

[14] Centers for Disease Control and Prevention. Legionellosis. MMWR 2011;60:1083-1086. Retrieved 08 20, 2011, from CDC: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6032a3.htm?s_cid=mm6032a3_e

[15] CDC. (2011, August 23). *Legionella.* Retrieved July 2011, from CDC Healthy water Swimming RWI: http://www.cdc.gov/healthywater/swimming/rwi/illnesses/legionella.html

[16] Vore, D. R. (2011). Aquatics Consultant Specializing in Public Health. *Recreational Waterborne Illness: A 2011 Comprehensive Review*, (http://www.ciphi.ns.ca/halifax2011/RoyVore.html). Halifax.

Fecal-derived organisms

Fecal-derived organisms originate in the gastrointestinal tract of humans and other warm-blooded animals. They cause gastrointestinal illnesses, such as diarrhea, and sometimes vomiting. Once ill, the individual excretes the organisms in their feces including formed stool and diarrhea. If pool patrons ingest the contaminated water they can become ill. An example microorganism is *E. coli*, especially a subtype designated 0157-H7, which can cause an infection that can destroy the function of the kidney and, at its most serious, be lethal. Fortunately, in water *E. coli* is easily killed by minimum level of disinfection. Another example is the protozoan Cryptosporidium. When present as a resistant form called an oocyte, it is not easily killed and is considered chlorine tolerant.

Preventing the spread of these microorganisms includes not swimming when ill, especially if the illness involves diarrhea, bather hygiene including a pre-swim cleansing shower, hand washing, sound operational procedures and policies including incident release plans, and consistent and constant minimum disinfection/pH level.

Chlorine-tolerant and chlorine-sensitive organisms

Not all organisms respond to chlorine disinfection the same way (Table 3, below). When chlorine disinfectant is maintained in the entire pool at the minimum level of 1 part per million (ppm; mg/L) it takes less than 1 minute to kill *E. coli 0157:H7.* But the same concentration can take over 10 days to kill *Cryptosporidium.*

Table 3. Chlorine Susceptibilities of Various Microbes.

Chlorine Disinfection Timetable[17]	
Agent	Disinfectant Times for Fecal Contaminants in Chlorinated Water
***E. coli* 0157:H7 (Bacterium)**	less than 1 minute
Hepatitis A (Virus)	approximately 16 minutes
Giardia (Parasite)	approximately 45 minutes
Cryptosporidium (Parasite)	approximately 15,300 minutes (10.6 days)
Notes:	• 1 mg/L (1 ppm) free available chlorine at pH 7.5 and 25° C (77° F) • These disinfectant times are only for pools that do not use chlorine stabilizers, such as cyanuric acid. Disinfection times would be expected to be longer in the presence of a chlorine stabilizer.

Recent studies in the United States and outbreaks in Canada have highlighted the increasing concern and health effects of chlorine-tolerant microorganisms like Cryptosporidium. These same studies highlight the effects of poor pool management.

[17] http://www.cdc.gov/healthywater/swimming/pools/chlorine-disinfection-timetable.html

Cryptosporidium

Cryptosporidium is a microscopic parasite that can cause cryptosporosis in humans. Symptoms include stomach cramps or pain, dehydration, nausea, vomiting, fever, and weight loss. The severity of the symptoms will depend on the age and the health of the individual. Young children and pregnant women may be more susceptible to dehydration and those with severely weakened immune systems are at risk for more serious disease and even life-threatening illness.[18]

Cryptosporidium is found in the intestinal tract of infected humans and animals. It can be introduced into the pool as a result of the source water being contaminated and by a bather infected with the parasite who has a diarrheal fecal accident in the pool or who does not take a pre-swim cleansing shower. Oocysts in the water can be ingested, which leads to illness.

When Cryptosporidium is introduced into a pool it will take a residual of 20 mg/L of chlorine12.5 hours or a combination of a quality ultraviolet (UV) system plus an increased level of chlorine residual hours to effectively kill the oocyts.[19] The chlorine resistance of the oocyte form of Cryptosporidium can overwhelm even a well-balanced pool if an accidental diarrheal release of oocytes occurs increasing the risk of exposure to multiple bathers. Once in the water, the protozoan parasite can be ingested by another pool patron if pool water is swallowed. The following precautions should be in place:

- The source water should be approved and safe for use.
- An effective response plan for accidental release of diarrhea or formed stool should exist and be ready to put into action.
- The pool should always operate with a well-designed and maintained circulation and filtration system capable of effectively removing oocytes, or a combination of effective circulation, filtration, and other technologies (e.g., UV) found to be effective against oocytes.
- Pool patrons should be educated on good hygiene practices and instructed not to consume the water.

Giardia

Giardia is another protozoan parasite that is somewhat chlorine resistant. It takes up to 25 minutes in a pool with 2 mg/L of free available chlorine and with a pH of 7.5 to kill Giardia. Giardia also causes a gastrointestinal illness that is associated with contaminated source water, poor bather hygiene, and the release of formed stool and diarrhea contaminated with Giardia. When considering a policy concerning minimum chlorine residual, a convincing argument can be made to maintain a minimum chlorine residual of 2 mg/L in venues that are at increased risk of fecal contamination, such as those used by young children.

[18] http://www.cdc.gov/parasites/crypto/gen_info/infect.html
[19] CDC & MMWE. (2007, July 27). *Cryptosporidiosis Outbreaks Associated with Recreational Water Use--Five States.* Retrieved 03 21, 2011, from MMWR, CDC: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5629a1.htm

Norovirus

Norovirus is a highly contagious virus that can be transmitted from person to person and through ingestion of contaminated food and water or contact with contaminated surfaces. The resulting stomach or intestinal infection causes stomach pain, nausea, vomiting, and diarrhea. Norovirus illness can be serious, especially for young children and older adults whose immune systems are less able to combat the infection. Norovirus is readily inactivated in treated water and is therefore considered chlorine sensitive. If a pool is effectively managed, a norovirus outbreak should not be expected. Effective pool management includes ensuring that hand washing and baby change stations are available and effective surface cleaning and disinfection practices, including how to clean and disinfect a vomit accident, are in place.[20]

E. coli 0157-H7[21]

The gastrointestinal illness resulting from the consumption of water or food contaminated with *E. coli 0157-H7* can range from mild to severe. The latter can be life threatening and can cause permanent kidney malfunction in young children and those with a weakened immune system. Fortunately, the bacterium has been well-studied and is very susceptible to chlorine; death of this organism occurs in less than 1 minute in properly chlorinated and balanced pools.

Hepatitis A

Hepatitis A is a virus that infects the liver. The virus can be spread by consumption of food and water contaminated with infected feces. The virus is easily killed within 16 minutes in a properly managed pool with a minimum chlorine residual of 1.0 mg/L and a pH within the appropriate range.

Shigella[22]

Bacteria in the genus Shigella can cause an infection termed shigellosis. Depending on the health of the affected individual, diarrhea that can be bloody due to bacterial damage of the intestinal lining, fever, and stomach cramps lasting 5 to 7 days can develop. Shigella is present in the diarrheal stools of infected persons while they are sick and for several weeks after they have recovered. So, even though a person may appear well, they can still spread the infection. Water may become contaminated with Shigella from contaminating sewage or from a bather. The latter is especially important in venues having splash tables or untreated wading pools, or in shallow play fountains used by daycare centres. Patrons can be exposed through ingestion of contaminated water.

Other

Other disease-causing microorganisms that do not cause recreational water infections but are still notable include several fungi that cause athlete's foot and human papillomavirus, which causes plantar warts, since these can be spread from contaminated surfaces to the bare feet of pool bathers and patrons. Regular cleaning and disinfection of decks and locker room floors will reduce these infections.

> This is not an exhaustive list of recreational waterborne illnesses. Further information is readily available. See additional resources in the appendix.

[20] http://www.cdc.gov/norovirus/about/overview.html
[21] Vore, Roy PhD, Recreational Water Illnesses, NSPF retrieved on January 11, 2014
[22] http://www.cdc.gov/nczved/divisions/dfbmd/diseases/shigellosis/#tips. Retrieved on January 11, 2014

1.2.2 Chemical hazards[23]

Chemical hazards associated with pools can be divided into two broad categories. The first includes chemicals used in and around the pool, and involves chemical spills, burns, and reactions from improper chemical storage and handling. The second category includes chemicals found in source water or compounds created as result of chemical reactions in the pool including disinfection by-products. The hazard from these compounds comes from inhalation, contact with skin, and ingestion.

Chemical (Disinfection) by-products (chloramines)

The oxidation of waterborne organic compounds by chlorine or other compounds is complex and can lead to the creation of disinfection by-products during treatment of aquatic water. Organic compounds find their way into the pool from the source water, bather waste (e.g., hair, bacteria, blood, soap residue, feces, urine, sweat, skin cells, saliva, vomit, and make-up), and environmental sources (e.g., dirt, bird droppings, pollen). When the contamination is high, new chemical bonds can form in the water, which often results in the creation of chloramines. Chloramines are volatile and are readily released into the air, creating the well-recognized chlorine smell. This aeration occurs as a result of bather use (splashing of water) and water-play features and air jets. The chloramines can accumulate in the air in an indoor aquatic venue. Health effects associated with their inhalation in the short-term and long-term are only beginning to be characterized for the aquatic environment.[24,25,26]

Known health effects from chloramine exposure in swimming pools or hot tubs can include eye irritation, throat irritation, nausea, and light-headedness. Asthmatics can be prone to asthma attacks.

The presence of chloramines is a consequence of a high contamination load due to

- poor pool operation and maintenance
- patron unhygienic behavior (contamination load)
- water aeration (play features, spraying water)
- improper or ineffective ventilation
- a combination of all[27]

With the recent popularity of large indoor public swimming pools with added features, such as wave action, slides, and spray features that agitate the water and the high bather loads adding to the contamination burden, indoor air quality is an increasingly important health concern.

[23] WHO, *Guidelines for Safe Recreational Waters.* Retrieved February 2011 www.who.int/water_sanitation_health/bathing/bathing2/en/index.html

[24] LaKind JS, R. S. (2010). *The good, the bad, the volatile: can we have both healthy pools and healthy people.* Enviro Sci Technology , 44(9):3205-10

[25] Weisel CP, R. S. (2009). *Childhood Asthma and environmental exposures at swimming pools: state of the science and research recommendations. Environmental Health Perspective* , 117(4):500-7.

[26] Zwiener C, R. S. (2007). *Drowning in Disinfection by-products? Assessing Swimming Pool Water. Environ Sci Technology*., 42:(2)363-72.

[27] Yoder, H. L. (2008, Sept. 12). *Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water Use and Other Aquatic Facility-Associated Health Events --- United States, 2005--2006.* Retrieved Feb 24, 2011, from CDC: http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5709a1.htm

1.2.3 Physical hazards

Public swimming pools can present several physical hazards for users and workers. These include drowning, near-drowning, fall impact injuries, and injuries resulting from improperly designed and poorly maintained water circulation systems. The latter can result in swimmer entrapment and bodily injury. Maintenance and operational staff can also be at risk.

Anti-entrapment concerns

In June 2002, 7-year-old Virginia Baker became stuck to a hot tub drain and was unable to pull herself free. Efforts by her mother to pull Virginia from the drain proved unsuccessful. Two men who eventually freed the young girl pulled so hard that the drain cover broke from the force. Virginia died from drowning, but the real cause of her death was suction entrapment due to a faulty drain cover. Her mother became a strong advocate for aquatic safety that resulted in the Pool and Spa Safety Act (Virginia Grahame Baker act) in the U.S. This act specifically addresses the hazards associated with the drains that are part of the circulation system of swimming pools and hot tubs.[28] The concerns that prompted this act in the U.S. exist in Nova Scotia. Pool designers, owners, and operators shall use effective pool design, operation including pool specific hazard identification and equipment maintenance to reduce the risk of these physical hazards. These procedures and protocols shall be clearly outlined in the Aquatic Safety Plan.

Drowning and Near-Drowning

Drowning, near-drowning, and secondary drowning can occur in seconds in very shallow water, and is often silent. Pool operators can reduce the risk of drownings/near-drownings in a number of ways. The list, which is not exhaustive, includes

- ensuring that barrier gates/doors, guard rails, depth markings, warning signage, and pool decks are maintained to prevent tripping and other injuries
- ensuring the aquatic facility has had an up-to-date risk assessment to determine the need and level of supervision
- consider use of new technologies, such as computer motionless sensor technologies, to assist lifeguards
- ensuring emergency response procedures have been developed and include communication plans, emergency phone/signal, emergency shut off valves, and appropriate first aid
- ensuring emergency rescue equipment is accessible to bystanders
- ensuring that all staff are trained in water safety and patron rescue
- patrons/bathers can help reduce the risk of drownings by participating in recreational water activity consistent with their swimming ability, using flotation devices if a non-swimmer and for specific water-related activities, and learning how to swim

[28] Commission, T. U. (2011). *Who is Virginia Graeme Baker?*. Retrieved August 4, 2011, from Pool Safety (The U.S. Consumer Product Safety Commission): http://www.poolsafely.gov/pool-spa-safety-act/virginia-graeme-baker/

1.3 Hazard Mitigation – Aquatic Safety Plans

Hazards and risk are a part of everyday life. The key is identifying the hazard and taking steps to minimize or eliminate the risk where needed, which is the intent of an Aquatic Safety Plan. Potential hazards vary as do the levels of risk depending on many factors including the specific pool design, operation, staff education, patron hygiene compliance, patron swim ability, and any special pool features.

Operational daily inspections, risk assessment and hazard mitigation includes

- routine pool management
- emergency or incidence response management

A venue's specific Aquatic Safety Plan is intended to combine both of these by encouraging development of policy and procedures for routine pool management and for emergency (incident) response with the goal of preventing recreational waterborne illness and injury (RWII) and ensuring a swift and effective response to emergencies that do occur. Both strategies seek to prevent illness and injury, while promoting safe, healthy, and fun recreational experiences.

Risk Management and Assessment

Risk management and assessment involves a variety of factors in all aspects of the aquatic programming and services, as well as the physical facility. Depending on the organization, help of risk management experts may be needed to

- identify the risks and the potential hazards
- evaluate these risks, based on the nature of the hazard and the exposure to the hazard
- manage the risks, which includes monitoring and prevention (e.g., signage)
- determine the cost of the risk management to allow the best financial decision
- determine the liability and insurance issues of the risk and related decisions
- determine if the related legal mandates (codes, best practice, regulations) are being met, at least minimally
- prepare an Emergency Response Plan

Section 2: Pool Management

2.1 Management Structure

Owner, management and employee structure, individual titles, training and responsibility needs will vary from facility to facility. But, the underlying operational and management requirements are similar.

The owner of an aquatic facility is legally responsible for the operation, maintenance, and management of the facility including ensuring employees are appropriately trained and ensuring they practice on-the-job due diligence. Aquatic facility staffing may include an owner/board, pool/facility manager, qualified operator, responsible supervisor, instruction staff, lifeguard supervisor, lifeguard, assistant lifeguard and/or play feature attendant, mechanical engineer, cleaning/sanitation attendant, and clerical staff to name a few potential titles. It is up to each facility to design the employer, management and employee structure (see Section 2.2, Staff Qualifications, Training, and Expectations). The titles of all staff (including owners) and their responsibilities, roles, required training, certifications, and required recertification need to be clearly defined, recorded, audited yearly, and recorded in the Aquatic Safety Plan.

Design of the management and employee structure should also clearly define and designate person(s) in position of authority who will be available during all open hours and at a minimum have the authority to close the pool in the case of an emergency, potential emergency, and any other incident that could occur and affect the health and safety of patrons and/or staff. (See also Appendix 7, Criteria for Immediate Closure of the Pool and Section 2.2, Staff Qualifications, Training, and Expectations)

2.2 Staff Qualifications, Training,[29] and Expectations

Rationale:

Operating a pool facility has become progressively more complex. Modern-day features including water slides, water rides, wave pools, and water spray play areas, and the advancements in pool equipment and treatment systems, and finally the emergence of chlorine-resistant pathogens, all add to this complexity. Further scientific evidence clearly shows that inadequately operated and designed pools do increase the probability of recreation waterborne illnesses[30]. Ensuring pool staff are educated and trained in the operation of the specific pool, and are available during operating hours, is essential in illness and injury prevention.

2.2.1 Pool operation

The staff of an aquatic facility or venue should include a qualified pool operator and a responsible supervisor. The qualified pool operator (see below) may be off-site and available by contractual arrangement. The supervisor shall be available on-site as described below. During pool operating hours one of these staff members shall be on-site.

2.2.1.1 Qualified operator

A qualified operator is certified as a pool operator by an industry-recognized program and is responsible for control of the pool, spa, or recreational centre operations. Operators must have a sound and demonstrable knowledge of the pool(s) safety plans, operating procedures, and hazard prevention protocols that include

- Nova Scotia Operational Guidelines for Aquatic Facilities
- the aquatic facilities' Aquatic Safety Plan
- pool plant mechanics (or have on staff or contract a designated professionally trained person)
- pool maintenance
- water chemistry
- chemical safety
- pool disinfection/oxidation requirements
- water testing
- hazard reduction strategies
- first aid
- may include life-saving and resuscitation techniques (or have on staff designated professionally trained person or personnel)

[29] Adapted with permission from the CDC Draft MOHC Operators Training Module, http://www.cdc.gov/healthywater/swimming/pools/mahc/structure-content/index.html

[30] Government of Alberta. (2006). Alberta Pool Standards. Retrieved June 2011, from Alberta Health and Wellness: http://www.health.alberta.ca/documents/Standards-Pools.pdf

2.2.1.2 Responsible supervisor

The Responsible Supervisor is an individual responsible for water treatment operations when the Qualified Operator is not on-site at the aquatic facility. This person shall

- have the authority to act in an emergency (or a person of authority is assigned this duty and is available)
- have the authority to close the venue when required (or a person of authority is assigned this duty and is available)
- be capable of testing the water quality levels as required and know how to make adjustments as needed to maintain water quality levels
- be knowledgeable regarding aquatic venue operation
- know how and when to contact the qualified operator

2.2.1.3 Contracted off-site qualified person

The Contracted off-site qualified person may replace an on-site qualified person for less complex pools, but a Responsible Supervisor shall be always available when the pool is operating.

An aquatic facility may have a contracted off-site qualified person instead of, or as well as, an on-site qualified person. The off-site individual shall meet the same criteria as the on-site person. They would be expected to make routine visits, as outlined in the Aquatic Safety Plan, to the facility, be available for consultation, and provide a written report that would be available and retained on-site and provide supervision/technical direction and advice to the on-site Responsible Supervisor.

2.2.2 Staff training

Rationale:
Depending on the size, design, features, and intent of the aquatic facility, there may be one or many part-time and full-time staff members that play very specific and sometimes general roles in the functioning of the facility. Developing job descriptions for all staff that clearly outline expected duties and the required training and on-going training required to enable the staff member to perform his/her duties safely and effectively is an essential part of pool operation and shall be recorded in the Aquatic Safety Plan.

Training shall include, but not be limited to

- Training in water safety (e.g., swim to survive), emergency procedures, first aid and CPR for appropriate pool-related staff
  - Not all staff working in a pool environment will necessarily be proficient swimmers. Lifeguards, if available, will not always be available. Staff including maintenance and cleaning personnel may be at risk of water-related injuries. Formal training, practical simulations, and regular in-servicing on the Aquatic Safety Plan and how to respond to a drowning person in a safe manner, without endangering their own life or the lives of others, is recommended.
  - Staff shall not work alone

- Orientation of all new staff shall include Aquatic Safety Plan training, orientation to the facility, and, when appropriate:
  - facility communication plan
  - facility fire safety plan
  - facility occupational and safety plan and procedures
  - cleaning and disinfection of surfaces procedures
  - injury prevention program (e.g., back care)
  - violence in the workplace
  - other facility-specific requirements
- Appropriate certification and training may also include pool operator training (see Section 2.2.1, Pool Operation)
- Lifeguard/lifesaving (see Section 8.2, Aquatic Facilities with Supervision and Lifeguards)
- Swimming and other class instruction
- Proper use of personal protective equipment
- Training in specialized first aid equipment use
- WHMIS (specialized)
- Maintenance and electrical training
- Any other identified certification and training

2.3 Aquatic Safety Plan Development

Rationale:

The intended purpose of an Aquatic Safety Plan is to protect the health of patrons and staff, and ensure the longevity of pool equipment. The goal is to develop pool-specific risk reduction/prevention policies and procedures, and describe actions to protect the health and safety of patrons and workers. Clear written operational procedures including preventative equipment/facility maintenance and cleaning, and procedures required to ensure consistent, efficient, and effective response to emergency situations that may occur are essential in the Aquatic Safety Plan. All staff shall receive continual training in the Aquatic Safety Plan.

Who should develop the Aquatic Safety Plan?

A designated team shall develop a comprehensive Aquatic Safety Plan document that is customized to the facility. Appendix 1 provides an example Table of Contents for an Aquatic Safety Plan and a Nova Scotia Aquatic Safety Plan template will be available. The designated team should include persons with aquatic venue risk assessment expertise, an experienced qualified pool operator, maintenance technicians, person(s)/organizations with lifeguard risk assessment expertise and any other essential pool staff.

> **Note:** A poorly developed plan can lead to high-risk situations for both patrons and employees. Investing in the development of a quality Aquatic Safety Plan is worthwhile and wise. Seeking the expertise of lifeguard facility planning and aquatic risk assessment specialists is recommended when developing or updating pool-specific policies and procedures. (See also Section 1.3, Hazard Mitigation - And Aquatic Safety Plans).

Other requirements include:

- All staff are required to receive formal training, participate in practical simulations, and sign-off on all facility procedures and training outlined in the Aquatic Safety Plan that is specific to them and general to all employees.
- The plan is to be reviewed and updated by the designated team as appropriate, or at least annually.
- Any additional required plans, such as the Fire Safety Plan, Occupational Health and Safety Plan, and Violence Prevention Plan can be incorporated into the Aquatic Safety Plan or maintained as separate documents.
- Plan components shall include:
  - venue description
  - job titles, descriptions, and expectations (Position Chart)
  - risk assessment – hazard identification
  - standard operating procedures for all aspects of the pool operation
  - preventative maintenance and cleaning plans of the pool including the nature and frequency of the cleaning and maintenance
  - staff training qualifications and certificates
  - procedures to be followed in the event of a serious injury, emergency, or incident (emergency response plan)
  - the type of lifesaving and first-aid equipment to be kept within the immediate vicinity of the pool(s)
  - the number of lifeguards (and assistant lifeguards) equipment and operations staff that are to be on duty while the pool is in use and, as required, specific to type of activity and pool features in use. See the recommended Table of Contents in Appendix 1, Aquatic Safety Plan Table of Contents.

2.3.1 Standard Operating Procedures

Rationale:
Qualified operators, maintenance technicians, cleaning staff, instructors, lifeguards, and other essential staff shall be provided and trained in correct operating procedures to ensure the health and safety of pool patrons as well as staff.

Recommendations:
This part of the plan shall identify and describe the procedures to be followed for all aspects of venue operation, which may include

- pool operator, responsible supervisor, maintenance qualifications, and other staff training
- worker safety (including safety for non-swimmers working in an aquatic environment)
- emergency response procedures (see also Section 2.3.5, Emergency Response and Communication Plan)
- communication plan
- proper testing of pool water chemistry
- proper adjustment of pool water chemistry
- proper backwashing of filters
- proper cleaning of hair and lint strainers
- proper priming of pumps

- filter care and maintenance
- proper application of diatomaceous earth to filters (where used)
- proper handling and storage of chemicals and equipment
- ensuring lockdown (see below) procedures are in place so no one is injured during maintenance
- ensuring written operating, maintenance, and inspection standards for all equipment including play equipment are in place (see Section 2.3.2, Preventative Maintenance)
- cleaning procedures (see Section 2.3.3, Cleaning Plan and Schedule)
- patron education and warning signs (see also Section 2.3.7, Patron Education)

This list is not exhaustive. More complex pool facilities will require more complex procedures. Where possible, pools shall keep a copy of engineering plans and/or pool drawings on-site to assist with trouble-shooting of problems.

> A clear distinction shall be made between the work done by lifeguards, maintenance staff, and custodians. It shall be clear who is responsible for which tasks.

2.3.2 Preventative Maintenance [31,32]

Rationale:
The goal of a Preventative Maintenance Plan is to help prevent costly repairs and breakdowns, and to prevent both recreational waterborne disease outbreaks and physical injuries due to faulty and poorly maintained equipment. Operators shall ensure that pools and pool equipment are kept in good repair so that no health hazards exist.

Preventative Maintenance Recommendations

As part of the Aquatic Safety Plan, a written Preventative Maintenance Plan shall be included. Staff shall be trained in the implementation of this plan. The plan shall contain

- a list of equipment needed and operational procedures the staff shall follow
- necessary equipment information:
  - an inventory of all equipment used in the pool operation
  - manufacturer's and pool designer's manuals, and recommendations for all equipment, which shall include equipment name, model number, any specs, operations manuals warranty, contact information for local vendors/supplier and technical representative
- schedule for routine preventative maintenance, and safety inspection
- daily (pre-opening), seasonal or periodic maintenance, servicing, and component replacement shall be developed based on the above information, equipment use, and any other pool-specific information including
  - assurance that nothing in the pool presents a tripping hazard to bathers, such as stairs or other physical structures in the pool water
  - assurance that all areas of the pool are sufficiently lit so that all areas are visible
  - scheduled regular testing of the function of equipment to ensure it is safe for use, and maintained in accordance with manufacturer's recommendations

[31] The USA Centre for Disease and Prevention. (2014) Model Aquatic Health Code–First Edition The Code
[32] The USA Centre for Disease and Prevention. (2014) Model Aquatic Health Code–First Edition The Code

- regular testing and maintenance of the surfaces of walkways, stairs, decks, and platforms to ensure they have not become a slip hazard as a result of becoming smooth and/or worn
- prevention of the formation of ice on walkways, steps and ladders of outdoor pools that are operated in the winter
- assurance that all handrails are securely attached
- assurance that all pool features including slides, diving boards, and Tarzan ropes are maintained to prevent injuries
- verification that the temperature of hot water outlets (including showers) is below 49°C to avoid scald injuries
- assurance that recirculation system, including disinfection equipment and filters, is functioning properly
- assurance that water depth is clearly marked in metric units of measurement
- assurance of safe storage of chemicals
- assurance that the facility is free from sharp or blunt objects that are likely to cause injury
- assurance that the facility is not deteriorating to allow bacterial or algae growth, biofilm development, or to cause injury
- regular testing of ground fault interrupters for underwater lights to prevent electrical shock (See Aquatic Safety Plan Template)

2.3.3 Cleaning Plan and Schedule

Rationale:

Developing a cleaning plan is a proactive measure that helps encourage sanitary conditions and an inviting venue for patrons, and also increases the longevity of equipment and ensures employee and patron safety.

Biofilm

A biofilm is a slime layer that develops as a result of bacteria excreting a slimy, sticky substance following their adherence to a surface. This substance acts as a barrier. Many bacteria naturally form biofilms. In nature, biofilms can contain many different species of bacteria, and may include disease-causing bacteria. Biofilms can be very difficult to remove and can confer resistance to chlorine; in fact, biofilms can be a source of chlorine consumption in the pool. Biofilms form on damp, moist, and wet surfaces, which need to be cleaned regularly. They are typical in pool water distribution systems, recirculation lines, filters, collector tanks, and swimming pools. Effective cleaning and operation of the pool and its equipment helps prevent excessive biofilm development. Removal of biofilms requires cleaning, disinfection, and scrubbing of the affected surface.

Cleaning plan

Operators shall identify appropriate cleaning schedules to ensure the health and safety of pool patrons and workers. This includes

- frequency of cleaning for each part of the pool, including pool toys
- chemicals and cleaners used, ensuring cleaner and disinfectant compatibility
- step-by-step procedures to be used to clean and disinfect, when necessary, including required disinfectant contact time and manufacturer's instructions
- any required training for cleaning staff
- any required personal protective equipment
- a lockdown procedure to ensure no one is injured during cleaning
- more complex procedures for more complex pools

A cleaning plan shall include and highlight the following:

- periodic removal of hard water scaling and body grease
- scrubbing and cleaning of all accessible surfaces as necessary to minimize the formation of slime and biofilms
- detailed standard operating procedure for cleaning and disinfection, which will include, but not be limited to
  - pool walls, floor, and pool decks
  - washrooms, showers, and change rooms
  - steam rooms and saunas
  - pool equipment and toys, such as floaties and cleaning devices
  - pool covers (where applicable)
  - transfer channels

Choosing cleaning products

Special consideration shall be given to choosing cleaning agents for in and around pools. Considerations include

- some cleaning products contain surfactants that affect the monitoring of chlorine residual and cause foaming or phosphates, which will promote algae growth
- some products may also contain oxidizing agents that cause a false reading on water test
- other compounds simply contain ammonia and could produce unhealthy pool conditions due to high chloramine levels
- cleaning products shall be kept out of the pool water and any transfer channel
- incompatibility between cleaning and pool chemicals must be avoided
- the pool area must not be cleaned when people are in the pool

Good cleaning practices include

- being appropriately trained and using appropriate personal protective equipment and lock out procedures
- maintenance of surfaces to be cleaned to ensure they are smooth, non-absorbent, and easily cleanable

- cleaning from the cleanest region to the dirtiest to reduce the risk of cross-contamination
- use of single-use cloths and cleaning equipment, such as mops and buckets, that are in good repair, replaced regularly, cleaned daily, and stored in a designated area after use in an inverted position or another orientation that promotes drying
- knowledge of detergents and disinfectants including compatibility with the surface being cleaned and disinfected, required disinfectant contact time, proper chemical handling, storage, and disposal
- availability and knowledge of all required material safety data sheets, manufacturer's instructions on equipment or surfaces being cleaned, manufacturer's instructions on cleaning and disinfectant agents, and any municipal, provincial, and federal by-laws and regulations

Cleaning frequency guidance

- Toilets, showers, changing facilities, and pool surroundings shall be cleaned and disinfected (when appropriate) at least daily.
- Hot tubs/spas shall be drained and the surfaces and pipework cleaned on a weekly basis or as needed (see Section 5.2, Wading and Spa/Therapeutic/Hot Tub Pools).
- Heating, ventilation, and air-conditioning systems shall be cleaned periodically (e.g., facility dependent).
- Features like water sprays shall be periodically cleaned, scrubbed, and flushed with disinfectant (e.g., 5 mg/L hypochlorite solution) (see Section 5, Aquatic Play Features and Other Pool Types).
- Shared equipment may include, but not be limited to, towels, bathing suits, snorkels, nose clips, goggles, fins, kickboards, tubes, and noodles. Shared equipment
  - shall be maintained in good repair
  - shall be stored in non-absorbent, easily cleanable receptacles
  - may require additional cleaning and disinfection if a communicable disease outbreak has been identified, or if there was a contamination event like a pool fouling. (Please refer to the emergency procedure sections for additional information.)

Bathing Suits and Towels
Bathing suits and towels should be washed with detergent and warm water, rinsed, and thoroughly dried at the warmest temperature in accordance with the fabric label after each use.

Equipment that comes in contact with eyes, nose, ears, and mouth (snorkels, nose clips, goggles)
The equipment shall be cleaned (scrubbed), disinfected, dried, and stored in a manner to prevent biofilm formation and biological growth.

Fins, Kickboards, Tubes, and Noodles
These shall be cleaned, scrubbed, and stored to prevent microbial growth.

2.3.4 Chemical Handling and Storage[33]

Rationale:

Chemicals commonly used in pools can be dangerous on their own, and if they are mixed with non-compatible chemicals or water the results can be dangerous and even deadly for workers, patrons, first responders, and those within the vicinity of the facility and storage area. Spills or leaks due to poor handling and storage technique or due to pipe or container corrosion can lead to chemicals reacting with other chemicals, which can lead to fire, smoke, poisonous gases, or other hazards.

> Due to the nature and volume of pool chemicals that are used and may be stored at aquatic facilities, many aquatic facilities are required to have a Fire Safety Plan as noted in the National Fire Code. This is a document that should be developed with the municipal fire inspector and can be included as part of the Aquatic Safety Plan.

Recommendations:

For each chemical, safe and appropriate handling, storage, and disposal step-by-step procedures shall be developed and documented as identified by material safety data sheets (MSDSs), manufacturer's instructions, and appropriate regulatory requirements (e.g., Nova Scotia Departments of Labour and Environment, Nova Scotia Fire Marshall's Office, Environment Canada, and any other agencies responsible for safe disposal and storage of other chemicals), and shall be reviewed for specific storage concerns and for incompatibility with other chemicals.

- A list shall be made of incompatible chemicals to provide clarity to staff and first responders.
- Concerning fire safety, a list of chemicals and where they are stored in the building shall be prepared and readily available to first responders in case of emergency.
- Every worker expected to handle chemicals shall be trained according to the requirements of WHMIS (Workplace Hazardous Material Information System) regulations. This includes generic education to enable workers to understand the information on labels and on MSDS, as well as workplace-specific training including how the product is used and stored safely, personal protection required, and what to do in an emergency. See also Aquatic Safety Plan Template.

[33] Based on consultation and conversation with Shelley Gray, Occupational Hygienist, NS Department of Labour and Advanced Education

The following are general chemical safety handling and storage tips:[34]

- Never add water to chemicals. Always add chemicals to water.
- Never mix chemicals together prior to adding to pool water.
- Always wear the appropriate personal protective equipment for the job.
- When possible always keep chemicals in their original container. Where chemicals are required to be decanted, ensure the new container is properly and clearly labeled.
- Always clean up any spillage as outlined in the Aquatic Safety Plan and as indicated on the product label.
- Always keep storage area dry. Do not hose the area down.
- Prevent locating overhead lines carrying liquid or chemicals in the chemical storage area.
- Always keep chemicals away from electrical equipment and flames (chemicals shall not be stored in the furnace room).
- Chemicals shall be stored away from direct sunlight, temperature extremes, and high humidity.
- Always throw empty chemical bags or containers in specifically labeled containers; even small quantities can mix with other trash and ignite spontaneously.
- Never flush excessive chemicals into sewage that leads to a septic tank treatment system.
- Always store chemicals in a safe manner and location.
  - Chemical storage area(s) should always be secured from an unauthorized entry.
  - Doors should be locked and appropriate signage should be posted.
  - Ensure incompatible chemicals are stored on separate shelf units from each other.
  - Where storage space is very limited, separation may be achieved by storing incompatible products off the floor (such as on pallets) so that spilled material will not contaminate containers of other chemicals.
  - Similarly, incompatible chemicals should not be stored above one another to avoid contamination by spilling.
- Where disinfection systems other than gaseous chlorine are used (e.g., hypochlorite or bromine), the disinfection chemicals shall be kept separate from any acidic products.

[34] National Swimming Pool Foundation, Pool & Spa Operator Handbook, 2012

2.3.4.1 Gas chlorine and compressed air storage and handling[35]

Rationale:
Ensuring proper storage and handling of Class 2 compressed gases shall be performed in a manner to prevent injury to workers and the public by preventing an explosion or gas leak.

Recommendations:
Storage: Class 2 compressed gases are required to be stored in a specifically designed room as outlined by the National Fire Code. Room requirements include but are not limited to

- location on an exterior wall
- ventilation to the outside
- gas tight
- separated from flammable materials[36]

> For additional information, consult with the chemical manufacturing company for guidance in safe delivery, handling, and storage. Other additional requirements will be cited on MSDS, within pertinent Nova Scotia Occupational Health Safety Regulations, and the National Fire Code.

2.3.5 Emergency Response and Communication Plan

Rationale:
The Aquatic Safety Plan development is also intended to identify practices to reduce the risk of emergencies occurring and to develop written emergency response plans to respond to serious injuries, emergencies and other incidents.

Recommendations:
The Emergency Response Plan shall include the following:

- written procedures for identification, efficient, consistent, and safe handling of emergencies
- identification of the equipment required to respond to all identified emergencies including personal protective equipment, and training of all staff in their use (occupational health and safety)
- identification of all appropriate signage required to assist in case of an emergency, which shall be posted in designated area (see Section 2.3.7 Patron Education, Signage and Appendix 8, Example: Pool and Spa Signage)
- training of staff in their specific role in the implementation of the plan
- training of all staff in the activation of the emergency plan
- a clear communication plan that facilitates activation of internal emergency response and/or contacting 911 as necessary
- provision and use of readily accessible and appropriate communication devices such as telephones, call boxes, walkie talkies, radio, and mobile devices
- procedures to be followed during staffed and unstaffed times
- acceptable alternative communication during loss of power
- training of all personnel

[35] B.C. Guidelines for Swimming Pool Operations V1.0 p. 29 retrieved from the www on October 7, 2013 at http://www.health.gov.bc.ca/protect/pdf/bc-pool-operations-guidelines.pdf
[36] In conversation with Fred Jeffers CFI-II CBO-II CFI NS Deputy Fire Marshal, Office of the Fire Marshal

Table 4, (below) summarizes emergency situations that may be addressed in a facility's emergency.

Table 4. Emergency Situations

Medical emergencies • near-drowning or drowning • unconscious/non-breathing/no pulse • chest pain • spinal and/or head injury • broken bones and/or sprains • seizures • heat-related incidents • major and minor first-aid • allergic reactions	**Facility emergencies** • leakage of chlorine, ozone, natural gas, propane • chemical spill • fire • power failure • inclement weather (These may already be included in the facility's Fire Safety Plan)
Health/hygiene emergencies • fecal/vomit incidents • disease outbreaks • blood and bodily fluid exposure (in and out of water)	**Patron-related emergencies** • entrapped person • hostile person • missing person See also Section 7.3, Preventing Suction Hazards in Pools and Spas
Natural disasters • earthquake • flood • lightning	**Other** • ambulance access • incident reporting • media response • incident stress debriefing

2.3.6 Records/Documentation[37]

Rationale:
Records serve many purposes including as a guidance tool for operators. They can provide insight in what works and what is not working and ultimately can save money. Operators shall ensure that daily records are kept for each pool and shall be available on-site for inspection on request.

Recommendations:
1. Records shall include

- all injuries sustained at or within the pool
- all occurrences of fecal, vomit, and blood contamination at or within the pool
- amount and types of chemicals added to the pool water daily
- amount of daily water replacement
- frequency of testing (equipment and features)
- daily, weekly, monthly, and yearly routine results of pool water tests performed
- daily, weekly, monthly, and yearly facility preventative inspections (e.g., pool ladder integrity)

[37] Adapted with permission from the B.C. Guidelines for Swimming Pool Operations

2. All records shall
- be accurate
- be clear and legible
- be in permanent ink
- indicate the date and time the test or corrective action was taken
- include the name of the individual making the entry
- be stored for 2 years and readily available on request
  A sample pool and spa records sheet is found in Appendixes 4, 5 and 6, which may be copied and adapted.

See also Aquatic Safety Plan Template, Example: Incident Response Plan.

Daily Records shall include
- disinfection levels such as free available chlorine (FAC), total chlorine (TC), combined chlorine (CC), bromine residual, pH
- daily attendance (total number of bathers)
- reading of make-up water
- any emergencies, rescues, or equipment breakdowns that occurred and the time of occurrence
- any required equipment inspections
- operating pressures of water recirculation pumps, filters and the corresponding rate of flow meter readings

Weekly Records shall include
- cyanuric acid (if used) levels
- any weekly preventive maintenance

Monthly Records shall include:
- results of inspections of all pool water outlet covers
  See also Appendix 3, Pool Parameters, Appendix 4, Example: Daily Pool Log and Appendix 5, Example: Spa Log

2.3.7 Patron Education

Rationale:
The role of pool patrons in preventing the spread of water-related illnesses and physical hazards cannot be understated. Ensuring a safe recreational water experience is a shared responsibility.
A pre-swim cleansing shower, not swimming when ill, practicing good personal hygiene, and abiding by the rules of the facility including not swimming or diving beyond your ability are all major contributing factors to safe and fun recreational experiences.

Section 2: Pool Management

Resource information:
Swimmer personal hygiene is a contributing factor to recreational water-related illnesses and the production of disinfection by-products in pools. Each of us has an average of 0.14 grams of fecal material that could rinse into the water if swimmers fail to take a pre-swim shower with soap. A single diarrheal contamination incident from a person infected with Cryptosporidium can introduce over 100 oocytes into the water, which, in a typically sized pool, is enough to cause infection if a mouthful of water is swallowed. Sweat, urine, make-up, skin, and hair all contribute to the production of disinfection by-products collectively termed chloramines, which can overload the disinfection process.[38,39]

Recommendations:

1. Public Education

Each public pool and spa facility shall have a plan for public education that may include the following:

- Educate season pass holders: educating can create a sense of ownership of the facility, increasing patron participation in facility safety.
- Educate daily patrons.
  - One strategy is to hand out prevention messages to patrons as they enter the pool or park area.
  - Reinforce people's natural desire to care about their health. A suggested lead-in might be: "To ensure the health and safety of all our visitors, please remember to follow these easy steps for healthy swimming."
  - Consider implementing a short safety and recreational water illness orientation for larger groups before they enter the pool complex. This is especially important for groups with young children.

2. Develop policies

Implement bathroom break policies during instructional classes and encourage bathroom breaks during public swims.

3. Signage

Signage can be an effective tool to educate and warn patrons on venue rules and venue hazards. Signage shall state the rules of the pool be placed in a prominent location within the pool enclosure so that it is clearly visible to all pool patrons.

[38] Vore, Roy, PHD, National Swimming Pool Foundation, Recreational Water Illnesses, 2012

[39] 2013 World Aquatic Health Conference Seminars, International Conference on Swimming Pool & Spa, Rome 2013: Key Advances in Disinfection By-Products and Microbiology, Laura Suppes, R.S., M.P.H., University of Arizona

Signage would include, but not be limited to, the following:

- diaper changing is prohibited pool side and diaper change station hygienic practice signage
- diaper-change station hygienic practices
- requirement of a pre-swim cleansing shower
- not to enter the pool enclosure with an illness including open sores, bandages, head colds, discharging ears or noses, or infected eyes
- not to swim if diarrhea has occurred in the past 14 days
- not to run, fight, or do anything else that could cause an injury while in the pool enclosure
- not to contaminate or foul the pool water
- to immediately report an injury suffered while in the pool enclosure, or any contamination or fouling of the pool, to the pool manager or lifeguard
- depth markers indicating water depths and changes in slope
- warning not to dive when the water is less than 2 metres (6.6 feet) deep (Note: the term "diving" is not intended to include swimming competitors or training for swimming competitions; in these cases, Federation Internationale de Natation rules are followed)
- ensuring thorough hand hygiene after bathroom breaks and before returning to the water
- safe use of hot tub
- rules for safe use of the swimming pool and swimming pool features
- location of the telephone for emergency use
- notification "for emergency dial 911"
- indication of "No Lifeguard On Duty" in those circumstances where lifeguards are not required (See Appendix 8, Example: Pool and Spa Signage)

Use of pictograms

Universally accepted and recognized pictograms provide clear and identifiable messaging for all languages, ages, reading and comprehension ability. There are various universally accepted and identifiable pictograms available for pools including chemical hazard signs and lifeguard not on duty signs. Here are a few examples:

Section 3: Hygienic Facility

Rationale:
Patron cleanliness and hygienic habits play a key role in water and air quality and the transmission of recreational water illness. Providing safe, clean, well-stocked, and accessible hygienic facilities can only encourage their use.

Section 3: Hygienic Facility

3.1 Partitions, Walls, and Floors

Recommendations:

- Surfaces shall be maintained to ensure ease of cleaning and disinfection and shall be designed and maintained to minimize bacterial growth.
- Floors shall be constructed and maintained non-slip (slip resistant), smooth, and impervious with no open cracks, be maintained free of tripping hazards including uneven surfaces or changes in elevation, and free from any physical hazard that may cause injury to bare feet.
- The covered juncture between the wall and floor and extending upward on the wall shall be maintained to allow for ease of cleaning.

3.2 Change Rooms

Recommendations:

- Change rooms shall include lockers (when appropriate), toilet facilities, cleansing showers, diaper change tables, and hand basins.
- They shall be constructed and renovated in accordance with provincial and local codes.
- They shall be maintained, cleaned and disinfected in a sanitary manner and procedures shall be included in the cleaning and preventative maintenance part of the Aquatic Safety Plan.

3.2.1 Cleansing showers

Recommendations:

- Tempered water only shall be provided at all showerheads.
- Water heater and thermostatic mixing valve should not be accessible to bathers.
- Showers should be supplied with wall-mounted soap dispensers.
- Showers shall be cleaned and disinfected daily or as demand requires.

3.2.2 Hand wash stations

Recommendations:

Hand wash stations shall include

- hand wash sink
- hot and cold running potable water (refer to Section 6.1, Water Source - source water)
- adjacent wall-mounted liquid soap dispenser
- hand drying device or paper towels dispenser, and trash receptacle
- any replacement mirrors shall be made with shatter-proof glass

3.2.3 Diaper change tables

Rationale:

Proper hand washing and cleaning and sanitizing of diaper change tables help prevent diarrheal illness.

Recommendations:

All aquatic facilities allowing diaper-aged bathers shall have at least one diaper change table in each male and female washroom, or make available a baby change table in a unisex or family change room (if available). Each shall be equipped with, at a minimum

- a hand wash sink, as described above, adjacent to the diaper change table
- signage indicating proper disposal of diapers, waste, hand washing of the care provider and child, and warning against swimming if ill with diarrhea
- a lined trash receptacle
- a Health Canada approved (shall have a drug identification number) sanitizer (disinfectant) to maintain a clean and disinfected diaper change unit surface before and after use

Changing diapers at pool side shall be prohibited.
See also Appendix 8: Example: Pool and Spa Signage

3.2.4 Solid waste disposal

Recommendations:

- Solid waste shall be removed at a frequency necessary to prevent attracting vectors (e.g., flies) or causing odor.
- Solid waste shall be disposed of in compliance with local codes.

3.2.5 Sanitary sewage disposal

Recommendation:

- The disposition of sanitary sewage from the hygienic facilities shall be into a sanitary sewer or an on-site sewage disposal system that is approved by the Nova Scotia Department of Environment.

3.2.6 Sharps containers

Rationale:

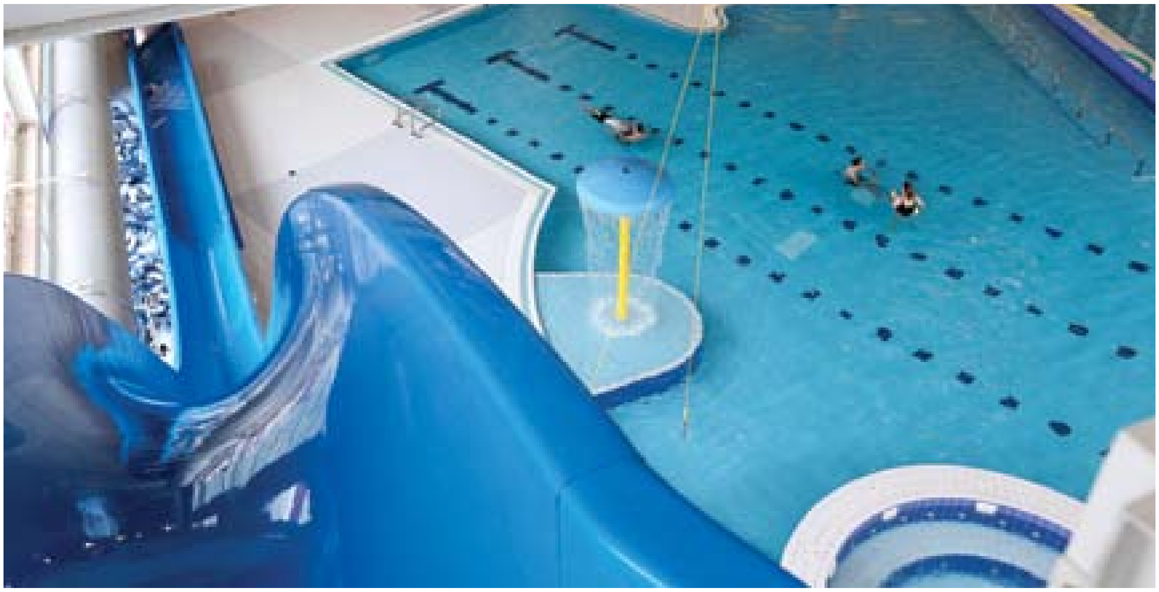
Sharps are any item that may penetrate the skin (e.g., needles, blades, and razors). To prevent accidental needle stick injury by those handling garbage or who may come into contact with a used sharp, sharps shall be disposed of in an approved sharps container and not with the regular waste.

Recommendations:

- Approved sharps containers that are marked with a bio-hazardous label are required for the safe disposal of used sharps.
- Sharps containers shall be out of reach of children and located in each washroom/change area.
- Signage shall be posted indicating the requirement of discarding used sharps into an approved sharps container immediately after use.
- A sharps container is considered full when it is at three-quarters of capacity, at which point it is securely closed and disposed of.

Sharps and biomedical waste should not be disposed of with municipal solid waste.

Section 4: Pool Surroundings and Decking



Rationale:
There are a variety of types of pools including indoor and outdoor facilities, which offer a variety of types of services and features. All shall be maintained and cleaned in a sanitary manner, and be included in the cleaning and preventative maintenance plan within the Aquatic Safety Plan. Pre-opening inspections shall be carried out each day prior to opening and all records shall be maintained.

Section 4: Pool Surroundings and Decking

4.1 Sauna and Steam Room Maximum Temperature

Recommendation: (when applicable)
- Shall be operated and maintained as designed

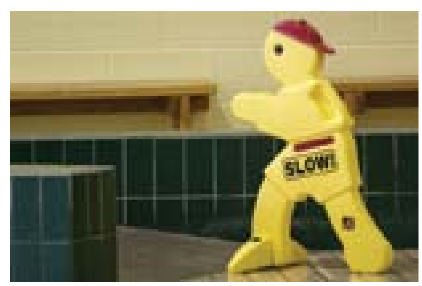
4.2 Deck Maintenance

Recommendations:
- At a minimum, decking shall be cleaned daily and kept free of debris, vermin, and vermin living environments.
- Decking shall be maintained to the original design slope and surface integrity.
- Decking shall be free of standing water.
- Drains shall be cleaned and maintained to prevent blockage and pooling of stagnant water.
- Absorbent materials used in wet areas must be able to be removed for cleaning and disinfection.
- Fixed equipment, loose equipment, and deck furniture shall not interfere with the circulation system or emergency exit procedures. See also Appendix 6, Hard Surface Incident Response Recommendations.

4.3 Hose Bibs

Recommendations:
- Sufficient numbers of hose connections shall be provided to allow cleaning throughout the pool area and be maintained within the dressing rooms and pool walkways at convenient locations to allow for adequate cleaning and flushing of floors and walkways.
- Hose bibs shall also be equipped with a Canadian Standards Association or equivalent atmospheric vacuum breaker.

4.4 Benches or Seats



Recommendations: (when applicable)
- A spectator area and the access to it shall not interfere with emergency evacuation procedures and shall be separated from the remainder of the deck by a barrier placed not less than 1.2 meters (or as designed) from the edge of the pool.[40]
- Benches and seats are stored outside the deck area when not in use.

4.5 Wall Clocks

Recommendation:
- A completely functional clock(s) shall be clearly visible from a pool, whirlpool, sauna, or steam room to assist bathers in determining their length of stay.

[40] U.S. Department of Health and Human Services, Centers for Disease Control and Prevention 2014, The Model Aquatic Health Code

Section 4: Pool Surroundings and Decking

4.6 Water Fountains

Rationale:
Encouraging the use of water fountains will help discourage patrons form consuming pool water.

Recommendations:
- Poolside water fountains shall be maintained and accessible for patrons use.
- Shall be cleaned and maintained in a sanitary manner.

4.7 Rinse Showers

Rationale:
A rinse shower is typically located in the pool deck area (often associated with outdoor aquatic venues) with ambient temperature water. The main purpose is to remove dirt, sand, or organic material prior to entering the aquatic venue. It is not meant to replace wash showers and may not be necessary at all aquatic facilities.

Recommendations:
- At least one rinse shower shall be provided where design requires.
- The floor shall be sloped to drain waste water away from the aquatic venue.

4.8 Barrier (accessibility) and Alarms

Rationale:
To prevent and reduce the risk of drowning, near-drowning, and other preventable injuries. Fencing, lockable doors, or doors with alarms and gates are necessary to ensure that people do not gain unsupervised access to a pool.

Recommendations:
An owner or operator shall ensure that during periods when the pool is not intended to be open for use, or if it is an unsupervised facility, the facility is made inaccessible to persons who are not involved with its operation or maintenance. Ensure the following:

- The surrounding perimeter barrier (fencing) shall be maintained at all times so that the pool area can only be entered through the intended entrance gate/door.
- All gates (entrances) shall be maintained at all times and shall be self-closing, self-latching, and lockable, with the self-latching device located 5 feet above the ground.
- Indoor pools may choose to use an alarm system on the doors that lead from the change room to the pool deck.
- Gates (doors), locks, and/or alarms (if required) shall be tested every day prior to opening and after closing, and the results recorded.

4.9 Emergency Exits

Recommendations:
Emergency exits shall be established for both indoor and outdoor facilities, and will be maintained, indicated by signage, well-lit, unobstructed, and accessible at all times.

4.10 First Aid Stations

Recommendations:
A designated area or room designed for the delivery of first aid shall be present in the aquatic facility. It is necessary to ensure that this room

- is clearly indicated by signage, accessible, and appropriately stocked and maintained for potential emergency situations (as identified in the Aquatic Safety Plan)
- is equipped with functioning emergency communication equipment (phone to dial 911 or a designated person) and posted procedures including emergency personnel contact information and contact information for the manager (See also Section 8.1.1.1, Emergency telephone and warning signals).

4.11 Emergency Telephone and Signage

Recommendations:
An emergency telephone shall be provided, clearly identified, and shall be:

- located in the pool area in a location that is easily accessible by both patrons and staff
- tested prior to opening every day and results recorded in the daily pre-opening inspection

4.11.1 Additional 911 recommendations:

- The facility shall have a clearly posted civic number.
  (See also Section 4.10, First Aid Stations, Section 8.1.1.1, Emergency Telephone and Warning Signals)

4.12 Emergency Stop Buttons

Rationale:
Emergency stop buttons can be an effective lifesaving tool when utilized e.g., with hot tubs, movable floors and special pool play features. In the case of an emergency, such as a suction entrapment, the circulation system (pumps) can be halted immediately via a stop button to break the suction.

Recommendation:
- Emergency stop buttons shall be maintained and tested, and results recorded as required in the operational manual and Aquatic Safety Plan. (See also Section 7.3, Preventing Suction Hazards in Pools and Spas.)

4.13 Lighting

Rationale:
Lighting (emergency lighting, underwater lighting, overhead lighting, outdoor pole-mounted lights, public areas, hallways, and natural lighting) is required for effective maintenance, cleaning, monitoring, safe facility use including lifeguarding, and security. Ensuring proper lighting levels are maintained and reach all areas of the aquatic facility is part of pool design and a preventative maintenance plan.

Lighting effectiveness is reduced by many factors including, but not limited to

- lamp placement
- lifespan of lamp bulbs
- surface deterioration and damage
- dirt accumulation

Recommendations:

- Whenever possible lighting should be designed to be indirect to prevent glare at the pool surface.
- Every indoor swimming pool shall ensure a minimum light intensity of 200 lux (15 foot candles) measured 30 inches above the water surface, deck, and in areas of the change rooms used by bathers during all operation and maintenance hours.[41]
- Lamp and light level intensities shall be included in the Preventative Maintenance Plan and cleaning and inspection protocol.
- The pool is closed immediately if light levels fall below 200 lux. See also Section 6.4, Water Clarity (Turbidity).

4.13.1 Emergency lighting

- Emergency lighting shall be tested and maintained according to manufacturer's instructions.

4.13.2 Underwater lighting (when used)[42]

- Underwater lighting shall be operational and maintained as designed.
- Lenses that are cracked but physically intact shall be replaced before the pool reopens to bathers.
- Lenses that are cracked and not intact require immediate closure of the pool and shall be replaced before the pool can be re-opened. (See also Section 4.14, Ground Fault Interrupter (GFCI) and De-energizer.)

4.14 Ground Fault Interrupter (GFCI) and De-energizer[43]

Rationale:
To prevent accidental electrocutions all electrical outlets and fixtures are to be designed, installed, and maintained in accordance with municipal and provincial electrical codes.

Recommendations:
If a pool has underwater lighting or any electrical outlets and fixtures within 3 metres (10 feet) of the pool surface, a ground current leakage detecting and de-energizing device (GFCI; a device that automatically shuts off the associated circuit if there is an electrical leak that could cause an accidental shock) shall be present.

- Required GFCI devices shall be tested monthly according to the manufacturer's instructions as part of scheduled maintenance.
- Daily testing of buttons before the pool opens to ensure the device is activated shall be done, with records of all testing maintained.
- The pool shall be closed if a GFCI is not working. Circuits for underwater lighting that do not have a GFCI shall be physically severed (cut).

[41] Illuminating Engineering Society, IESNA RP 6.01 - Sports and Recreational Area Lighting, (2001).
[42] The USA Centre for Disease and Prevention. (2014) Model Aquatic Health Code-First Edition The Code
[43] Adapted with permission from Toronto Public Health, Swimming Pool Operations Manual (2009). Retrieved from the www at http://www.toronto.ca/health/hphe/pdf/swimming_pool_m2009.pdf

4.15 Pool Basin

Rationale:
The ability to see the sides and bottom of a pool basin by patrons and operators is an important safety and operational component. Diving or falling into shallow water or not having the ability to judge water depth due to a lack of water depth markings, or the inability for the patron to judge water depth due to a darker pool basin finish can result in basin collision that can lead to spinal, head, brain, or other traumatic injury and may result in death. Maintaining clear depth markings, pool water clarity, and the ability to distinguish features, such as stairs and depth, may help increase patrons' awareness of these dangers. Furthermore, darker pool basin colours interfere with the operator's ability to determine algae growth on the pool basin.

4.15.1 Colour and care

Recommendations:
- White is preferred or be light in colour, except for markings related to safety and competition.
- Underwater step treads shall be marked in contrasting colour to indicate location.
- The venue shall be clean, and free of scum line, algae, and biofilm.
- The venue shall be inspected annually for cracks, surface deterioration, equipment cracks, rust, and deterioration and repaired as required. A structural engineer shall evaluate any crack[44]
  - with vertical displacement of varying width concentrated to a specific area
  - exposing any reinforcement
  - which is an obvious recurrence from previous patches
  - in a corner
  - drawing a defined line
  - on the surface over 1/8 inch (3.2 mm) in width (See also Section 6.4, Water Clarity (Turbidity)

4.15.2 Depth Markings

Recommendations:
Depth markers shall [45]

- be visible by swimmers in the pool
- indicate the depth of water in metric or imperial units of measurement
- be located above the water surface on the pool wall and on the walkway at the pool edge, or, 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 at the pool edge
- be located at maximum and minimum depth, at 30 centimetres (1 foot) increments between the shallow depth and the point of break, and at intervals no more than 7.62 metres (25 feet) measured peripherally at other intermediate points
- be in Arabic numerals at least 10 centimetres (4 inches) in height
- be a colour that contrasts with the background

[44] http://www.cdc.gov/healthywater/pdf/swimming/pools/mahc/mahc-complete-draft-CODE-for-2nd-round-of-comments.pdfp 206
[45] British Columbia Ministry of Health, Health Protection Branch Population Health and Wellness Division, B.C. Guidelines for Swimming Pool Design V1.0, 2011

4.15.3 Lane Markings

- Lane markings shall be marked in contrasting colour to the pool basin to indicate location.

4.15.4 Movable floor

Recommendations:

- No one shall be allowed to swim beneath a bulk head if it is operated with an open area underneath.
- Circulation system must be able to effectively distribute disinfection to areas below moveable floors.
- A sign indicating movable floor and/or varied water depth shall be provided and clearly visible from the deck.
- The floor shall be equipped with emergency stop features.

4.15.5 Pool vacuuming

Recommendations:

- Vacuuming shall be done when the pool is closed.
- Vacuum port openings shall be covered with an approved device cover when not in use.
- Pools with missing or damaged vacuum port openings shall be closed and repairs made before re-opening.
- All accessible surfaces shall be scrubbed and cleaned as necessary to minimize the formation of slime and biofilm layers. (See also Section 7.3, Preventing Suction Hazards in Pools and Spas.)

4.16 Starting Platforms/Blocks

Recommendations: (when applicable)

- Starting blocks shall only be used for swimmer training or competitive swimming activities.
- When starting blocks are permanently attached to the pool deck, covers, cones or signage shall be used to inform closure and to deter access.
- Starting blocks designed to be removed shall be removed at all times when use is prohibited.

4.17 Pool Steps and Guardrails

Recommendations:

- Steps and guardrails shall be secure and unable to move during use.
- Steps and guardrails shall be maintained to prevent slips and falls (see also Section 5.1.2, Diving Boards and Platforms).
- Underwater step treads shall be marked in contrasting colour to indicate location.

4.18 Lifts and Hoists [46]

Rationale:
As noted in the introduction providing accessible aquatic experience is a plus for all communities and individuals. Safe and well-maintained lifts, hoists and pools with zero entry points allow the needed access to those in the community with mobility impairments.

Recommendations: (when applicable)
- All lifts and hoists for people with mobility impairments shall be removed when not in use, or designed in such a way that they do not project into the pool and pose a hazard to swimmers.
- All supporting features must be approved by a reputable health and safety certifying agency.

4.19 Designated Food Area Handling and Consumption Areas

Recommendations: (when applicable)
- Any food handling areas shall meet the Nova Scotia Department of Agriculture Food Safety Regulations.
- Consumption of food is not allowed in or partially in the water at aquatic facilities.
- No food and beverage containers or tables made of glass are allowed in areas of aquatic facilities used by patrons and bathers.

[46] British Columbia Ministry of Health, Health Protection Branch Population Health and Wellness Division, B.C. Guidelines for Swimming Pool Design V1.0, 2011

Section 5: Aquatic Play Features and Other Pool Types

Aquatic Play Features, Water Parks, Wading Pool, and Hot Tub/Therapeutic/ Spa Pools

Rationale:
Diving boards, slides, Tarzan ropes, climbing walls, wave action, continuous surfing pools, vortex pools, and spray features are a few examples of aquatic play features and pools that are becoming increasingly common at recreational aquatic venues. Water parks' and splash pads' primary offerings are water play features. They are a popular attraction for children and families, and can add to a great aquatic experience. But they all pose risks to patrons if they are not properly designed, installed, maintained, and supervised. Risks can include, but are not limited to, bather collisions, impact fall injuries, entrapment, evisceration, drowning, poor air quality, and microbial contamination. Due to their size, shape, and unique design, play features tend to be more difficult to effectively circulate, filter, and chemically treat.

Section 5: Aquatic Play Features and Other Pool Types

5.1 Aquatic Play Feature General Recommendations[47,48]

- Play features shall be designed and installed according to manufacturer's instructions, appropriate Canadian Standards Association standards, ASTM standards, all municipal and provincial codes (Nova Scotia Labour and Advanced Education, Amusement Devices Safety Act), and, when required, engineering plans.
- Operating procedures, operational manuals and directives, risk assessments, and all required training shall be incorporated in the Aquatic Safety Plan for each aquatic feature.
- Staff training shall be regularly conducted and training records kept on file. Training shall include, but not be limited to
  - safe operation of the feature
  - safe supervision (which may include the use of aquatic feature attendants (assistant lifeguards) in combination with qualified lifeguards)
  - emergency procedures
  - preventative maintenance and cleaning including biofilm prevention and removal
- Aquatic features shall be maintained in good repair to prevent slips, falls, and pinch hazards when appropriate.
- Each facility shall perform a risk assessment for each feature to determine enhanced supervision and use requirements.
- Surfaces shall be made of non-slip material where appropriate.
- Play features shall be inspected daily and routinely audited for
  - structural integrity, cracks, loose bolts, and any other identified risk
  - cleanliness and biofilm development
  - suction and entrapment risk
- A plan shall be in place for emergency closure, including how to safely bring a queue of children/bathers down a ladder or off a play feature.
- Water level shall be maintained.
  - Some water features, such as slide receiving pools, require a specified water level to ensure bathers are provided with safe entry into the receiving pool or with enough resistance upon entrance into the receiving pool to slow down. Water levels that are too high or too low can be hazardous.
  - It must be ensured that a water replacement policy is in place, and that water quantity is monitored and logged because of water loss due to splash-out and increased evaporation.
- Signage shall be clearly posted and shall include
  - emergency procedures, warning signage, and use requirements including height, swim ability, and age restrictions (See Appendix 8, Example: Public Pool and Spa Signage)
  - universally accepted pictograms when possible
- Water quality parameters shall be maintained and recorded as required to ensure effective water quality. These include
  - appropriate water testing and maintaining required records
  - continuous disinfection and maintaining pH levels as described in these guidelines and the venue's specific Aquatic Safety Plan to eliminate bacteria inside the spray features is key to preventing air endotoxin levels and symptoms[49]

[47] NSPF, Aquatic Play Feature Handbook
[48] ANSI/NSPF-9 2005 Aquatic Recreation Facilities

- Emergency stop button(s) shall be installed on play features, such as continuous surfing pools and slides or as determined by manufacturer.
- Audible and visual warning device that are tested daily may be necessary for play features that alert bathers of the beginning of the play feature.

Play feature specific information

Consult feature specific manufacturer's installation and operational instructions.

5.1.1 Rope swings [50]

The design, location, and maintenance of rope swings shall take into consideration both safety and structural concerns.

Recommendations:

- Any installation of a rope swing shall be certified by a structural engineer. When a rope swing is in use, it can create considerable torsional stress on beams above, and the effect of the swing shall be considered on the structure of the building.
- Injuries occur when the rope swing is not placed over an area of the water sufficient to prevent adult-sized individuals from striking the bottom of the swimming pool. Design of these swings shall consider trajectory, pool slope, and potential impact with side of the pool, walls, and deck.
- Rope swings shall not conflict with other pool activities (e.g., diving).
- Sufficient lateral clearance shall be provided between the rope swing and the dive area in the deep end.
- Sufficient water depth is required.

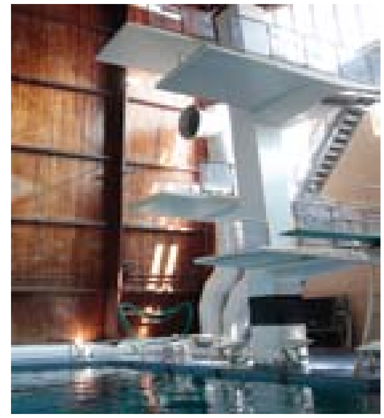
5.1.2 Diving Boards and Platforms

Recommendations:

- Pools where diving is permitted, instruction provided and competitions performed shall have adequate clearances and depth of water for safe diving. The Federation Internationale de Natation Amateur (FINA – www.fina.org/) standards shall be followed for clearances and water depths for springboards, diving platforms, and starter blocks.
- Each facility shall have in place a diving board use policy that specifically indicates user age, user ability, and required supervision. Consideration should be given to restricting use of diving boards that are above 3 metres to competitive/trained divers.
- Adequate guardrails around that portion of the diving board or platform, which is not above the water area, shall be maintained and assessed on all diving boards and platforms 1 metre (3 feet) or more above the water surface.
- Diving boards and steps leading to diving boards are to have slip-resistant surfaces.

[49] NIOSH. 2008. Health Hazard Investigate Report: Investigation of Employee Symptoms at an Indoor Waterpark, Mason, OH. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institutes for Occupational Safety and Health, NIOSH HETA No. 2007-0163-3062 http://www.cdc.gov/niosh/hhe/reports/pdfs/2007-0163-3062.pdf

[50] British Columbia Ministry of Health, Health Protection Branch Population Health and Wellness Division, B.C. Guidelines for Swimming Pool Design V1.0, 2011



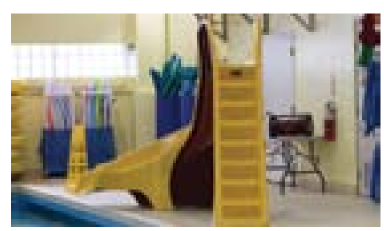
- When the diving board is 3 metres or higher above the water the operator shall ensure that[51]
  - the gate allowing access to the platform is locked, except during periods when the platform is in use for diving
  - when the platform is in use, the pool is used only for diving unless a rigid barrier or double safety lines 300 millimetres apart supported by buoys are in place, located from the wall under the platform at
    - 11.6 metres in the case of a 5 metre platform
    - 12.5 metres in the case of a 7.5 metre platform
    - 15.25 metres in case of a 10 metre platform

5.1.3 Water Slides and Flumes

There are a variety of types of water slides including those designed for small children to large flume styles slides found in hotels and waterparks. They are being built bigger and are capable of more speed, and are one of the most popular features at swimming pools. In Sweden and Europe, 16% and 18%, respectively, of public pool injuries are related to water slides. Serious injuries and even deaths related to water slides[52] have occurred in Canada.[53]

Recommendations:
Slides shall be maintained and operated to manufacturer's/designer's specifications and the most recent Canadian Standards Association Standard Z267-00 Safety Code for Amusement Rides and Devices or its successor.

- Water slide lines susceptible to holding stagnant water shall maintain a disinfectant residual throughout the lines in accordance to these guidelines.
- Recirculation and filtration systems shall be in use during operating hours.
- Slime and biofilm layers shall be removed on all accessible slide surfaces.
- Before opening the venue, the slide water flow rates shall be inspected to ensure they are with in the designer or manufacturer's specifications. Daily inspections will look for:[54]
  - loose railings
  - leaking seals at butt joints
  - rough patching of cracks or joints
  - absence of guards or loose guards on the turns
  - unusual movement of the flume bed when walked on
  - growth of algae on the support structure
  - sharp edges on the flume safety rails
  - projection of any portion of vegetation into the flume
  - clear view of the receiving pool at the exit of the flume



[51] Adapted with permission from Toronto Public Health, Swimming Pool Operations Manual (2009). retrieved from the www at http://www.toronto.ca/health/hphe/pdf/swimming_pool_m2009.pdf
[52] www.childsafetyeurope.org/publications/info/protecting-water-recreation.pdf
[53] Lifesaving Society, Yi Fan Wang Coroner's Ingest Recommendations, May 23, 2013 retrieved from the www at www.cdc.ca/news/canada/new-brunswick/coronor-s-jury-recommends-pool-safety-changes-1.1317228
[54] Saskatchewan Ministry of Health, Swimming Pool Design and Operational Standards p. 34

Section 5: Aquatic Play Features and Other Pool Types

- Warning signage shall be present and use requirements including height, swim ability, and age restrictions shall be provided (see example signage).

- Each facility shall perform a risk assessment to determine enhanced supervision requirements to be implemented when slides are in operation. This may require supervision at the bottom of the slide where the swimmer enters the water as well as at the slide entry.
- Emergency procedures specifically designed for the slide shall be clearly posted and training in these procedures shall be practiced, with records of the training maintained on file.

5.1.4 Wave feature

Rationale:

The production of a wave can create an unsafe environment for a non-swimmer or a swimmer caught off-guard. The mechanical devices used to create the wave may present an entrapment risk to bathers and workers. The wave action also increases the water surface area; for outdoor pools this may increase a loss of disinfection due to ultraviolet rays. Due to size, shape, and wave action, these pools require special care to maintain good circulation, filtration, and chlorine residual throughout the entire pool.

Maintenance Recommendations[55]

- Wave chamber bars: A wave chamber in a pool basin shall be equipped with wave chamber bars constructed of stainless steel or similar acceptable material, which are intended to act as a notice to bathers that the area is restricted, with the goal of preventing entrapment of patrons. The wave chamber including the bars should be marked off with a rope, lane line, or other measures to discourage public access near the wave chamber bars.
- Deck guard rails shall be maintained at the deep end around the wave chamber walls to prevent public access to this part of the pool when necessary.
- The wave chamber bars and deck guard rails shall be regularly inspected for structural integrity. Inspections shall be documented and the inspection records retained.

[55] British Columbia Ministry of Health, Health Protection Branch Population Health and Wellness Division, B.C. Guidelines for Swimming Pool Design V1.0, 2011

- The air blowers of the wave chamber shall be contained in a separate room that is not accessible by the general public, will be designed to operate at acceptable noise levels, and will be regularly assessed for their occupational health and safety risk.
- The wave amplitude shall be designed for the specific pool.
- Emergency stop button, protective railings/barriers, and the audible and visual warning devices shall be tested daily and maintained as required.

Wave Pool Use Recommendations

- Life jackets shall be provided free for patrons who request them.
  - Children less than 48 inches in height, shall wear a properly fitting life vest as a requirement to gain access to a wave pool.
  - A child less than 42 inches in height should be accompanied by an adult and be "within arm's reach" of this adult to be granted entry into the park by the wave pool operator.[56]
- The wave pool operator shall ensure that there are a sufficient number of lifeguards on duty to recognize, respond, and provide care to swimmers in distress or passive or active drowning persons within, but no longer than, 30 seconds of the onset of their peril.
- A lifeguard shall have an unobstructed view of, and be able to completely observe, in its entirety, his/her defined zone of protection in the wave pool.
- A wave pool operator shall ensure that conditions in a wave pool are continually reevaluated for safety and shall adjust lifeguard staffing accordingly.
- An emergency stop button (see section 4.12) for the wave equipment shall be easily accessible to the lifeguards and other pool officials.
- A wave pool operator shall ensure that the wave pool has regular periods without breaking waves being produced, by ensuring that continuous breaking wave cycles in a wave pool shall not exceed 15 minutes.
- Appropriate signage detailing warnings and restricted use conditions shall be located in plain view of pool patrons.

Audible and Visual Warning Device

- Every wave pool shall be equipped with a warning device like a buzzer and light that is to be sounded and displayed to alert swimmers of the commencement of operation of the wave generator.

[56] California Public Health, Wave Safety Act (2008), http://www.cdph.ca.gov/HealthInfo/environhealth/water/Documents/RecHealth/HEALTH%20AND%20SAFETY%20CODE%20Sections%20115950%20-%20115952.pdf

5.1.5 Spray Grounds/Spray Feature

Rationale:
Special considerations for these facilities are advisable because of the population served. Air quality is often as good as the water quality in these types of pools due to the aeration (via spraying) of water. Spray pools that collect water for recirculation and that have no treatment have been associated with communicable disease outbreaks and are therefore not recommended.

Recommendations:
Spray grounds/feature shall be

- subject to all sections of these guidelines including water quality, filtration, and recirculation
- made of durable material impervious to moisture and retaining a slip-resistant texture that is comfortable to bare wet feet
- free of obstructions
- repaired of any cracks that have the potential to
  - cause leakage
  - create a tripping hazard
  - cause lacerations
  - impede cleaning and maintenance of the spray ground area
- free of slime and biofilm layers on all accessible surface
- cleaned, scrubbed, and flushed with disinfectant (e.g., 5 mg/L hypochlorite solution) each day for the appropriate contact time
- cleared of contaminants, such as by washing to the sanitary sewer or to the nearest deck drain, or removal in a manner that prevents contamination of the spray ground
- not used for drinking; water fountains should be located in the vicinity of the spray park to discourage patrons from drinking water from the spray features
- designed to use a continuous supply of fresh treated potable disinfected water for spraying, which would then drain to waste or,
- in the absence of continuous fresh potable water, shall use full water treatment including filtration and chemical treatment.

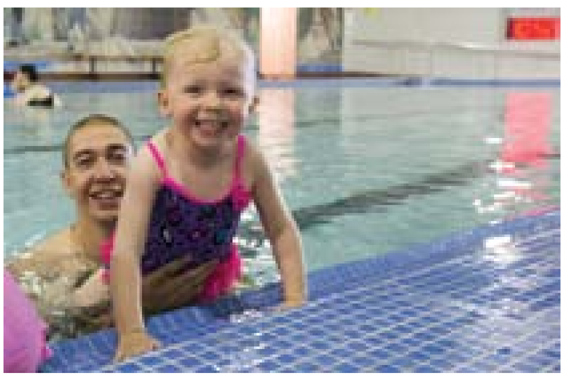


5.2 Wading and Spa/Therapeutic/Hot Tub Pools

Rationale:
As noted in Section 1.2, microbial recreational water illness risks increase in venues with higher water temperatures and when there is a lower ratio of water volume to bather load. These types of venues shall be considered increased risk venues and pool type specific operational strategies shall be developed and implemented to reduce the risk of illness and injury.

5.2.1 Wading pools

Wading pools are less than 2 feet in depth, are maintained at a warmer temperature, and are designed for a younger patron who may or may not be toilet trained. Swim diapers are not fool-proof and, therefore, there is an increased risk of an accidental fecal release and an overall increased risk of contamination.



Wading Pool with Recirculated and Filtered Water[57]

These pools are not typically emptied daily and should be the standard when developing a new wading pool.

Recommendations:

- All sections of this guideline shall be utilized including water quality, filtration, and recirculation sections.
- These pools shall be classified as an increased risk aquatic venue in the Aquatic Safety Plan.
- A dedicated filtration and circulation system shall be in place, with the entire volume of the wading pool capable of being recirculated through an approved filter in 2 hours or less.
- An automatic feed control system shall be in place to maintain consistent disinfection and pH.
- A recirculating wading pool may be drained and left empty overnight.
- A secondary disinfection system is recommended
- Due to the potential use by diaper-aged children educating parents, guardians and staff on the proper use of swim diapers (they do not prevent fecal contamination)
- Due to the age of patrons the wading pool area shall have signage regarding required parent or guardian supervision at a minimum (See also Sections 5.1.5, Spray Grounds/Spray Feature and 7.3, Preventing Suction Hazards in Pools and Spas)

[57] NSPF, Aquatic Play Feature Handbook

Section 5: Aquatic Play Features and Other Pool Types

Wading Pool Fill and Dump

These pools are filled and emptied daily. There is no standing water when the pool is not in use.

Recommendations:

- The pool shall be completely drained after the last period of use each day.
- The main drain valve of the pool shall remain open during non-fill time.
- All debris, glass, leaves, or other material that could pollute the water or that could be hazardous to the pool users shall be removed from the pool bottom and area surrounding the wading pool and properly disposed of.
- The pool shall use water from a potable supply or treated swimming pool water.
- Treated water shall be used and all water monitoring tests are required.

5.2.2 Spas, Hot Tubs, Therapeutic Tubs

Rationale:

These pools have higher water temperatures, lower water volumes, and high bather load. This increases the potential for biofilm formation, which increases the demand of the primary disinfectant and adds to the operational challenges. The close proximity of the head to the water level provides unique opportunities for microbial inhalation risks if poor operation occurs. These types of pools have also been associated with entrapment injuries and deaths.

Recommendations:

- All sections of this guideline shall be utilized.
- There shall be no persistent foam including after the jets are turned off.
- There shall be no visible sign of algae.
- Spa surfaces shall be maintained free of biofilm.
- This type of pool shall be classified as an increased risk venue in the Aquatic Safety Plan.
- Signage shall be maintained and indicate
  - maximum bather capacity
  - caution and health warnings including restrictions
  - location of emergency stop button

  see also Section 2.3.7, Patron Education
  see also Appendix 8, Example: Public Pool and Spa Signage
- Each spa shall have a dedicated and separate filtration and circulation system
  see also Section 7, Recirculation and Filtration
  see also Section 6.2.1, Spa water replacement
  see also Section 7.3, Preventing Suction Hazards in Pools and Spas
- An emergency stop button shall be available (see also Section 4.12, Emergency Stop Button).
- A timing device shall be installed and operational, and located so that a patron must exit the spa to reset the device (see also Section 5.2.3, Timing device).

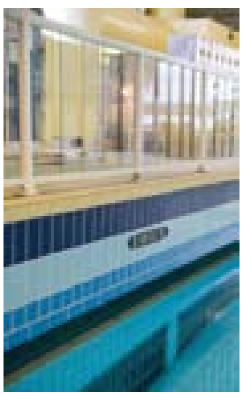
5.2.3 Timing device

Rationale:
Prolonged exposure to warm water temperatures can have detrimental health effects including but not limited to

- inability to exit the spa
- failure to recognize the hot temperature of the water and the need to leave
- unconsciousness and drowning

The timing device controls the period of operation of the jet pump reducing the health risk to bathers.

Recommendation:
- Required maintenance of the timing device shall be done to ensure it can only be set to a maximum of 15 minutes and is placed in a location that requires bathers to exit the spa to reset.


Wave Chamber and Guard Railing


Emergency Stop Button

Timing Device

NOVA SCOTIA

Section 6: Pool Water Quality Management

Rationale:

Essential components of effective pool water management include water source, managing pool water clarity to minimize injury hazard, managing water quality to prevent the transmission of infectious disease, and managing potential hazards from disinfection by-products that can be found in the water and air.[58] These challenges can be met through a combination of the following factors:

- treatment to remove particulates, pollutants, and microorganisms including filtration and disinfection to remove/inactivate infectious microorganisms
- pool hydraulics to ensure effective distribution of disinfectant throughout the pool, good mixing, and removal of contaminated water
- frequent addition of fresh water to dilute substances that cannot be removed from the water by treatment
- cleaning to remove biofilms from surfaces, sediments from the pool floor, and particulates adsorbed to filter materials
- ventilation of indoor pools to remove volatile disinfection by-products and radon[59]
- education and encouraging good patron hygiene

[58] WHO.(2006). Guidelines for safe recreational waters. Retrieved February 2011, from WHO Water Sanitation and Health: http://www.who.int/water_sanitation_health/bathing/srwe2chap5.pdf

[59] http://www.who.int/water_sanitation_health/bathing/srwe2chap5.pdf p. 80

Section 6: Pool Water Quality Management

6.1 Water source – source water

Rationale:
Water used in an aquatic facility includes drinking water, pool fill water, make-up water, and pool waste water. Each water system can contribute to the health safety of employees and patrons.

Recommendations:
- Drinking water: Any water supply serving the pool and used for drinking water and other purposes shall be potable and meet the requirements of the latest edition of the Canadian Drinking Water Guidelines for bacteriological and chemical quality. This includes water provided at plumbing fixtures used for drinking, cooking, dishwashing, hand washing, and showering as well as the pool water. Once the water is in the pool and the recirculation system, it is no longer potable and should not be ingested.
- Backflow protection: All portions of the potable water supply system serving the pool(s) and auxiliary facilities shall be protected from backflow with a backflow prevention device.
- Fill/make-up water:
  - shall be tested for water quality as part of the Aquatic Safety Plan to ensure effective overall water treatment and to ensure fill water does not contribute to pool water contamination (e.g., some municipal water treatment use chloromated chlorine, which increases the level of chloramines in the pool water and affect water quality and air quality).
  - shall be from a potable water supply.

6.2 Water Replacement / Make-Up Water [60,61]

Rationale:
Water loss is common at aquatic venues due to evaporation, user splash out, plumbing, shell leaks, and planned dilution (adding fresh water to decrease the concentration of disinfection by-products not removed by the water treatment system). Planned dilution also helps control levels of total dissolved solids and other chemical used in pools (e.g., cyanuric acid).

Recommendations:
Calculating how much and how often pool water replacement shall occur during the aquatic safety planning stage involves, at a minimum

- removal of water from the pool and replacement with make-up water will occur as needed to maintain water quality
- recommended use of a dilution rate of 30 litres of fresh water per bather to decrease the concentration of bather-generated contaminants [WHO 2006]
- daily recording of water replacement rates shall be part of record keeping
- make-up water (fresh water) shall be from an uncontaminated potable water supply

(See also Section 5.1, Aquatic Play Feature General Recommendations)

[60] Toronto Public Health Swimming Pool Operator's Manual p 14
[61] WHO.(2006). Guidelines for safe recreational waters. Retrieved February 2011, from WHO Water Sanitation and Health: http://www.who.int/water_sanitation_health/bathing/srwe2chap5.pdf?ua=1 p 12

6.2.1 Spa water replacement

Rationale:
Spas, hot tubs, and therapeutic spas have higher contamination loads due to lower volume of water per patron (bather) and higher water temperatures. Both these factors increase disinfection use and contribute to the challenge of maintaining clean water. Complete water replacement, cleaning, scrubbing, and inspection prior to refilling are effective operational tools to prevent recreational water-related illnesses in these settings.

Recommendations: [62]
For spa water volumes exceeding 4000 litres

- 30 litres/day of water shall be replaced per bather to a maximum of 20% of total spa water volume

For spa water volume less than 4000 litres

- drain the water to waste and refill to the total volume of water in the public spa when[63]
  - total dissolved solids (TDS) have increased to 1500 ppm greater than TDS at spa start-up (start-up TDS includes source water TDS and any other inorganic salt added at start-up)
  - water replacement interval (WRI) is less than or equal to the number of days from the last replacement, calculated as WRI = V ÷ 10 x U
    WRI = maximum number of operating days between drainings, rounded up to a whole number
    V = total volume of the spa in litres
    U = total estimated number of bather uses per operating day

Prior to refilling of spa pools the following shall be performed along with any other identified operational procedures identified in the Aquatic Safety Plan:

- inspection of all parts including, but not limited to, drain covers, suction fittings, and all emergency equipment to ensure they are properly secured and operational according to standards and the manufacturer's operational instructions
- inspection of surfaces for biofilm, and the cleaning and scrubbing of all surfaces

6.3 Overflow Water/ Backwash Water

- Overflow water shall return to the filter system or shall be discharged to a sewer system approved by Nova Scotia Environment. Where overflow gutter water discharges into a sanitary sewer, a suitable air gap of not less than the diameter of the drainpipe shall be provided to create a gravity drip into the sewer without direct mechanical connection.
- Backwash water shall be discharged into a sanitary sewer with an approved gap or by other means advised by NSE.

[62] Toronto Public Health Swimming Pool Operator's Manual
[63] ANSI/APSP 11 2009 p. 4

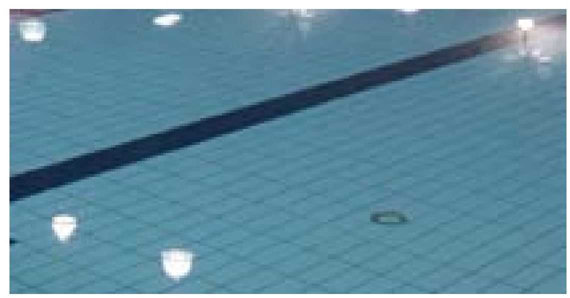
6.4 Water Clarity (Turbidity)

Rationale:
Poor water clarity in a pool can be a significant health hazard. When the water clarity is so poor as to obscure view of swimmers under the water or the bottom of the pool, immediate closure of the pool is required. Excessive turbidity can hinder lifeguard visibility of patrons who may be in distress under the water and interfere with patrons' visibility of other swimmers, the pool walls, and floor, which could result in impact injury and even death.

Poor water clarity indicates high turbidity. Turbidity is a measure of the density of particles suspended in water. High numbers of suspended particles (>1,000,000/mL) reduces water clarity (i.e., the water appears cloudy, green-coloured, or dull). High turbidity (poor clarity) usually results from

- poor water circulation and filtration
- poor operation, leading to build-up of algae and environmental dirt
- poor water balance (high pH, high total alkalinity, or high calcium hardness)
- no or ineffective disinfection/oxidation
- improper product addition
- improper ventilation

Poor water clarity

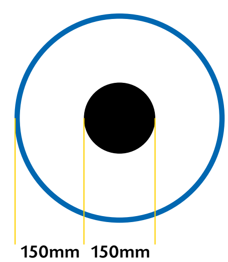


Good water clarity

Recommendations: [64, 65]

1. Maintain effective pool clarity

- The aquatic venue bottom shall be visible at all times.
- The bottom drain (at the deepest part of the pool) shall be clearly visible from the lifeguard stand and from the side of the pool at all times.
- Water shall pass the black disc test.
  - A black disc measuring 150 millimetres in diameter on a 450 mm white background is affixed to the bottom of the pool at the deepest point and shall be clearly visible from any point on the deck nine metres away from the disc.



Hint: The black colour will turn to grey as the water becomes cloudy.

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[64] Adapted with permission from Toronto Public Health, Pool Guidelines
[65] ANSI/apsp-11 2009 p. 3

Spas/Hot Tub Clarity
The bottom of the spa at its deepest point shall be clearly visible (this test shall be performed when the water is in a non-turbulent state and bubbles have been allowed to dissipate).[66]

2. Establish preventative and troubleshooting policies
An Aquatic Safety Plan shall

- include operational procedures to prevent, identify, and rectify high turbidity (low visibility) that shall include
  - effective water quality management
  - effective filtration and water circulation
- identify when to backwash filters, change filter mediums, and ensure the filtration and circulation systems operate 24 hours a day
- identify chemicals that can be used to assist in turbidity prevention and reduction (e.g., flocculants, clarifiers, ultraviolet, ozone, and monopersulfate use)
- include closure procedures and protocols
  - make sure a staff member with authority to close the pool when the pool fails the clarity test is on duty during all operation hours
  - implement and train staff on pool closure protocol

6.5 Pool Water Glare

Rationale:
Not all pools will experience a glare issue but glare can obstruct the ability of the patron and staff to see the bottom of the pool and therefore interfere with lifeguards' ability to see patrons in distress. It will interfere with the pool operator from seeing the early signs of algae growth and it also may prevent the patron from seeing the bottom of the pool, leading to impact injuries.

Recommendations:
- Windows and lighting equipment shall be adjusted to minimize glare and excessive reflection on the pool water surface.
- In lifeguarded facilities, the operator shall assess glare conditions frequently during operating hours to ensure the bottom and objects in the pool are visible. The operator may consider adjusting guard positions to improve visibility as a result of glare interference.
- The operator shall supply lifeguards with polarized sunglasses while conducting patron surveillance when it is necessary to reduce glare. (See also Section 8.2, Aquatic Facilities with Supervision and Lifeguards.)

[66] ANSI/apsp-11 2009 p. 4

6.6 Disinfection of Pool Water

Rationale:
"Strictly, disinfection means removing the risk of infection, and is achieved primarily by maintaining the correct concentration of disinfectant in the water. Primary disinfection means a treatment that will kill bacteria, viruses, parasites and provide a residual. Secondary disinfection (UV or ozone) increases the kill of infectious organisms, especially Cryptosporidium and is recommended for increased risk venues; Oxidation by disinfectants and non-chlorine oxidizers breaks down soluble dirt and other organic contamination introduced by bathers." [67]

6.6.1 Primary disinfection

Choosing the type of primary disinfectant depends on pool design, pool type, chemical storage space, pool intended use, intended bather load, potential for increased contamination burden, source water quality, and how it will be introduced, maintained, and monitored, and if secondary disinfection will be utilized. A primary disinfectant shall have the ability to leave a measurable disinfectant residual.

The choice of primary disinfection shall carefully consider the range of source water parameters, as disinfection can be affected by other chemicals and contaminants.

6.6.1.1 Chlorine

Chlorine is the most common primary disinfectant used in the treatment of swimming pool/spa water. Chlorine exists as gas, solid, and liquid. Each has advantages and disadvantages in its use and different ways of introduction to the water, which also plays a role in the management of chlorine and its effectiveness.

The chemical reaction that occurs upon introduction of chlorine to pool water is important to understand to ensure proper water management and to reduce risk of recreational water illness.

When chlorine is added to pool water, some of the chlorine reacts with organic materials and metals in the water, and will not be available for further disinfection. This is called the chlorine demand of the water. The remaining chlorine concentration is termed total chlorine.

$$TC = CC + FAC$$

Total chlorine (TC) consists of combined chlorine and free available chlorine (FAC; the chlorine available to inactivate disease-causing organisms).[68,69]

6.6.1.1.1 Testing and FAC Minimum Level Recommendations

Daily frequent monitoring and adjusting of chlorine residuals and other water parameters (pH) is necessary to ensure optimum chlorine effectiveness. (Table 5, next page).

[67] Pool Water Treatment Advisory Group (PWTAG), *Code of Practice The Management And Treatment Of Swimming Pool Water(2013)*, http://www.pwtag.org/documents/CodeofPractice1.13v5_000.pdf p 16
[68] http://www.cdc.gov/safewater/publications_pages/chlorineresidual.pdf
[69] http://www.ncceh.ca/en/professional_development/practice_questions/pool_chlorination

Table 5. FAC Minimum Level Recommendations [70]

Pool type	Free Available Chlorine	
	Un-stabilized	Stabilized or used with cyanuric acid (outdoor pools)
Public Pool (and play features)	1.0 mg/1 (ppm)	2.0 mg/1 (ppm)
Hot tub/Therapy/ Spa	3.0 mg/1 (ppm)	Not recommended
*Hypochlorous acid is approximately 80 times more effective than the hypochlorite ion as a disinfectant. It is important to maintain the pH below 7.8 to avoid disease transmission.[71]		

*Effect of pH on Chlorine

- at pH 8.0, only 20% of the FAC is immediately available as hypochlorous acid thereby making any measurable free available chlorine (FAC) less effective
- at pH 7.5, about 50% of the FAC is immediately available as hypochlorous acid making the FAC more effective

6.6.1.1.2 Combined chlorine (CC; chloramines)[72]

Rationale:
CC forms when chlorine chemically bonds to material containing nitrogen including, but not limited to, urine (ammonia), dead algae, skin and sweat. This reduces the chlorine available for disinfection, which reduces disinfection power. CC can be determined using an appropriate test kit and utilizing this formula:

CC = TC – FAC.

High CC levels

Levels above 0.4 mg/L (ppm) can indicate that the bathing load or contaminant load (from swimmers) is high. High CC can cause complaints of a strong chlorine smell, eye and possible breathing irritation after exposure to pool water and air, particularly for indoor pools. These complaints are further exacerbated when water becomes agitated from patron activity, pool features (wave pools, spray features), or hot tubs as all of these by nature aerosolize the water and corresponding CC into the aquatic venue's air.[73] High levels of CC, poorly positioned air vents, and inadequately designed and maintained ventilation systems increase potential health effects and equipment corrosion.[74]

[70] The USA Centre for Disease and Prevention. (2014) Model Aquatic Health Code-First Edition The Code
[71] ANSI/APSP 11 – 2009 p. 8
[72] CDC's Healthy Swimming Recommendations and the MAHC; The WHO Guidelines for safe recreational water environments Vol 2, Swimming Pools and Similar Environments; NSW Ministry of Health Australia; The National Swimming Pool Foundation, Pool & Spa Operator Handbook
[73] World Aquatic Conference Session, International Conference on Swimming Pool & Spa, Rome 2013: Key Advances in Disinfection By-Products and Microbiology, *Laura Suppes, R.S., M.P.H.,*
[74] NIOSH. 2008. Health Hazard Investigate Report: Investigation of Employee Symptoms at an Indoor Waterpark, Mason, OH. Cincinnati, OH: US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institutes for Occupational Safety and Health, NIOSH HETA No. 2007-0163-3062 http://www.cdc.gov/niosh/hhe/reports/pdfs/2007-0163-3062.pdf, ANSI/APSP 11 -2009 p. 4

CC and Ventilation

- The CC value found in water does not take into account how ventilation systems and air movement affect the chloramine levels in the air. An indoor pool with normal combined chlorine levels can have high air trichloramine levels if there is insufficient intake of fresh air. Conversely, an indoor pool (water) with relatively high combined chlorine levels can have normal air trichloramine levels if the ventilation system is highly efficient. Therefore, interpretation of combined chlorine results needs to take into account ventilation efficacy. Proper air movement and distribution are crucial in reducing chloramine concentrations and health effects.
- Chloramine compounds are heavier than air and are more likely to concentrate closer to the pool surface and deck level, and some airflow is required to move them towards an air return. Adequate airflow rates at deck and pool surfaces are necessary to move the contaminants from the pool to the return ducts so they can be exhausted from the building.

Combined Chlorine Reduction Recommendation[75]

Removing and/or reducing CC in pool water is an operational challenge. Pool operators and patrons must strive to reduce formation of CC in the water and from evaporating into the air. It is recommended to

- maintain CC below 0.4 ppm (mg/L) in pools
- test CC levels daily and maintain a record of results
- utilize techniques to reduce CC, such as
  - education of bathers on their role in pool contamination
  - utilization of tools like break point chlorination to reduce combined chlorine BPC = (CC-FC) x 10
  - UV technology to help degrade CC
  - ensuring a ventilation system is designed, positioned, and maintained to provide adequate withdrawal, and that dilution is good industry practice and meets at a minimum the Ashrae 62.1- 2007 standards for indoor pool ventilation. Note: This may not be possible for existing pools. These pools should at least have the ventilation system cleaned and evaluated. They should also consider poor ventilation as an obstacle for adding new pool features. (See also Section 6.13, Ventilation, Air Circulation, and Moisture Control.)

6.6.1.1.3 Effects of Cyanuric Acid on Chlorine[76]

Rationale:
Cyanuric acid is a weak acid that is marketed as a chlorine stabilizer for swimming pools exposed to natural UV light (outdoor pools). Other terms used by the pool supply industry are isocyanurates, conditioner, and CYA.

Cyanuric acid forms a weak bond with the free available chlorine in the pool water, effectively trapping the FAC from escaping and protecting it from the sun's UV rays. Properly managed, cyanuric acid reduces the amount of chlorine that needs to be added to maintain the minimum residual in an outdoor pool. In a small pool with a moderate bather load, cyanuric acid can significantly reduce the costs spent on chemical disinfectants.

[75] The Association of Pool and Spa Professionals, American National Standards for Water Quality in Public Pools and Spas, ANSI/APSP-11 2009
[76] Based on the CDC's Healthy Swimming Recommendations and the MAHC; The WHO Guidelines for safe recreational water environments vol 2, Swimming Pools and Similar Environments; NSW Ministry of Health Australia; The National Swimming Pool Foundation, Pool & Spa Operator Handbook

However, the temporary bonds cyanuric acid forms with the free chlorine may reduce the overall effectiveness of the FAC. The time required to kill bacteria in a pool can be significantly increased with the use of cyanuric acid and low levels of FAC. As the level of cyanuric acid rises in the pool water, the killing power of the FAC residual weakens. At above 50 ppm of cyanuric acid, the time it takes to kill bacteria in the water is longer compared to swimming pool water without cyanuric acid. As the level of cyanuric acid accumulates, the chlorine will become increasingly less effective in keeping the water clean and problems such as increased cloudiness in the pool water, and abundant growth of bacteria and algae, can occur.

- Unlike chlorine, cyanuric acid is never exhausted. Once added to the pool water, it remains. Adding more cyanuric acid will increase the level, not replace exhausted chemical.
- The best way to reduce cyanuric acid is to partially drain the pool and add fresh water.
- A pool shall be tested for cyanuric acid before any is added.
- Dichlor and trichlor are two solid chlorine compounds that are widely used as disinfectants in swimming pools. Both are often marketed as stabilized chlorine because they release cyanuric acid into the pool water. If either of these is used as the primary disinfectant then it may not be necessary to also add cyanuric acid to a pool. Testing levels is always the best policy to ensure sufficient, but not excess, quantity.

Recommendations:

- Cyanuric acid levels shall be tested at least once a week and before any additional cyanuric acid is added.
- Cyanuric acid levels shall not exceed 100 ppm, with the ideal concentration being 30-50 ppm.
- If levels rise above 100 ppm, a portion of the pool water shall be removed and fresh water added. There is no other means to reduce cyanuric acid levels in pools except by dilution with fresh water that contains no cyanuric acid.
- Pools that use cyanuric acid or stabilized chlorine shall at a minimum maintain a free chlorine residual of 2 ppm (mg/L).
- ORP readings decline as cyanuric acid levels increase, which reduces chlorine oxidation potential.
- Stabilized chlorine should not be used to hyper-chlorinate as it will raise cyanuric levels to unacceptable levels. (see the Diarrheal Release Response Recommendations Fact Sheet)
- Cyanuric acid should not be used with bromine or ozone.

6.6.1.2 Bromine Disinfection (Primary Disinfectant)[77]

A second form of primary disinfection is bromine. When bromine is dissolved in the water it produces hypobromous acid, a moderately powerful oxidizer and a good disinfectant. It is used more often in spas than pools due to the high contamination load and higher water temperatures found in spas (therapeutic pools and hot tubs). Bromine is more effective at higher pH values compared to chlorine. However, its use continually decreases pH and alkalinity levels, and bromine is not used with ozone or cyanuric acid. There is no known bromine stabilizer so this product is less effective in outdoor pools.

[77] National Swimming Pool Foundation (NSPF), Pool & Spa Operator Handbook (2011)

Table 6. Recommendations [78,79]

Pool type	Minimum bromine residual
Public swimming pool	3.0 mg/L (ppm)
Spa/Hot tub/Therapy pool	4 to 6.0 mg/L (ppm) High water temperature and heavy use may require operation at maximum levels[80]
With an N diethyl-p-phenylene test kit, the chlorine reading should be multiplied by 2.25 to obtain the bromine concentration.	

6.6.2 Secondary (supplemental) disinfection – Ultraviolet (UV) Light and Ozone

Secondary disinfection can be used in combination with the primary disinfection. In some instances, including increased risk venues (wading-toddler and therapeutic pools where accidental release is more common), it is highly recommended to use with primary disinfection.

Secondary disinfection is not a substitute for a residual disinfectant (primary disinfection) as it does not carry its disinfection properties into the pool.

6.6.2.1 UV light recommendation

- UV systems shall only operate while the recirculation system is operating.
- An operational manual is to be available onsite and staff shall be properly trained in the operation and maintenance of all equipment.
- UV systems shall be operated and maintained according to manufacturer's instructions.
- UV systems shall be designed and installed so lamps can be readily cleaned and maintained.
- UV systems shall be operated and maintained to meet or exceed the minimum validated output intensity needed to achieve the required dose for a 3-log inactivation of Cryptosporidium.
- UV sensors shall be calibrated at a frequency in accordance to the manufacturer's instructions and all calibration shall be maintained onsite.
- UV systems shall be operated not to exceed the maximum validated flow rate and shall meet no less than the minimum validated output intensity.

78 The USA Centre for Disease and Prevention. (2014) Model Aquatic Health Code-First Edition The Code
79 Toronto Public Health, Spa Operations Manual, p. 53
80 ANSI/APSP 1 2009 p. 9

6.6.2.2 Ozone[81]

- An operational manual is to be available onsite and staff shall be properly trained in the operation and maintenance of all equipment.
- Ozone systems shall be operated and maintained according to manufacturer's instructions.
- Ozone is toxic at high concentration and an irritant at low concentrations. When used indoors, air monitoring devices shall be utilized and the ozone concentration in the air shall not exceed the 8-hour Time Weighted Average in any 8-hour work shift of a 40-hour work week.[82]
- Residual ozone concentration shall remain below a minimum of 0.1 ppm (mg/L)
- Ozone systems shall be operated and maintained to meet or exceed the minimum validated output intensity needed to achieve the required dose for a 3-log inactivation of Cryptosporidium.

6.6.3 Salt Water Generation Disinfection Systems

Rationale:
These are part of a new wave of disinfection delivery. These systems produce chlorine (sodium hypochlorite) onsite and it is used as a disinfectant for the pool water. Therefore water management and disinfectant parameter testing is the same as for chlorine.

Resource:
Salt water generators use a low voltage electric current to convert chloride salt in water into chlorine (sodium hypochlorite) via electrolysis. A timer or an automatic sensor and control system can control the operation of a salt chlorinator. Chlorinator output is related to the size or number of electrode plates. As this output is fixed, bather loads and chlorine consumption should be considered before installing the system.

Scaling of the electrode plate may occur if there is too much calcium hardness in the water. Electrodes require periodic cleaning with acid in accordance to manufacturer's directions. Cells will require replacing with age.

Recommendations:

- Use only pool grade salt.
- Maintain salt in the pool water at approximately 2500 ppm or as indicated by the manufacturer's instructions.
- Pool chemistry parameter levels like FAC, CC, and pH will have the same effect and require the same attention as a non-salt generated pool, and require the same frequency of testing.
- Fecal release remediation may require super or hyper chlorination with a secondary source of chlorine to allow a quick response to a fecal accident. This shall be clearly identified and outlined in the facility specific Aquatic Safety Plan.
- A warning device (visual and/or audible) shall be programmed to warn operators when the cell voltage is not working or not within the manufacturer's recommended range.
- An automatic shut-off mechanism shall be in place to shut off the chlorinator's electric power to the electrolytic cell in the event of[83]
  - loss of electric power
  - interruption in water flow through the cell

[81] The USA Centre for Disease and Prevention. (2014) Model Aquatic Health Code-First Edition The Code
[82] ANSI/APSP -11 2009 p. 2
[83] NSF/ANSI 50-2009a

6.6.4 Disinfection dosing (disinfection and chemical addition methods) [84,85]

Rationale:
How disinfectants and chemicals are added to the pool influences the disinfectant's effectiveness. Chemical dosing can occur pre- or post-filtration, and is dependent on the individual disinfectants and pool design. It is important to respond quickly to changes in disinfectant demand in busy pools. Automation allows this to be done with less effort and with more precision and has been proven to save money by reducing chemical costs.

Hand dosing or broadcasting delivers disinfectant (chemicals) to the pool water manually (by hand or by manually adding to an erosion feed system). It is not the recommended method to be used in "larger"pools due to several drawbacks that include, but are not limited to

- the potential for human error
- ineffective response times to an increase in disinfection demands
- increased worker safety risk

Hand dosing requires strong pool management of operations, training, and monitoring and shall not be done when patrons are in the pool or pool area.

Automatic dosing system is the preferred method of dosing as it will deliver disinfectant to the pool in a controlled continuous and steady rate in response to the disinfection demand. There are various forms of automatic dosing systems including systems that collect information via probes that feed the information back to a controller that automatically adjusts the dose rate of the continuous metered dosing system. In some cases it can also monitor pH and oxidation-reduction potential. Examples include salt water generators (see Section 6.6.3, Salt Water Generation Disinfection Systems), dry chemical feeders, or a pump that delivers liquid chlorine at a particular rate, or erosion feeders.

An automatic dosing system enables a quick and effective response to pool water disinfection and pH demands. It is intended to prevent the disinfectant residual to drop below the set level and prevents pH from moving out of the required range.

Recommendations:
- Swimming pools and spas shall have, or strive to have, automatic dosing equipment that meets NSF/ANSI Standard 50, to effectively manage pool water.
- A maintenance and inspection plan shall be developed and implemented as outlined in all the necessary equipment and chemical manufacturer's manuals and any engineering instructions.
- The system
  - shall operate 24 hours a day
  - ensures dosing pumps are in good working order and will automatically shut off when circulation system is turned off or if there is a failure (If chemical dosing continues with no water, a chemical build-up will occur that could result in a chlorine gas build-up that would be dangerous to the patrons and pool environment).
  - having automatic controllers shall be monitored by visual observation and as indicated in the manufacturer's instructions at the start of each operating day to ensure functioning
  - ensures chemical levels and equipment are routinely checked

[84] http://www.health.nsw.gov.au/environment/factsheets/Pages/disinfectant-dosing.aspx
[85] WHO, http://www.who.int/water_sanitation_health/bathing/srwe2chap5.pdf p87

- Hand dosing, broadcasting, or floating devices are not continuous-metered disinfectant dosing systems. An erosion feeder is not a continuous-metered disinfectant dosing system unless it can deliver the disinfectant at a constant continuous rate instead of at a diminishing rate.

6.7 Oxidation-Reduction Potential (ORP) [86]

ORP is the potential of a disinfectant to inactivate germs and oxidizing organic material.

- It senses the oxidation potential of the water (chlorine is a strong oxidizer, so ORP inadvertently measures the disinfectant's oxidation capability). It is not a replacement for testing FAC but can be an effective system to assist in water quality management.
- OPR does not measure disinfection level, such as FAC.
- ORP and disinfectant level do not have a linear relationship. Low free available chlorine level in a pool does not mean that the ORP will also be low.

The ORP measure is in millivolts using probes. The higher the millivolt reading, the more powerfully the swimming pool water is able to oxidize and disinfect. It will require calibration and training on its use, including potential interferences, which all shall be outlined in a facility-specific Aquatic Safety Plan. For additional information see manufacturer's instructions.

ORP Recommendations [87]

- In swimming pools and spas, an ORP of 650 to 720 mV allows quick disinfection and breakpoint chlorination (destruction of chloramines) where conditions permit.
- Ensure probes are calibrated every day to a known standard as described in the manufacturer's operation manual.
- Since some chemicals used in public pools including cyanuric acid and potassium monopersulfate can interfere with the ORP test results, ensure an Aquatic Safety Plan identifies any potential interference in testing and monitoring of all water parameters.
- Ensure that probes are cleaned at a frequency that ensures they will always effectively respond to pool demands (Note: Some probes come with an automatic cleaning feature).
- Free available chlorine levels shall be checked daily as described in this guideline and as determined in the facilities Aquatic Safety Plan.
- Perform appropriate (refer to operations and maintenance instructions) verification tests that will verify that the ORP sensor is operating properly.

[86] CDC's Healthy Swimming Recommendations and the MAHC; The National Swimming Pool Foundation, Pool & Spa Operator Handbook (2011) p. 93

[87] CDC's Healthy Swimming Recommendations and the MAHC; The National Swimming Pool Foundation, Pool & Spa Operator Handbook (2011)

6.8 Non-chlorinating oxidizing products – potassium monopersulfate

Non-chlorinated oxidizing products like potassium monopersulfate can be used as a non-chlorine oxidizing shock instead of chlorine shock or when super-chlorinating. These compounds are used in addition to disinfectants. They do not replace disinfection but instead assist primary disinfectants. They cannot be used to hyper-chlorinate when an incident release has occurred.

6.9 Water Balance

Water balance includes pH, alkalinity, calcium hardness, total dissolved solids (TDS), and Langelier Saturation Index (LSI).

6.9.1 pH [88]

Rationale: Correct pH is essential for water balance (equipment protection), bather comfort, and disinfection efficiency. Understanding what affects pH and how pH affects water quality (including disinfection efficacy) are essential for a pool operator to know.

pH is a measure of the relative acid/alkali strength of a solution. pH is measured on a scale from 1 to 14, with 7.0 being neutral. Pool water shall be maintained between 7.2 and 7.8 with the ideal level between 7.4-7.6 (Table 7, below).

Table 7. Consequences of pH

When pH is too high	When pH is too low
water is more likely to have scale-forming properties creating higher equipment maintenance and shortening equipment lifespan	water will be corrosive to pool equipment and surfaces
pH will affect chlorine disinfection ability • as pH increases, free chlorine loses its oxidative ability • at a pH of 8.0, only 20% of free chlorine is immediately available as hypochlorous acid, which is the compound that kills germs • at a pH of 7.5, about 50% is immediately available	water will irritate the eyes and skin, and cause bathing suit wear

What affects pH

Knowing what affects pH will aid in maintaining a satisfactory pH level in the aquatic water. pH is affected by

- addition of disinfectants that are strongly acidic or alkaline, which will lower or increase pH
- aeration (exposure to the air, such as by wave action), which increases pH by removing acidic gases
- pH of source water
- patron waste and personal hygiene including urine, fecal matter, and cosmetics

[88] http://www.who.int/water_sanitation_health/bathing/srwe2chap5.pdf

Recommendations[89]

- The ideal range for pool/spa water is 7.4 to 7.6.
- The acceptable range is 7.2 to 7.8.
- pH shall be tested prior to opening to adjust pool chemistry if necessary before opening and every 2 to 4 hours depending on the pool chemical addition method and bather load (see Table 8, Frequency of Water Parameter Testing, page 76).

6.9.2 Alkalinity (Carbonate/Biocarbonate)

Alkalinity measures the amount of salts present in the water. Alkalinity works as a buffer to prevent pH fluctuation or pH bounce. Conversely, total alkalinity above 200 ppm can make any necessary pH adjustment difficult (i.e., pH lock). Both of these extremes affects water chemistry and the ability of chlorine to kill bacteria and will cause corrosion, staining, scaling, cloudy water, or eye/skin irritation.

Recommendations:

- 60 to 180 ppm (mg/L)[90]
- ideal range 80 to 100 ppm when calcium hyperchlorite, lithium hypochlorite, and sodium hypochlorite are used, which increase the pH
- ideal range 100 to 120 ppm when dichlor, trichhlor, chlorine gas, and bromine are used (these cause pH to fall)

6.9.3 Calcium hardness[91]

Calcium hardness measures the amount of calcium salts present in the water. Relative to the other water balance parameters, if calcium hardness is too high, scaling of heaters and pool finishes may occur. If calcium hardness is too low, etching of cement and tiles and corrosion of heating and circulation components may occur. Calcium behaves differently from most chemicals, in that it becomes less soluble as temperatures rise, which is an important factor for pools with higher water temperatures. In areas of high calcium source water, specialist advice shall be sought before establishing recommended water balance parameters and choice of disinfectant and pH chemicals.

Recommendation:

Pools and Water Parks	150 - 400 mg/L
Spas	100 - 250 mg/L

6.9.4 Total Dissolved Solids (TDS)

TDS measures all solids and salts dissolved in pool water. TDS is increased by the addition of chemicals and salts from pool users and then concentrated further by the evaporation of water. TDS has also been described as a measure of the age of the water. Water replacement ensures lower TDS levels, water freshness, and water health.

Recommendations:

- The level of TDS shall be a maximum of 1500 ppm above fill water TDS.
- For salt-chlorinated pools, the TDS should be measured after the addition of salt to determine the acceptable base TDS. The salt in salt-chlorinated pools constitutes the bulk of TDS and shall be accounted for when measuring TDS.

[89] http://www.who.int/water_sanitation_health/bathing/srwe2chap5.pdf, CDC MOHC, Disinfection, ANSI/APSP-11 2009 p. 14
[90] ANSI/APSP-11 2009,Vore, Roy, RWI, NSPF
[91] ANSI/APSP-11 2009

6.9.5 Langelier Index (Saturation Index, SI)

Rationale:

Water balance describes the scale or corrosion activity of pool water. Water balance is affected by five factors: pH, total alkalinity, calcium hardness, temperature, and TDS. When balanced, these factors increase disinfection efficacy, maintain bather comfort and protect the pool equipment and pool surfaces from corrosion and scaling. Maintaining water balance takes knowledge, time, and precision.

Water balance can be calculated using a number of indexes and tables. The SI is the most universally accepted method and is calculated as:

SI = pH + TF+ AF+ CF– 12.1
TF = temperature factor
AF = alkalinity factor
CF = calcium factor

pH and specific tables are used to establish the factor of temperature, alkalinity, calcium, and then use the constant -12.1 for TDS. If the sum of these factors is too low, water will be corrosive to fittings and finish. These corrosive conditions occur when SI is less than –0.5 (for heated water, SI should not be less than –0.2). When the sum of these factors is too high, water will cause deposits to form on fittings and finishes. These scale-forming conditions occur when SI is more than +0.5.

Recommendation $-0.3 < SI > +0.3$

6.9.6 Water temperature

Monitoring and ensuring the appropriate pool water temperature is dependent on, and important for, several reasons including, but not limited to these factors:

- At higher water temperatures, the primary disinfectant is used up more rapidly increasing the risk of no or reduced primary disinfection residual levels, which leads to microbial growth.
- The activity level expected of the patrons may have an effect on what temperature the water shall be maintained. Typically, competition pools are maintained at a lower temperature than wading (toddler) pools.
- Human health can be affected by water temperature that is too high or too low.
- The higher the temperature, the more likely scaling is to occur because calcium solubility is lowered as temperature increases.
- At a lower temperature, the water can absorb more calcium. Concrete, marble sheen, or tiled pool surfaces may become etched.

Recommendations:[92]

- Pool temperature depends on the intended user/type of pool, but typically is between 26 to 32°C[93]
- Spa (hot tub, therapy) pool water temperature shall not exceed 104°F (40°C) due to health concerns.
  - The length of time a patron stays in a higher temperature pool is dependent on age and health conditions. Restricted and warning signs shall be clearly displayed in the direct area of the pool. See also Section 5.2.3, Timing Device.

6.10 Other

Clarifiers, flocculants, and defoamers shall be used per manufacturer's instructions.

[92] The USA Centre for Disease and Prevention. (2014) Model Aquatic Health Code-First Edition The Code
[93] ANSI/APSP-1 2009 p. 27

6.11 Monitoring Water Quality Parameters [94,95]

Rationale:

Accurate test results allow the operator to verify that the pool chemistry is effective and allows the operator to take corrective action as necessary to ensure effective disinfection, reduce operation costs, and prevent equipment/surface corrosion and scaling. To ensure accurate results, testing shall be done using appropriate equipment and following the manufacturer's instructions. Good record keeping helps to reveal and resolve problems, track chemicals used, and troubleshoot unexpected results. For example, identifying through testing that the free available chlorine residual is zero will indicate a need of immediate corrective action. Good record keeping can be helpful to determine the exact amounts of chemical required to effect a particular amount of change in pool chemistry.

Water Quality Testing Equipment (WQTE) Recommendations [96,97]

- Suitable testing equipment is to be provided for the reliable determination of primary disinfectant residuals including free available chlorine, total chlorine, pH, total alkalinity, calcium hardness, cyanuric acid, total dissolved solids, oxidation-reduction potential, salt, and any other parameter identified in the Aquatic Safety Plan.
- Testing equipment shall come with [98]
  - detailed instructions including calibration methods, if applicable
  - maintenance of WQTE components, if applicable
  - proper storage instructions and replacement instructions
    - Test kits are best kept in a cool and dark place to prevent deterioration of the chemicals. Chemicals and reagents are to be replaced frequently as per the manufacturer's recommendations (in many cases, annually). Test kit and chemical operational instructions on storage, handling, and replacement shall be consulted when developing standard operating procedures.
- Titration testing is recommended over colorimetric test kits as they are accurate to 0.2 mg/L (ppm) with easily recognizable start and end points.
- Tests need to be conducted according to manufacturer's instructions and recommendations, and shall be undertaken by individuals trained to do the testing and familiar with test result response. Testing equipment needs proper maintenance.
- Chemical controllers shall be maintained and calibrated according to manufacturer's recommendations.
- If automatic sensing devices are used to determine the ORP, pH, and disinfectant residuals, manual testing shall be conducted at least once a day to ensure that the automated sensing device is maintaining proper control.
- Test kits that use the diethyl-p-phenylenediamine (DPD) method or FAS-DPD are recommended for testing free and combined chlorine.
- Test kits using the orthotolidine (OTO) method are not recommended as they present health hazard risks to the user, can test only for total chlorine, and do not differentiate between free and combined chlorine.

[94] Adapted with permission from the BC Guidelines for Swimming Pools 2012
[95] CDC's Healthy Swimming Recommendations and the MAHC; The WHO Guidelines for safe recreational water environments Vol 2, Swimming Pools and Similar Environments; NSW Ministry of Health Australia; The National Swimming Pool Foundation, Pool & Spa Operator Handbook
[96] B.C. Guidelines for Swimming Pool Operations
[97] ANSI/APSP-1 2009 p. 27, p. 30
[98] NSF/ANSI 50-2012 p. 59

Section 6: Pool Water Quality Management

Potential water test interferences shall be accounted for and steps to reduce interference shall be developed. For example, potassium monopersulfate will cause a false positive (more intense pink colour) for combined chlorine at any level and for free chlorine at high levels (over 25 ppm) when using a DPD test kit.[99]

Table 8. Frequency of water parameter testing[100]

Parameter	Frequency of testing during periods of use All Aquatic Venues	
Sanitizer (disinfectant) and pH	Manual feed system	Prior to opening, then every 2 hours
	Automatic Feed	Prior to opening, then every 4 hours
	In-Line ORP	Prior to opening, then every 4 hours or once a day
Clarity	Daily	
Temperature	Daily	
Alkalinity	Once per week	
Hardness	Every two weeks	
Cyanuric Acid	24 hours after addition then once per month. If stabilized chlorine is used, then once every 2 weeks	
Salt	Weekly or as per manufacturer's instructions	

[99] CDC's Healthy Swimming Recommendations and the MAHC; The WHO Guidelines for Safe Recreational Water Environments Vol. 2, Swimming Pools and Similar Environments; NSW Ministry of Health Australia; The National Swimming Pool Foundation, Pool & Spa Operator Handbook

[100] ANSI/NPSP 11-2009 p. 31

6.12 Water Microbiological Testing

Recommendations:[101,102]

- Provided minimum disinfection levels and other parameters are consistently maintained, monitored, and recorded as described in this guideline, routine microbiological testing is not necessary, unless the Aquatic Safety Plan has established reasons, except
  - before a pool is used for the first time
  - before the pool is put back into use after it has been shut down for repairs or cleaning
  - if there are difficulties with the treatment system
  - as part of any investigation into possible adverse effects on bather and worker health
- When sampling is performed it shall be conducted
  - from the point near an outlet or from any other location necessary to give an accurate representation of the water in the pool
  - between 200 and 400 millimetres below the surface of the water
  - using standard operating procedure and appropriate sampling technique
- Algae shall not be visible in the pool or spa when it is open for public use.

6.13 Ventilation, Air Circulation, and Moisture Control [103,104,105]

Rationale:

Ventilation and air circulation systems provide fresh air exchange and air circulation. For indoor facilities it is also an essential tool used, in combination with good water chemistry control, to remove disinfectant by-products (DBP) from the air breathed (when such by-products exist). Proper ventilation and circulation also ensures relative humidity levels are maintained at a level that is comfortable for the patrons. Humidity should also be maintained at a level that prevents damage to the equipment and structural integrity of the facility.

Biological and chemical by-products in pool water that are released to the air can affect patron health and pool equipment. This is especially problematic for indoor water parks and indoor aquatic facilities with many play features. When urine and sweat are introduced into the pool water the nitrogen will combine with the chlorine to form monochloramines, dichloromethanes, and eventually trichloromethanes (chloramines). Dichloromethanes and trihalomethanes can easily move from water to air. Aquatic play features will aid in this transfer from water to air. The levels of di- and trichloromethane will increase with high bather loads, poor water chemistry control, poor water feature maintenance, and poor ventilation.[106]

101 WHO
102 Vore, Roy Ph.D., Recreational Water Illness, Aquatic Management Series, The National Swimming Pool Foundation.
103 The USA Centre for Disese and Prevention. (2014) Model Aquatic Health Code-First Edition The Code
104 National Swimming Pool Foundation, Pool Operator Handbook 2011 , p. 158-159
105 NSPF Aquatic Facility Environmental Health Leader Symposium Live Streamed from WAHC, Indoor Air Quality Franceen Gonzales, Vice President, Risk Management at Great Wolf Resorts, Inc., October 15, 2013
106 National Institute for Occupational Safety and Health (NIOSH) (2010). Workplace Safety Report: Reducing Illnesses at Indoor Waterparks. DHHS NIOSH Publication No. 2010-138 retrieved from the www on March1, 2014 at http://www.cdc.gov/niosh/docs/wp-solutions/2010-138/pdfs/2010-138.pdf

Section 6: Pool Water Quality Management

Recommendations:

1. General

- Air handling systems shall be maintained and operated to comply with all requirements of the original system design, construction and installation.
- The air handling system shall operate continuously, including providing the required amount of outdoor air. The exception is that the amount of outdoor air may be reduced by no more than 50% during non-use periods as long as acceptable air quality is maintained.
- Develop and implement a ventilation/circulation system program of standard operating, maintenance, testing, and inspection procedures with detailed instructions and provide the required training to ensure effective ongoing maintenance and monitoring and cleaning.
- Implement a ventilation cleaning program including replacement or cleaning, where appropriate, of ventilation air filters.
- Monitor, log, and maintain ventilation set points and other operational parameters as intended according to the engineering and manufacturer's specifications.

2. Facility Modification

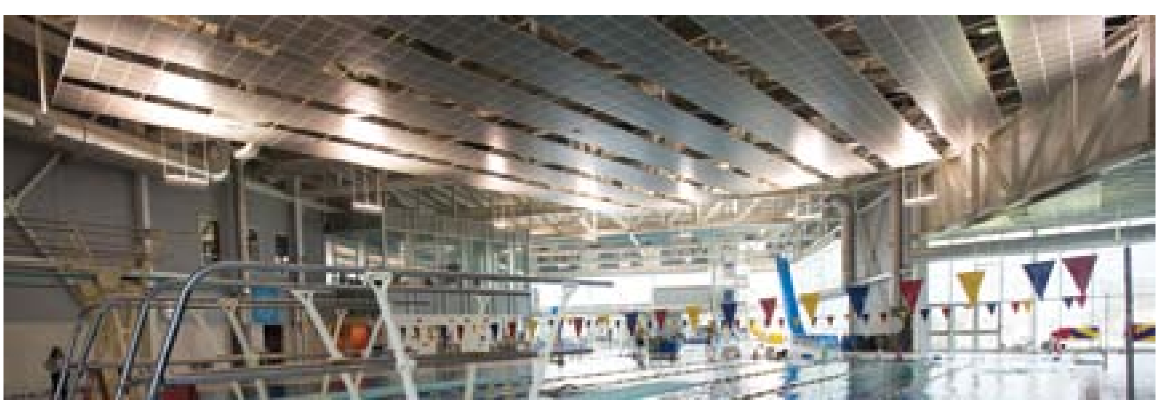
- ensure ventilation and circulation needs are evaluated, including vent positioning, when an aquatic venue is modified, which would include, but not be limited to
  - addition of aquatic features, such as spray pads/elements, wave, and slide features
  - increase in size or number of pools and spas
  - modification of ceiling height

3. Troubleshooting could include

- ensuring that air exhaust ducts are exhausted outside and are not exhausted to another area of the building (such as change rooms)
- ensuring that low-level exhausts are used close to the water or water feature to help exhaust air from surface water
- ensuring that relative humidity levels are maintained below recommended levels (higher levels encourage corrosion and occupant discomfort)
- developing and implementing an operational plan for reducing combined chlorine compounds and an educational campaign on the role patrons play

4. Emergency Planning

- Develop an air quality action plan with procedures for purging the indoor aquatic facility for chemical emergencies or other indicators of poor air quality.



6.14 Facility Heating

Recommendations:

- Maintenance, repairs, and alterations to facility-heating equipment shall preserve compliance with applicable codes.
- Air temperature shall be controlled to the original specifications or in the absence of such, the dew point of the interior space should be maintained at less than the dew point of the interior walls at all times so as to prevent damage to structural members and to prevent biological growth on walls.

6.15 Water Heating

Recommendations:

- Maintenance, repairs, and alterations to pool-water heating equipment shall preserve compliance with applicable codes.

Section 7: Recirculation and Filtration

Rationale:
Water circulation and filtration plays a key role in water quality and the prevention of recreational waterborne illness and physical injury. Effective and appropriately sized water pumps, flow rates within the recirculation system, and the appropriate filtration provide the following benefits:[107]

- An effective circulation system
  - ensures treated filtered water is delivered to all parts of the pool
  - delivers the water in a safe manner (without risk of entrapment)
  - ensures dirty water (particles and germs) are removed from the pool
- Effective filtration
  - removes particles that may shield microorganisms that will interfere with disinfection functioning
  - removes particles that will contribute to turbidity, which increases pool clarity and reduces the risk of failing to see a bather in distress under water
  - removes organic particles from pool water, preventing the production of disinfection by-products in the water and their release into the air
  - is crucial in the removal of Cryptosporidium oocytes and Giardia

[107] http://www.who.int/water_sanitation_health/bathing/srwe2chap5.pdf

Section 7: Recirculation and Filtration

7.1 General Recommendations

- The recirculation system and chemical feeders shall be designed and maintained to circulate and treat the water continuously throughout the entire pool 24 hours each day, regardless of the actual use time of the pool, except when maintenance, repairs, and backwashing are being done.
- Flow through the various components of a recirculation system shall be balanced according to maximize the clarity and safety of a pool.
- For gutter or skimmer pools with main drains, the required recirculation flow shall be as follows during normal operation:
  - at least 80% of the flow through the perimeter overflow system
  - no greater than 20% through the main drain

7.2 Circulation, Chemical Feeders and Filtration Recommendations [108]

- equipment is to be maintained and function as intended and designed
- operational manuals for all equipment shall include operating, cleaning, installation,and maintenance instructions and these details shall be incorporated into the standard operation procedures of the Aquatic Safety Plan and be on site
- appropriate training of all staff in the operation, maintenance, and repair of equipment and/or a list of appropriate professionals (e.g., certified electrician) named in the Aquatic Safety Plan where required

7.2.1 Surface Water Removal (Skimmers)

Rationale:
Overflow system (gutter) and skimmers are two methods used for surface water removal in filtering, disinfection, and recirculation of water to the pool. If these become blocked or if they are broken it will lead to ineffective circulation and disinfection and may become a suction entrapment risk for patrons.

Operational Recommendations:

- Surface water removal systems shall be designed, installed and operated not to create a hazard to the user.
- The overflow systems shall be kept clean and free of debris that may restrict flow.
- The automatic fill system shall maintain the water level at an elevation such that the gutters shall overflow continuously around the perimeter of the pool.
- The automatic fill system shall maintain skimmer water levels near the middle of the skimmer openings when the pool is unoccupied.
- The flow through each skimmer shall be adjusted as often as necessary to maintain skimming action that will remove all floating matter from the surface of the water.
- The strainer baskets for skimmers shall be cleaned daily.
- Broken or missing skimmer weirs/covers shall be replaced immediately. (See also Section 7.3, Preventing Suction Hazards in Pools and Spas.)
- A flotation test may be required to evaluate the effectiveness of surface skimming.

[108] NSF/ANSI 50-2012

7.2.2 Piping and valve system

Rationale:
A pool's piping and valve system is an essential component to the circulation system. Being able to identify the pipe being used for a particular function when maintenance is required will ensure worker safety and effective preventative maintenance.

Recommendations:
- All piping shall be non-toxic and be able to withstand the design operations pressure.
- Pipes shall be colour coded, labeled, or tagged for clear identification to aid in pool operation, maintenance, and safety. Components that shall be clearly identifiable include, but are not limited to
  - chlorine lines and pipes carrying chlorinated water
  - other chemical lines
  - potable water lines
  - flow of water in the pipe
  - filtered water lines
  - backwash lines
  - heated water lines
  - valve, meter, and pressure gauge identification

7.2.3 Pumps and Strainers

Rationale:
Circulation pumps provide the power to enable the water to move through the circulation system. If these are not sized appropriately and provided with preventative maintenance, the pumps will not work or will not be effective leading, to pool closures.

Recommendations:
- Pumps shall be sized to suit the water circulation system of the pool to ensure it is capable of providing the flow required for filtering the pool water and filter cleaning, if applicable, against the total dynamic head developed by the complete system.
- Pumps shall be provided with preventative maintenance.
- Pumps shall be equipped with appropriate and accessible (pressure) gauges.
- Strainers shall be in place and cleaned as required to maintain pump performance.
- Emergency shut-off switches shall be maintained and inspected to ensure the circulation power can be stopped in case of emergency.

7.2.4 Pool design flow rate

The flow rate of a pool is measured in gallons per minute (or L/min) and is the rate of water movement within the circulation system. There shall be sufficient flow rate to achieve required turnover rates.

Flow Rate = Pool volume/Turnover rate/60 min/hour

7.2.4.1 Turnover rate and flow rates

Rationale:
To ensure water clarity and prevent recreational water injuries, the volume of pool water shall continuously be removed from the pool, filtered, treated, and returned to the pool. This does not happen completely in one turnover. Instead it is done through dilution and so it will take several turnovers to ensure the entire body of water is moved through the filtration and treatment system. The pool type (design) and potential contamination load play a key role in designing turnover rates. It is essential the flow rate and circulation system does not allow for any stagnant spaces in the water or suction hazard concerns.

The turnover rate is calculated in hours and is the time it takes for the volume of pool water to be filtered, disinfected, and returned to the pool:

Turnover rate (hours) = Pool volume / Flow rate / 60 min/hour

Table 9. Turnover Rate (hours): Quick Reference Chart

Recommended Turnover Rates by Pool Type [109, 110, 111]								
Pool type	Swimming Pool	Wave Pool	Wading Pool*	Water slide/ Receiving Pool/Plunge	Whirlpool spa	Activity Pool (>2 ft)	Lazy River Pool	Run-out slide
After major renovation or built after 2014								
Turnover max rate	6 hours	2 hours	1 or less hour	30 minutes – 1 hour	30 minutes	2 hours	2 hours	1 hour
Before 2014 Guideline								
Turnover max rate	6 hours (4 in 24 hours)	N/A	4 hours (6 in 24 hours)	N/A	30 minutes	N/A	N/A	N/A

* Would benefit from secondary disinfection

Resource:
An increase in turnover rate will mean an increase in the flow rate. A decrease in turnover rate will produce a decrease in the flow rate. This is an important relationship to understand from an operational and safety perspective. A drop in flow rate may indicate the filters need to be cleaned (backwashed/maintenance performed), skimmers need cleaning, and/or water pump issues. If the flow rate is too high for equipment capability including covers it may present a suction entrapment hazard due to an increase flow in the circulation system. See Section 7.3, Preventiing Suction Hazards in Pools and Spas.

[109] Comparison of various Provincial Pool Guidelines including those in draft form
[110] The USA Centre for Disease and Prevention. (2014) Model Aquatic Health Code-First Edition The Code
[111] ANSI/APSP-9 2005 Standard

7.2.5 Flow meters/Pressure and Vacuum Gauges

All pools and spas shall be equipped with a flow metering device that indicates the rate of flow through the filtration system. Where a single treatment plant serves two or more separate pools, provisions shall be made for measuring the flow into and from each pool. Ideally all pools shall have separate circulation and filtration systems.

Recommendations:

- Every pool shall be equipped with, and staff trained in, the flowmeter device or other industry-specific device used to determine flow rate (electronic or analog).
- The device shall be accessible for ease of viewing and servicing.
- The device shall be appropriately calibrated.
- The Aquatic Safety Plan shall stipulate the design flow rate and readings shall be checked and recorded daily.
- Skimmers and baskets shall be cleaned of debris daily or more often if required.
- Drain covers shall be properly sized to the design flow rate.
  - The flow rating of the cover must exceed the maximum achievable flow by the pump when all the circulation valves are fully open, and with a clean filter, strainer, and skimmer baskets. This is an important aspect of suction entrapment hazard mitigation.

7.2.6 Filtration

Rationale:

Filtration plays a key role in cleaning the pool water by filtering out (trapping) contaminants in the filter media. There are a variety of types of filters and filter media utilized in industry including sand filters, diatomaceous earth filters, and cartridge filters. Without proper maintenance, filters can become clogged, reducing flow rates, and can become a source of pool water contamination.

Recommendations:

- All pools that recirculate water require filtration.
- All filters shall be certified to BSF/ANSI 50.
- The operator shall be trained in the use of the various settings, valves, gauges, and procedures of the filtration system including filter, recirculate, backwash, cleaning, replacement and drain.
- A qualified operator shall inspect other granual filters for proper depth and cleanliness at least once each year, replacing the media when necessary to restore depth or cleanliness.
- One full set of spare cartridges (when used) shall be maintained on site in a clean and dry condition.
- Diatomaceous earth (DE), when used, shall be added to precoat filters in the amount of 1 to 2 pounds (0.45 to 0.91 kg) per 10 square feet of filtration surface area unless more is recommended by the filter manufacturer and the filter is certified to NSF/ANSI 50 by an ANSI-accredited certification organization for a higher precoat media dosage rate.
- Perlite, when used, shall be added to precoat filters in a minimum amount of 0.5 to 1 pounds (0.23 to 0.45 kg) per 10 ft^2 (0.93 m^2) of filtration surface area unless more is recommended by the filter manufacturer and the filter is certified to NSF/ANSI 50 by an ANSI-accredited certification organization for a higher precoat media dosage rate.
- Ensure filter flow rates are maintained as designed and that they can achieve the pool's turnover rate.

Table 10. Commonly Accepted Media Rates[112]

Filter Type	Filter Media Rate	Filter Type	Filter Media Rate
High Rate Sand	5-20 gpm/ft^2 204 -813 lpm/m^2	Cartridge	0.375 gpm/ft^2 15 lpm/m^2
Diatomaceous Earth	2.0 gpm/ft^2 81 lpm/m^2	Diatomaceous Earth with Slurry	2.5 gpm/ft^2 102 lpm/m^2
Rapid-Sand Filter	3gpm/ft^2 122 lpm/m^2		

7.2.6.1 Filter backwashing/cleaning and replacing

- As per manufacturer's instructions.
- Filter backwashing shall occur when the water entering the filter and the water exiting the filter reaches a 10 to 30 psi difference in the pressure gauge.
- If there is only one pressure gauge then backwashing shall occur when the pressure increases by 8 to 10 psi.
- Filter backwash lines, deck drains, and other drain lines connected to the aquatic facility or the aquatic facility recirculation system shall be discharged through an approved air gap.
- Also see manufacturer operating instructions for guidance.

7.2.7 Surge tanks

Rationale:
Proper maintenance will reduce the chance of biofilm formation and bio-corrosion.

Recommendation:
- Surge tanks shall be provided with a means for complete draining to allow for routine inspections, maintenance, and cleaning.

7.2.8 Inlets

Rationale:
Inlets deliver water and play a key role in the circulation pattern and mixing of swimming pool water. A blocked, broken, or plugged inlet will interfere with this process and affect water quality.

Recommendations:
- Ensure all inlets are functioning at the capacity and as designed to ensure circulation pattern and mixing of swimming pool water.
- Methods of testing include
- ensuring that disinfection levels in various locations of the pool are consistent
- performing a dye test
- physically feeling if water flow exits from inlets

[112] NSF/ANSI 50 – 2012

7.3 Preventing Suction Hazards in Pools and Spas[113]

Rationale:
Suction has been the cause of preventable deaths and severe injuries in swimming pool facilities worldwide. Water outlets can cause suction that is strong enough to entrap body parts or hair, causing a bather's head to be held under water, leading to drowning. In addition, there have been reports of incidents in which the suction from the pool and spa drains or pool water play features is strong enough to disembowel a swimmer. Any drain that the body can cover completely, combined with a plumbing layout that allows a build-up of suction if the drain is blocked, can present this hazard.

> **Note:** The term anti-vortex should not be interpreted to imply an anti-entrapment device and does not impart any protection. It should no longer be referenced in this regard.

Unblockable drain: a drain of any size or shape that a human body cannot sufficiently block to create a suction entrapment hazard.

7.3.1 System evaluation and routine maintenance

Operating procedures including system evaluation, inspection, routine maintenance, and procedures for suction- and entrapment-related emergencies that ensure water leaving and returning to the pool does not create suction or entrapment hazards shall be developed and be clearly outlined in the Aquatic Safety Plan.

A complete set of pool drawings shall be available and on-site for easy reference by pool staff. Manuals for the operation and maintenance of the pool as well as technical data sheets shall also be available at the pool. These manuals

- should provide complete and thorough information from the manufacturer regarding maintenance needs of suction points
- are updated as required
- include information from the pool architect/designer regarding potential hazards
- will have operating records maintained to provide information regarding make and model, purchase date, and expiry date of suction outlet covers, and manufacturer's flow rate

System evaluation and routine maintenance shall be done to ensure that suction fittings and inlets are secure and in good repair. The qualified person(s) shall ensure

- suction points are designed to prevent a person from being held onto the suction point
- that system tests shall comply with ANSI/APSP-16 2011 or the most recent version of this standard
- that inlet fittings are designed to prevent entrapment
- that when fasteners are used the suction fitting shall be designed to require tools for disassembly preventing patrons from removing the fitting

[113] Saskatchewan Ministry of Health, Swimming Pool Design and Operational Standards
[114] Alberta Public Health
[115] U.S. Consumer Product Safety Commission (CPSC),Pool Safely, The Pool & Spa Safety Act, http://www.poolsafely.gov/faqs

- the pool has and maintains skimmers or gutters designed to prevent entrapment
- that each main drain
  - is located at, or as close as possible to, the deepest part of the pool basin
  - is covered with a grate that cannot entrap a person or be readily removed
  - has approved drain covers that are sized to have the appropriate flow rates
- that circulating pumps have an effective vacuum-breaking design measure
- that no equalizer lines terminate in the pool basin
- that submerged equalizer lines or equalizer fittings in the pool, if they exist, are disabled/deactivated

7.3.2 Installation and update

Installation of anti-entrapment fittings:[114]

Anti-entrapment fittings shall be installed in accordance with the manufacturer's instruction, and be maintained in good working order when the pool is available for use.

Every submerged suction outlet shall have at least one of the following:

- a cover that complies with performance standards of American National Standard for Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, and Hot Tubs (ANSI/APS-16 2011 or the most recent version), and is installed, maintained, and tested according to manufacturer's instructions
- a custom-fabricated cover that is constructed and certified by a professional engineer, and installed and maintained according to an engineer's instructions
- every equalizer line outlets shall have a cover that complies with ASME A122.19.8-2007, or be permanently disabled
- every vacuum outlet shall have a cover and be used in a manner that prevents bather entrapment

Single-submerged suction outlet that is blockable[115]

Pools that have a single submerged suction outlet that is blockable shall employ at least one of the following additional options that is approved by a professional engineer and be documented as such in the Aquatic Safety Plan:

- conversion to a multiple suction outlet system with at least two fully interconnected submerged suction outlets at least 3 feet apart (900 mm) from centre to centre for existing pools and 3.3 feet apart for new pools, or
- installation of a safety vacuum release system (SVRS) that relieves suction when blockage is detected and that is installed to meet the performance standards of ASTM F2387 and/or ASME/ANSI A112.19.17s, or
- installation of a properly designed and tested suction limiting vent system that meets ASME-A112.19.17, or
- installation of an automatic pump shut-off system which meets ASME-A112.19.17, or
- permanent disablement of the submerged suction outlet either by reversing the flow through the fitting or completely sealing the existing outlet when the skimmer is capable of providing for 100 percent flow, maintaining acceptable turnover rates, or installation of an equivalent system approved by a professional engineer.

[114] Alberta Public Health
[115] U.S. Consumer Product Safety Commission (CPSC),Pool Safely, The Pool & Spa Safety Act, http://www.poolsafely.gov/faqs

Vacuum Suction Outlet

A submerged suction outlet used for vacuuming shall have a cover to reduce the risk of entrapment, and be used in a manner to protect the bather from entrapment or from being permanently disabled.

7.3.3 Inspection and closure

Covers of each submerged outlet shall be routinely inspected every day before pool/hot tub opening. If cracked, broken, or missing, the pump shall be immediately shut down and the pool/hot tub will remain closed.

> The pool or hot tub shall be closed immediately if any suction fitting is found to be damaged, defective, or missing.

7.3.4 Procedures for suction- or entrapment-related emergencies[116]

Recommendations:

The Aquatic Safety Plan shall identify procedures to be followed to free someone who has become trapped or held against a suction point. It is recommended that pool owners train staff to

- shut down the pumps immediately if someone becomes trapped
- ensure scissors are readily available that can be used to cut hair that has become entrapped
- have established procedures for draining the pool
- have in place any other procedures necessary to free a person trapped underwater

[116] BC Pool Operator Guidelines

Section 8: Safety Equipment and Lifeguard Policy[117,118,119,120]

Rationale:
The role and purpose of emergency equipment, lifeguard equipment, lifeguards, and warning signage is to prevent accidents, assist in an emergency, and provide hazard and risk information to the patrons in both supervised and non-supervised aquatic venues. The aquatic venue's specific requirements for lifesaving and first aid equipment, lifeguard policy and training, and warning signage shall be based on a facility-specific risk assessment and these guidelines. The requirements shall

- match the risks and hazards at a specific pool(s)
- be listed in the Aquatic Safety Plan
- be assessed, evaluated, maintained, and monitored as described in the pool-specific Aquatic Safety Plan

> **Note:** In this document and section, the term "lifeguard" refers to a professional person with specific training and certification hired to supervise people in an aquatic environment. A lifesaver may or may not be someone with training and skills to assist another in an emergency, but not in a professional capacity.

[117] International Life Saving Federation of Europe, European Guidance in Swimming Pools (version 2005-01) retrieved from the www on Sept 2, 2013 at www.europe.ilsf.org/sites/europe.ilsf.org/files/BasicGudieance_SwimmingPools-web.pdf
[118] Canadian Red Cross, The Canadian Red Cross Operational Best Practices for Aquatic Facilities 2009
[119] The USA Centre for Disease and Prevention. (2014) Model Aquatic Health Code-First Edition The Annex
[120] Lifesaving Society, Public Pool Safety Standards For Canadian Public Swimming Pools, 2012

Section 8: Safety Equipment and Lifeguard Policy

8.1 Aquatic Facilities' Safety Equipment

Rationale:
Patrons and workers of facilities are at risk of finding themselves in emergency situations that will require assistance of a lifesaver and may require the assistance of professionals. For example a parent's or guardian's ability to help a child in distress may require multiple types of safety equipment. Having the appropriate equipment available will allow a lifesaver to provide assistance to a swimmer without having to enter the water and endanger themselves is critical.

8.1.1 Safety Equipment

Recommendations:

- Safety equipment shall be sufficient for reasonably foreseeable incidents (emergencies) and shall be
  - in the immediate vicinity of the pool and be mounted in locations that are easily seen
  - appropriately identified including signage and always ready for use
  - accessible whenever the pool is being used
  - in good working condition
  - appropriate for the specific facility
  - checked regularly for defects and the need for maintenance or replacement
- Pools shall maintain safety equipment as listed in their Aquatic Safety Plan.
- Evaluate the facility for the need of any Emergency Stop Button. (see Sections 4.12, Emergency Stop Buttons and 7.3, Preventing Suction Hazards in Pools and Spas)
- All pools over 10 m^2 in size shall have at a minimum the equipment summarized in Table 11, below.

Table 11. Safety Equipment for Pools Greater Than 10 m^2.

Reaching pole	• A non-conductive reaching pole with a loop design at least 3.5 m in length is required. A shorter pole can be used if the Aquatic Safety Plan identifies that there is insufficient space for a pole this long.
Buoyant throwing aids	• At least two buoyant throwing aids, securely attached to a line of at least 6 mm in diameter and having a length of at least half the width of the pool + 3 m are required. The line shall not be wrapped around the throwing ring.
Emergency telephone and communication	• See Sections 4.1.1, Emergency Telephone and Signage, and 8.1.1.2, First Aid Equipment • Internal communication plan
A.E.D. (defibrillator)*	• Shall be located in an accessible location that has visible signage
First aid equipment	• First aid kit • Blanket • Personal protective equipment, e.g., gloves • See Section 8.1.1.2, First aid equipment
Signage	• See Appendix 8 - E.g., no lifeguard on duty, emergency contact information, CPR signage, imminent health hazard sign (when close to the pool)
These are minimum standards and may be increased as a result of risk assessments at the construction, design, and renovation stage or during development or review of policies and pool needs.	

* This equipment is appropriate only at facilities with lifeguards or other personnel trained in their use

8.1.1.1 Emergency telephone and warning signals

To facilitate rapid contact with emergency services in event of an emergency, all pools shall have

- a telephone (land line) dedicated for free-of-charge contact with emergency services, in a clearly visible location and indicated by signage
- a procedure and script for contacting emergency services that is posted in view of the designated emergency telephone
- an alternate method of contacting emergency services in the event that the land line phone is not available (e.g., emergency radio, cell phone, satellite phone, intercom to on-duty staff)

8.1.1.2 First aid equipment

Recommendations:

- All aquatic facilities require first aid equipment.
- First aid equipment shall
  - match the needs of the specific pool
    - needs shall be decided after conducting a facility risk assessment listed in the facility-specific Aquatic Safety Plan and staff shall be trained in their use
  - be located in an easily reachable place, designated as the First Aid Station and be ready for use at all times and include at a minimum the following items (Table 12, below).

Table 12. Recommended First Aid Equipment.

First aid kit	Sized and equipped to match the needs of the aquatic venue • first aid guide, absorbent compress, adhesive bandages, adhesive tape, sterile pads, disposable gloves, scissors, elastic wrap, bloodborne pathogen spill kit
Blankets	One or two
Personal Protective Equipment (PPE)	Including pocket mask and appropriate gloves
These are minimum standards and may be increased as a result of risk assessments at the construction, design, and renovation stage or during development or review of policies and pool needs.	

8.1.2 Safety equipment recommended at aquatic facilities providing Supervision

Rationale:

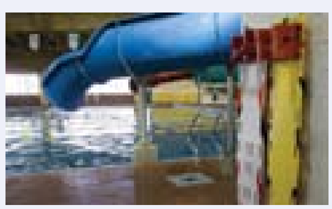
To perform their duties certified professional lifeguards require specific equipment above and beyond what is listed in Section 8.1.1., Safety Equipment

Recommendations:

- Safety equipment identified in Section 8.1.1 plus equipment identified in Table 13, see next page is recommended for pools with certified professional lifeguards on duty:

Section 8: Safety Equipment and Lifeguard Policy

Table 13. Required Safety Equipment with Lifeguards on Duty

Lifesaving Equipment		
Communication (signal device)		• whistle (and any additional means of communication identified as necessary in the facility-specific Aquatic Safety Plan) • when lifeguards and supervisors do not have visual and verbal contact with each other, walkie-talkies or a similar device should be considered depending on a risk assessment conducted for the Aquatic Safety Plan
Rescue tube or equivalent		• must be carried by lifeguards at all times
Breathing and PPE		• oxygen therapy*- Equipment (400 litres or greater) with regulator and protective carrying case and a spare oxygen tank* • full set of airways*
Identifiers		• clearly visible and recognizable uniforms
Sun (UV) protection		• sunblock or a means of sun protection (when appropriate) • polarized sunglasses to reduce the effects of glare (when appropriate) See also Section 6.5, Pool Water Glare
Spine board		• With at least three velcro straps and head immobilization
Control station (if necessary)		• elevated platform or chair at least 1.8 metres above the water surface for supervised pools; • additional control stations; based on risk assessment and noted in the Aquatic Safety Plan when control stations are staffed
Signage		• See Appendix 8

* This equipment is appropriate only at facilities with lifeguards and/or other personnel trained in their use.

8.2 Aquatic facilities with Supervision and Lifeguards[121,122,123]

When professional lifeguard services are provided, owners/operators of pools shall ensure that the supervision management structure, number of lifeguards, and lifeguard training is adequate for the facility and its features to ensure the safety of patrons and staff. Supervision management structure, qualifications, and requirements shall be matched to the risks and hazards at the specific aquatic facility, expected swimmer skill level, special activities, and swim features. For example, the ability to guard 40 patrons with proven ability to swim in a flat water pool with no water features may require fewer lifeguards than 40 patrons of various ages and skill levels in a pool with one or more pool features (slides, diving boards, Tarzan ropes, wave action) in use.

> Great care and attention shall be given when developing the supervision management and staffing structure, policies, and procedures. Seeking the expertise of a lifeguard facility planning specialist is recommended when developing or updating pool-specific policies and procedures.

8.2.1 Supervision Management Structure

Recommendations:

- A supervision management structure that clearly identifies roles and responsibilities shall be developed and articulated in the Aquatic Safety Plan.
- Such management structures will vary depending on the size, population, programming and features of a facility.
- It may include Lifeguard Supervisor/Manager, Lifeguards and Assistant Lifeguards.
- It is the responsibility of the management to clearly define each of the roles, required training and responsibilities of each designated position and to ensure this complies with the lifeguard certification body and any facility legal/insurance representative. This shall be clearly articulated in the Aquatic Safety Plan and specific to each facility.

8.2.2 Lifeguard and Assistant Lifeguard Qualifications

Lifeguard Qualifications Recommendations:

- Certification through a recognized lifeguard training program, such as The Life Saving Society or Canadian Red Cross (or equivalent), is mandatory.
- Hold a current certification and have met all training, including all pre-service requirements, and participate in continual in-service training requirements are mandatory.
- Lifeguards shall be trained in all aspects of the Aquatic Safety Plan including formal training sessions, practical simulations, and regular in-service training. All training shall be documented and employees shall sign-off on all training.
- Lifeguards shall be able to provide adequate supervision and be capable of rescuing any patron as specified in the facility-specific Aquatic Safety Plan, based on the risk assessment completed in preparing the plan.

121 http://www.health.gov.sk.ca/public-swimming-pool-safety-plan-feb2013
122 http://www.health.gov.bc.ca/protect/pdf/bc-pool-operations-guidelines.pdf
123 The USA Centre for Disease and Prevention. (2014) Model Aquatic Health Code-First Edition The Code

Assistant Lifeguard Recommendations:

- Is a person who is appointed by the pool owner/operator to assist the lifeguard(s) with surveillance of bathers while they are on deck or in the pool and to supervise bather safety e.g., water slide attendant.
- Must have received or renewed the Bronze Cross Award or its equivalent within the previous two years of the date of active duty.
- Must be under the direct supervision of the Lifeguard or Lifeguard Supervisor.
- They are not to replace a certified lifeguard.
- Assistant lifeguards shall be trained in the Aquatic Safety Plan including any identified formal training sessions, practical simulations, and regular in-service training. All training shall be documented and employees shall sign-off on all training.

Certification currency:

- Appropriate and legal proof of Certification must be available at the pool for examination.

8.2.3 Do I need lifeguards?

Recommendations:[124]

With the increase in water play features being added to a variety of types of aquatic facilities settings, risks to all swimmer ages and skill levels have increased in a variety of aquatic venues. The following aquatic facilities are recommended to have lifeguards; however, each facility shall determine if they require lifeguards and the required level of supervision:

- any aquatic venue that allows for unsupervised children
- any aquatic venue that is open to the general public
- any aquatic venue while it is being used for the recreation of youth groups, including but not limited to childcare usage or school groups
- any aquatic venue while it is being used for group training, including but not limited to competitive swimming and/or sports, lifeguard training, exercise programs, and swimming lessons
- any aquatic venue with an induced current or wave action
- any aquatic venue which allows the usage of diving boards or starting platforms

8.2.4 Minimum Supervision Staff

Rationale:

Risks and hazards at each pool vary depending on patron age and skill level, pool size, type, and special features and services offered (e.g., slides, birthday parties, and instruction). A thorough risk assessment is recommended to establish pool supervision requirements, patron hazard notification, and education.

Recommendations:

- Management must ensure that, when the pool is open to the public, pool supervision is provided by at least one lifeguard and any additional lifeguards as required by the Aquatic Safety Plan.
- There must also be at least one additional person who is trained in the procedures and use of the equipment described in the Aquatic Safety Plan – and designated by the operator for this purpose – on duty within the swimming facility available to assist the lifeguard in an emergency.

[124] MAHC, The Code p. 284

- If staff members other than lifeguards are responsible for assisting a professional certified lifeguard (e.g., assistant lifeguard, play feature attendant), training shall be provided by the employer to ensure the non-lifeguard staff are
  - familiar with emergency procedures
  - trained in water safety
  - experienced through formal training and regular in-service training
  - certified with a current CPR certificate and Standard First Aid and as noted in Section 8.2.2, Lifeguard and Assistant Lifeguard Qualifications
- When the pool is in use only for aquatic instruction and the aquatic instructor is also a lifeguard or is trained in CPR and basic emergency response, that person may act as both the instructor and lifeguard if it has been deemed acceptable in the Aquatic Safety Plan and after a careful and thorough risk assessment. Any other specialized lifeguarding policies shall be clearly identified in the Aquatic Safety Plan.

8.2.5 Ratio of bathers to lifeguards

Minimum staffing levels are required to ensure adequate supervision. However, aquatic facilities today can offer a wide variety of services and features, and no two pools are the same. This makes it difficult to make specific recommendations concerning the ratio of bather to lifeguard beyond minimum recommendations. Appropriate ratios shall be determined in the Aquatic Safety Plan after a risk assessment and in consultation with the professional lifeguard service provider.

Factors influencing lifeguard to bather ratios that will increase the minimum lifeguard recommendations include, but are not limited, to

- facility design
  - pool size, form, and type
  - surveillance zones, sweep time and lifeguard response time
  - pool surfaces and depth
- number of pools and spas open at any one time
- bather activity including the use of "play features"
  - if special features are in operation, such as diving installations, Tarzan ropes, wave machines, currents, water slides, inner tube rides, slow and fast river rides, falling rapids, and walls for climbing, lifeguard to bather ratios will increase to ensure effective supervision
  - bather age and skill level and any other factors to ensure on-going vigilance in all pool areas open to the public

8.2.6 New technologies to assist lifeguards

Rationale:

New technologies including computer-aided drowning detection systems are designed to improve safety supervision and further reduce water-related incidents and drowning. These systems are intended to detect a motionless body and sound an alarm alerting lifeguards of a potential incident and its exact location to encourage a timely response.

Recommendations:

- Incorporating the use of computer-aided drowning detection, or future technological systems designed to assist lifeguards in aquatic settings shall be considered as part of the Aquatic Safety Plan review process.
- These technologies shall not replace or reduce the number of lifeguards on a pool deck.

Section 8: Safety Equipment and Lifeguard Policy

Aquatic Facilities without Supervision

Rationale:
Not all aquatic facilities will provide supervision. Such facilities may include campgrounds and hotels. However all aquatic facilities carry a degree of risk to all patrons and staff. Notification of patron rules and warnings, and providing a means of emergency response capability, is essential.

Recommendations:
- Establish patron rules, hours of operation, emergency response procedures and communication plans, and post this information so it is in clear view of the patrons as noted in these guidelines
- A clearly visible notice shall be posted at each entrance to the pool stating that no lifeguard is on duty, and that children shall be supervised by a responsible adult (see Section 2.3.7, Patron Education).
- An emergency telephone or communication device is to be provided within the pool area (See Section 8.1.1.1, Emergency Telephone and Warning Signals).
- Designate an emergency contact person(s) as the contact during an emergency situation. (For example this may be a maintenance person, front desk clerk, rental office manager, or pool operator).
  - The designated person(s) shall be present during pool operating hours.
  - Provide the appropriate training to the designated person(s), which may include lifesaving skills such as basic first aid, CPR, blood exposure, emergency plan response, communication and implementation, and any other training deemed necessary upon risk assessment. See Section 2, Pool Management, for additional information.
- Facilities with a surface area greater than 10 m^2 (108 ft^2) shall also have lifesaving and first aid equipment at pool-side, as described in Section 8.1.1, Safety Equipment.
- Hot tubs, therapy pools, spas and "water play" features shall be equipped with an emergency shut-off valve capable of shutting down the pumps to end suction entrapment.

> While some of these pools may not employ lifeguards, the operator of a pool may choose to employ lifeguards for any activities they deem necessary to protect the health and safety of patrons. The Lifesaving Societies Semipublic Swimming Pool Standards state "Drowning research statistics show that most drowning occurs in aquatic settings without lifeguard supervision. Almost half of the victims were alone at the time of their death."[125]

[125] Lifesaving Society, (2004) Semipublic Swimming Pool Standards retrieved from the web at http://www.lifesaving.org/download/SemipublicSwimmingPoolSafetyStandards.pdf

Section 9: Appendices

Note: Some of the appendices may actually be a fact sheet and may not be included in these guidelines.

Section 9: Appendices

Appendix 1: Example: Aquatic Safety Plan Table of Contents

Facility Name

Facility Address

Plan Prepared by

Date Plan Prepared

Plan Reviewed by

Date Plan Reviewed

Pool Characteristics

- Type of Facility (outdoor pool, indoor pool, wading pool)
- Square Footage
- Minimum Depth
- Maximum Depth
- Bather Capacity
- Diving Allowed (Y/N)
- Slides (Y/N)
- Pool volume
- Other features (e.g., climbing wall, rope swing)

Pool Operator Qualification

Lifeguard Certifications (e.g., required skills and certifications for lifeguard personnel)

Other personnel qualifications, certifications, job descriptions, and required training (e.g., instructors)

Operating Procedures

- Pool and Hot Tub Rules
- Pool and Hot Tub Water Testing and Maintenance Log
- Maintenance and Cleaning Schedules
- Chemical Storage and Handling Procedures
- Integrating the Fire Safety Plan

Emergency Response Procedures (e.g., search, communications, reporting, training)

Injury Prevention

- Waterfront Hazards (e.g., mitigation of hazards in entrance areas to pool, diving boards, and slides)
- Lighting and Electrical (e.g., emergency lighting)
- Maintenance (e.g., daily inspections and reporting of results)
- Rules – other than the pool and hot tub rules
- Diving Areas (posting of rules)
- Pool Slides (posting of rules)

Responding to Incidents

- Important Phone Numbers
- Incident Response
- Fecal Clean Up Procedure
- Lifesaving, Lifeguard and First Aid Equipment
- Pool Supervision Schedule
- Vomit and Blood Clean-up Procedures

Appendix 2: Pool Operation Training Course Requirements

Basic Pool Operation Course Requirements

Nova Scotia Operational Guidelines for Aquatic Facilities

Pool types and designs

Pool chemistry

Water testing

Circulation, filtration, and turnover rate

Suction entrapment hazards

Preventative maintenance

Seasonal maintenance

Safe handling and storage of chemicals

Troubleshooting problems

Comprehensive Pool Operation Course (12 to 14 hours minimum)

Review of basic course information

Nova Scotia Operational Guidelines for Aquatic Facilities

Increased depth on pool chemistry

Filter sizing

Pumps and motors and their maintenance

General maintenance

Mechanical workings

Risk management

Secondary disinfection (ozone, ultraviolet light)

Oxidation-reduction potential

Troubleshooting problems

Appendix 3: Pool Parameters

Parameters	Pool Type	Min.	Ideal	Max.	Test Frequency & Comments
Free Available Chlorine (FAC) (not stabilized, no cyanuric acid)	Pool & Water Park	1.0 ppm	2-4 ppm	5.0 ppm	*Prior to opening daily, every two hours for manual feed or every 4 hours for automatic feed.
	Increased Risk Venue	2.0 ppm	Secondary disinfection system recommended		
	Spa	3.0 ppm	3.0-5.0 ppm	5.0 ppm	
FAC when using cyanurate acid or using stabilized chlorine	Outdoor Swimming Pools/Parks	2.0 ppm	3.0-5.0 ppm	5.0 ppm	*Same as above
Bromine	Pool	3.0 ppm	4-6 ppm	6.0 ppm	*Same as above
	Spa	4.0 ppm	6.0 ppm	8.0 ppm	
Oxidation-Reduction Potential (ORP)	All Pools	650 mV - 750 mV			Daily testing
Combined Chlorine (CC)	Pools	0.0 ppm	0.0 ppm	<0.4	At least daily testing
pH	All	7.2	7.4-7.6	7.8	*Same as above
Total Alkalinity	All	60 ppm	80-120 ppm	180 ppm	At least weekly
Calcium Hardness	All	180 ppm	200 ppm	400 ppm	Weekly / monthly
Temperature	Pool	Activity dependent			Daily
	Spa	<104°F, (40°C)			
Total Dissolved Solids	All	Less than 2000 or 1500 above fill water TDS			Quarterly
Salt Levels	Salt water generated pools	2500-3500 ppm			Weekly
Cyanuric Acid (outdoor pools only)	Stabilizer is not effective in brominated pools.	0 ppm	20-30 ppm	100 ppm	At least weekly

Appendix 4: Example Daily Pool Log

Pool Record Log to be Inspected/Tested Prior to Pool Opening

		Time	Operator Signature			Time	Operator Signature
Emergency Telephone				Ground Fault Circuit Interrupter (activated)			
Pool Rules Notices Posted Unsupervised Sign Posted if Applicable				First Aid Kit Fully Stocked			
Non-conducting Reaching Pole Present				Buoyant Throwing Aid Present with Adequate Rope			
Spine Board				Self-Latching Gate Securely Latches Gates Closed			

Public Pool – Water Chemistry and Clarity Tests

	30 min prior to opening	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm
Total Alkalinity Minimum 60-120												
pH 7.2-7.8												
Free Available Chlorine (min) Unstabilized 1.0ppm Stabilized (CYA-Present) 2.0 ppm												
Bromine 3. 0ppm												
Combined Chlorine >0.4 ppm												
Oxidation-Reduction Potential Minimum XXx mV												
Water Clarity Black Disc Visible from 9m												
Total # of Bathers												
Operator's Initials												

Water Meter Reading		Records of any emergencies, rescues, or breakdowns of equipment, maintenance, date of pool drain and refill, type and amount of any chemicals added manually, etc.:
Reading at beginning of day	Reading at end of day	
Make-up Water Added		

Weekly Cyanuric Acid Test for Stabilized Pool: (sign and date) (maximum 100 ppm)

Monthly Water Outlet Cover Security Test: (sign and date)

Appendix 5: Example Spa Log

Spa Record Log to be Inspected/Tested 30 Minutes Prior to Opening

		Time	Operator Signature			Time	Operator Signature
Emergency Telephone				Ground Fault Circuit Interrupter (activated)			
Caution Notices				First Aid Kit Fully Stocked			
Non-conducting Reaching Pole Present				Buoyant Throwing Aid Present with Adequate Rope			
Spine Board				Self-Latching Gate Securely Latches Gates Closed			

Public Spa – Water Chemistry and Clarity Tests

	Prior to opening	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm
Total Alkalinity Minimum 80-120												
pH 7.2-7.8												
Free Available Chlorine 3-5 ppm Total Bromine 4-5 ppm												
Oxidation-Reduction Potential Minimum												
Water Clarity Lowest water outlet drain visible in non-turbulent state												
Total # of Bathers												
Water Temperature (max. 40°C)												
Operator's Initials												

Water Meter Reading		Records of any emergencies, rescues, or breakdowns of equipment, maintenance, date of pool drain and refill, type and amount of any chemicals added manually, etc.:
Reading at beginning of day	Reading at end of day	
Make-up Water Added		

After drain and refill, inspections of drain covers, suction fittings, emergency equipment within spa: (date and sign) (secure and operational)
Weekly Cyanuric Acid Test for Stabilized Spa: (sign and date) (ideal 30 maximum 100 ppm)
Monthly Water Outlet Cover Security Test: (sign and date)
Monthly Emergency Stop Button Test: (sign and date)
Monthly Vacuum Release Mechanism Test: (sign and date)

Appendix 6: Hard Surface Incident Response Recommendations[126]

(Vomit, blood, or feces on pool deck/change room incident)

Accidents can happen out of the pool too. Being prepared to deal with a vomit, blood, or fecal incident on your pool deck or in the change/shower rooms is important for the prevention of disease transmission within the facility. The following recommended procedure shall be adapted to suit your facility-specific Aquatic Safety Plan.

1. Establish an incident response kit consisting of cleaning equipment, buckets, mops, Health Canada-approved (must have a Drug Identification Number) disinfectant, or household bleach (5.25%) and the appropriate personal protective equipment.
2. Immediately close the affected area and post warning signs until clean-up is complete.
3. Put on disposable gloves to prevent contamination of hands. Torn gloves shall not be used, and avoid tearing your gloves on equipment or sharp objects. Use additional personal protection equipment, as needed, to protect personal clothing, skin, lips, lungs and eyes.
4. Wipe up the spill using paper towels or absorbent material and place in a plastic garbage bag.
5. Gently pour approved disinfectant or bleach solution onto all contaminated areas of the surface. Ensure product used is compatible with other chemicals used in the pool and area.
   - Either a Health Canada-approved disinfectant (one with a Drug Identification Number) following the instructions on the package, or
   - A bleach disinfecting solution shall be applied liberally.
     - Recipe for Bleach Disinfecting Solution
       - 9 parts cool water
       - 1 part household bleach
       - Add the household bleach to the water.
       - Gently mix the solution.
6. Let the approved disinfectant or bleach solution remain on the contaminated area for the required contact time.
7. After required contact time wipe up the remaining disinfectant/bleach solution.
8. All non-disposable cleaning materials used such as mops and scrub brushes shall be disinfected by saturating with a disinfectant solution and air dried.
9. Remove gloves and place in plastic garbage bag with all soiled cleaning materials.
10. Double-bag and securely tie up plastic garbage bags and discard.
11. Thoroughly wash hands with soap and water.
12. Log the incident and remedial action taken.
13. Replenish incident response kit.

[126] This Fact Sheet is consistent with CDC's Healthy Swimming Recommendations and the MAHC. For more information go to CDC Healthy Swim website

Appendix 7: Criteria for Immediate Closure of a Pool

The Issue

Closing a pool to all swimmers and patrons is necessary and the responsibility of pool staff when conditions exist of an imminent nature that could cause illness or injury to the patrons. A swimming pool is subject to immediate closure when any of the following conditions are observed:

Issue	Risk
Unsecured pool enclosures: shall be self-closing and self-latching gates	• Risk of drowning
Emergency telephone or alarm system missing or malfunctioning (where applicable – no lifeguard on duty)	• No means to get help
No or malfunctioning automatic shut-off for high risk venues and hot tub (spas)	• Risk of entrapment, evisceration and drowning
Lifesaving safety equipment not available or not in good repair	• Unable to assist in an emergency situation
Lack of supervisory personnel and/or required lifeguards or the required number of lifeguards not available (where applicable)	• Risk of drowning or serious injury
Poor Water Clarity: must be able to clearly see the main drain of the pool and/or the pool must pass the black disc test.	• Swimmer cannot see bottom increasing risk of injury • Unable to see if a person is in trouble under the water increasing risk of drowning • Indication of ineffective disinfection and/or filtration system
Lack of disinfectant residual in pool water and no disinfectant available on site to resolve the issue	• Risk of disease transmission
pH outside of acceptable range: pH of above 8 ppm and no product to lower pH to appropriate range	• pH has a dramatic effect on water quality and the effectiveness of the disinfectant
Fecal (solid or diarrheal), vomit, or chemical release in the pool (see fact sheets)	• Risk of disease transmission or injury
Filtration or circulation system is not operative or is malfunctioning	• Risk of disease transmission • Increased risks of high turbidity interfering with clarity of pool • Diminishes the ability of proper disinfection
Missing or damaged drain cover or fittings	• Suction entrapment and entanglement risk • Drowning risk
Ground Fault Circuit interrupter missing or malfunctioning	• Electrical shock hazard
Improper chemical storage	• Improper or incompatible storage of chemicals can create a risk of fire, explosion, release and personal injury to anyone in or around the facility
Other Hazardous Conditions	• Risk of physical injury e.g., power outage, broken glass, severe weather at outdoor pools (thunder and lightning), water too hot in spas or any other imminent health risk

Appendix 8: Example: Public Pool and Spa Signage

It is further recommended to supplement these signs with universally accepted pictograms when possible. Not all facilities will require all signage.

Public Pools Signage Recommendations	Lettering Size Stroke Size	Recommended Location
CAUTION SWIM AT YOUR OWN RISK LIFEGUARD IS NOT ON DUTY	25 mm	Posted in a conspicuous place within the pool and as determined in the Aquatic Safety Plan risk assessment
HEALTH WARNING No person infected with a communicable disease or having open sores on his or her body shall enter the pool. No person shall bring a glass container onto the deck or into the pool. No person shall engage in boisterous play in or about the pool. The maximum number of bathers permitted on the deck and in the pool at any time is ______. The location of the emergency telephone that is available is ______________________________.	25 mm	In at least two locations and as determined in the Aquatic Safety Plan risk assessment
A CLEAN POOL IS A SHARED RESPONSIBILITY **POOLS ARE NOT A BATHTUB OR A TOILET** • Each bather shall take a shower using warm water and soap and thoroughly rinse off all soap before entering or re-entering the deck • Take frequent bathroom breaks • Do not pee in the pool • Do not poo in the pool • Do not drink the pool water • Do not swim if you have had diarrhea in the last two weeks	25 mm	At each entrance to the pool surround area and as determined in the Aquatic Safety Plan risk assessment
Designated Diaper Change Area • Never leave child unattended on the diaper change table. • Dispose of used disposable diapers in the diaper bucket or receptacle provided. • When finished dump contents from reusable diapers into toilets and bag diapers to take home. • Use the materials provided to clean/sanitize the surface of the diaper change station before and after each use. • Wash your hands and your child's hands after diapering. • Do not swim if ill with diarrhea.	25 mm	Located at diaper change area

Appendix 8: Example: Public Pool and Spa Signage

It is further recommended to supplement these signs with universally accepted pictograms when possible. Not all facilities will require all signage.

Example Hot Tub Rules **Before entering the Hot tub you should:** • Consult with your doctor if you - Are an elderly person - Have heart disease, diabetes, or high or low blood pressure - Are taking medications for cardiovascular or nerve disorders - Are pregnant • Make sure someone is someone is available to always be with you in the hot tub. **When you are in the Hot Tub you must:** • Always enter and leave the hot tub slowly and cautiously. • Keep long hair out of the water, away from all underwater fittings, especially suction fittings. **When you are in the Hot Tub you must NOT:** • Dive into the water. • Stay in the hot tub for more than 10 minutes at one time (long exposure may result in nausea, dizziness or fainting.) **Once you have finished you should** • Shower to cool down • Then, if you wish, return for another brief stay. • Drink water.	25 mm	In conspicuous location in clear view of the Hot Tub patrons
Pool Rules **Before entering our pool you must:** • Ensure you are not ill–including having conditions such as diarrhea, vomiting, open sores, bandages, head colds, discharging ears or noses, or ear infections. Persons with related symptoms should not enter the pool until 48 hours after cessation of these symptoms. • Wear clean and appropriate bathing attire. • Take a cleansing shower with soap. • Ensure all young children and non-swimmers are closely supervised (within arm's reach at all times) by a responsible person of at least 16 years of age. • Ensure that infants and toddlers are wearing swim diapers and/or elastic swim pants. • Ensure one responsible person supervises a maximum of three children who are less than seven years of age. • Note that you must report an injury suffered while in the pool enclosure, or contamination or fouling of the pool (e.g., urinating or defecating), to the pool manager or lifeguard.	25 mm	Posted at slide entrance on pool deck and channel tunnel entry area, and as determined in the Aquatic Safety Plan risk assessment.

Appendix 8: Example: Public Pool and Spa Signage

It is further recommended to supplement these signs with universally accepted pictograms when possible. Not all facilities will require all signage.

The following is not allowed in our pool: • Changing diapers poolside. • Running, fighting or engaging in other conduct likely to cause an injury. • Contaminating or fouling the pool. • Diving into pool in water less than 2 m deep (the term"diving" is not intended to include swimming competitions or training for swimming competitions. In these cases the FINA rules should be followed). • Bringing glass into the pool area. • Using or being under the influence of intoxicants.		
Water Slide Safety Signage [127,128] • Maximum operational load 1 person, 300 pounds • All riders must be 48 inches tall to ride the water slide (Users of the slide must be of an age and size to manage the slide) • Obey all orders given by the attendant and operator • Hands must be kept inside the channel • No bunching or chaining by riders permitted • Wait until the landing area is clear before entering the slide • Slide only in the sitting position or on the back into a feet-first position • Absolutely no riding on stomach or head first • Do not attempt to stop on the slide • Leave the plunge area immediately • Any other restrictions required by the slide manufacturer and designer • Any emergency procedures specifically designed for the slide must be clearly posted	25 mm	Posted at slide entrance on pool deck and channel tunnel entry area, and as determined in the Aquatic Safety Plan risk assessment.
Emergency Telephone Located Here This emergency phone directly links to 911 **or** This emergency phone is directed to a designated facility emergency person		Post at the emergency telephone

127 Lifesaving Society, Yi Fan Wang Coroner's Ingest Recommendations, May 23, 2013 retrieved from the www at www.cdc.ca/news/canada/new-brunswick/coronor-s-jury-recommends-pool-safety-changes-1.1317228

128 http://www.health.gov.bc.ca/protect/pdf/bc-pool-design-guidelines.pdf

Appendix 8: Example: Public Pool and Spa Signage

It is further recommended to supplement these signs with universally accepted pictograms when possible. Not all facilities will require all signage.

Emergency Telephone Script 1. Dial __________(911) (if necessary include any numbers that will give you an outside line) 2. What is your emergency: State Fire, Medical, etc. (what do you need) 3. Facility land line phone number is:__________________ 4. Give location a. Civic # is:______________________________ b. Street Name is:___________________________ c. Street type is: e.g., avenue, street, etc. _____________ d. Town:________________________________ e. County:_______________________________ f. Address _______________________________ g. Emergency entrance is located where: ____________		Post at the emergency telephone
MARKINGS **Water depths indicating the deep points, breaks between gentle and steep slopes and shallow points and the words DEEP AREA, SHALLOW AREA**	100 mm	On the deck clearly marked in figures at appropriate locations.
CAUTION **SHALLOW WATER NO DIVING**	150 mm	Post at a conspicuous location, where the pool has a maximum water depth of <2.50 meters.
CAUTION **NO DIVING**	150 mm	Post conspicuously on each wall or fence enclosing the pool as determined in the Aquatic Safety Plan risk assessment.
UNSUPERVISED BATHERS NOT ALLOWED BEYOND THIS POINT	25 mm	
NO BATHERS BEYOND THIS POINT	25 mm	Where appropriate as determined in the Aquatic Safety Plan risk assessment.
EMERGENCY STOP BUTTON In the event of an emergency push emergency stop button and use emergency phone. An audible and visual signal will activate.	25 mm	
Any additional signage as determined in the Aquatic Safety Plan risk assessment.	TBD	

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