B.C. Guidelines for Swimming Pool Operations

V1.0

Health Protection Branch

Population Health and Wellness Division

Ministry of Health

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B.C. Guidelines for Swimming Pool Operations

INTRODUCTION

The B.C. Pool Regulation, BC Reg. 296/2010 replaced the existing Swimming Pool, Spray Pool and Wading Pool Regulation, B.C. Reg. 289/72, and the Pool Exemption Regulation, B.C. Reg. 256/98. The regulation came into effect on October 8, 2010. The regulation modernizes the requirements for the design, construction, alterations to, and operation of swimming and bathing facilities offered for use by the public.

The new regulation is a shift from a prescriptive to an outcome based regulation, and the draft Operations Guidelines document is to assist operators and regulators in interpreting the BC Pools Regulation with respect to the operation of pools. These standards represent generally accepted minimum standards of safe practices. While the guidelines provide information on pool operations, they are not meant to be a substitute for a detailed swimming pool operator's course.

The draft guidelines were developed with input from various stakeholders, including British Columbia's health authorities, BC Parks and Recreation Association, the Lifesaving Society, Canadian Institute of Public Health Inspectors, Architects Institute of B.C., WorkSafe BC and the Association of Professional Engineers and Geoscientists of B.C.

Where there is a discrepancy between the B.C. Pool Regulation and these guidelines, the Pool Regulation shall prevail.

The operations guidelines may be reviewed and updated from time to time. Please visit www.health.gov.bc.ca/protect/ehp_recreational_water_quality.html for updates.

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A. OPERATION - GENERAL

1. Operating Permit

Reference Section of Regulation: *Section 6*
All pools in British Columbia that fall under the Pool Regulation must have a valid permit to operate issued by the health authority. The regulation requires that an operating permit must be posted in a prominent place on the premises and that all requirements set out in the permit must be complied with. An operating permit is not transferable (e.g. the permit is valid only for the pool for which it has been issued; the permit is not valid with a change of pool ownership) and expires on the earlier of the date specified, if any, or one year following issuance.

The permit may state terms and conditions as to the operation of the pool, such as maximum bather load to which the operator must adhere, design flow rate, as well as any other conditions required by the health authority that must be adhered to. Contact your local health authority to make application for, or to seek further information on obtaining or renewing a permit.

2. Signage and Pool Rules

Reference Section of Regulation: *Section 8*
An operator must post a sign stating the rules of the pool in a prominent position within the pool enclosure. These rules must prohibit:

- Entering the pool enclosure with an illness, including open sores, bandages, head colds, discharging ears or noses or infected eyes.
- Entering the pool enclosure without having first taken a cleansing shower.
- Running, fighting or engaging in other conduct likely to cause an injury while in the pool enclosure.
- Contaminating or fouling the pool.
- Failing to immediately report an injury suffered while in the pool enclosure, or contamination or fouling of the pool, to the pool manager or lifeguard.
- Failing to supervise children less than seven years of age for whom one is responsible while in the pool enclosure.
- Diving into pool in water that is less than 2 m (6.6 ft) deep (the term ‘diving’ is not intended to include swimming competitions or training for swimming competitions. In these cases the Federation Internationale de Natation rules should be followed).

Signage must also be provided that indicates the:

- Location of the telephone for emergency use.
- Emergency numbers for the nearest hospital, ambulance services, police department and fire department.
- ‘No lifeguard on duty’ – in those circumstances where lifeguards are not required.

Additional Signage Instructions for Hot Tubs

Hot tubs may warrant additional signage considerations. The following instructions are recommended:

- No Diving.
- Keep long hair out of the water, away from all the filters and drains.
- Clocks must be installed in a manner and size that they will be beneficial to persons with visual deficiencies.
- Children less than seven years of age must be constantly supervised.
- Unsupervised use by children is prohibited.
- Keep children less than seven years of age, especially infants, out of hot tubs and spas. Their small bodies overheat too fast.
- Water temperatures must not be hotter than 40ºC (104ºF).
- Elderly people, people with heart disease, diabetes, or high or low blood pressure and people taking medication for cardiovascular or nerve disorders should not use the spa or hot tub without first consulting their doctor.
- Don't stay in too long (i.e. max 10 min). Then shower, cool down. Then, if you wish, return for another brief stay. Long exposure may result in nausea, dizziness or fainting.
- Always enter and leave the hot tub slowly and cautiously.
- Don't use when you are under the influence of alcohol or other intoxicants.
- If you are pregnant see your doctor first before using.
- Do not submerge your head into water.

Examples of typical rule signs for pools and hot tubs are included in Appendix B.

Pool operators may consider posting additional rules as they deem appropriate for their facility. These may include, but are not limited to:

- Prohibiting glass in the pool area.
- Prohibiting those under the influence of intoxicants.
- Requiring clean and appropriate bathing attire as determined by pool management.
- Restricting the use of equipment in the interest of safety where appropriate.
- Requiring all children less than seven years of age be closely supervised (within arm's reach at all times) by a responsible person of at least 16 years of age.
- Requiring no more than three children less than seven years of age to be supervised by one responsible person of at least 16 years of age at one time.
- Prohibiting those with flu like symptoms including vomiting and diarrhea for up to 48 hours after cessation of such symptoms.
- Requiring infants and toddlers to wear swim diapers and/or elastic swim pants.

All signage must be in a location where pool patrons can clearly see and read it, preferably as they enter the pool. It should be consistent in format and easily understandable, and should include symbol signage wherever possible. Further consideration should be given to ensuring print on signs is easily read by those with impaired vision. Providing Braille signage for the blind on all doors or any important safety notices are another important consideration. All signs should be in English, but they can also be in a second language that is common to the location.

Prominently posted pool rules help to clearly specify and educate patrons on appropriate behavior to ensure the health and safety of themselves and others using the facility.

3. Bather Load

The maximum permitted bather load of the pool is stated on a pool's operating permit or data sheet. The maximum bather load should be posted in prominent place.

Pools are designed with a maximum number of bathers in mind for health, safety and engineering reasons. Pool operators should ensure:

- Disinfectant has the capacity to treat water contaminated by bathers.
- The capacity of the surge tank for the pool is not exceeded.
- Sufficient washroom and change room space is provided.
- Overcrowding does not lead to increased risk of injury.
- Swimmers in distress can be easily identified.

Maximum bather loads should be based on each individual pool in a facility, not the combined capacity of all pools in a facility. In most cases this will be determined using the formula below, however this may need to be further reduced based on operational issues or other factors (e.g. washroom capacity).

Imperial: Maximum bathing load = (D/27) + (S/10)
Where D = area of swimming pool in sq ft where the water depth is more than 5 ft
Where S = area of swimming pool in sq ft where the water depth is less than 5 ft.
Pool depths of less than 2 ft shall not be considered in the calculations.

Metric: Maximum bathing load = (D/2.5) + (S/0.93)
Where D = area of swimming pool in sq m where the water depth is more than 1.5 m
Where S = area of swimming pool in sq m where the water depth is less than 1.5 m.
Pool depths of less than 60 cm shall not be considered in the calculations.

Bather load for hot tubs may be determined at a rate of 30 cm (1 ft) of seating per person.

4. Cleanliness

Reference Section of Regulation: *Section 9*
As part of the Pool Safety Plan (see section D), the Pool Regulation requires that there must be a written program for the cleaning and maintenance of the pool, including the nature and frequency of cleaning. This may include a posted cleaning schedule which can help to organize the tasks of regular cleaning efforts. A cleaning schedule should also include what methods, equipment and cleaning products are to be used for a given task.

Quatemary ammonium cation cleaners/sanitizers should not be used for cleaning pool deck surfaces as they interact with the chlorine to produce disinfection by products such as chloramines, decreasing the disinfecting efficacy of the pool water and contributing to the 'chlorine smell' associated with pools.

Pools must be kept clean and clear of obstructions, provide adequately equipped hand basins, and, where such services are offered: bathing suits and bath towels are laundered after each use and stored/handled in a sanitary manner.

Pool water and the walls and bottom of the pool should be kept free of visible dirt, litter, body oils and algae growth.

Walkways, pool aprons, dressing rooms, shower rooms and toilets should be cleaned and sanitized at least daily and kept free of all equipment and material not needed for the proper operation of the pool.

Hand washing facilities are to be adequately equipped and maintained with single-use towels or dryers and single-use soap in dispensers.

A clean pool is not only a more pleasant environment for patrons, but contributes to health and safety. Promotion of good personal hygiene (i.e. hand washing and showers) helps maintain a sanitary and healthy swimming pool environment.

Dirty or unsanitary conditions can:
- *Introduce unwanted bacteria, viruses, mold and algae into the pool environment*
- *Reduce the effectiveness of chlorine and other disinfectant*
- *Help provide algae, mold and bacteria the nutrition they need to grow*

This can lead to:
- *Slippery conditions due to growth of algae and mold*
- *Bacterial and fungal growth which can lead to infections*

B. POOL WATER

1. Pool Water Parameters

Reference Section of Regulation: *Section 10*
Maintaining pool water parameters within the acceptable ranges will help to promote adequate disinfection and good water clarity, which are essential to the health and safety of patrons. Balanced pool chemistry also helps reduce corrosion and scaling of the pool, which significantly lowers long-term maintenance costs.

2. Testing Water Parameters

Reference Section of Regulation: *Section 10(2)*
The regulation requires minimum testing frequencies for water chemistry parameters, listed in Table 2-1 below, however many pools may benefit from more frequent testing.

Table 2-1
Water Parameters Testing Frequency

Water Parameters	Min Frequency in Regulation	Recommendation for Most Pools
Free available Chlorine	at least twice daily	every 4 hours*
Combined Chlorine	at least twice daily	at least twice daily
pH	at least twice daily	every 4 hours*
Alkalinity	at least weekly	at least weekly
Cyanuric Acid**	at least weekly	at least weekly
Calcium Hardness***	at least weekly	at least weekly

**or before and after periods of heavy use*
*** for use only in outdoor pools*
****not specified in Regulation, but recommended*

Your local health authority will help you determine an appropriate frequency for your facility.

The minimum testing frequency stated in the regulation should be adequate for pools that see very little use; however pools that experience heavier use will require much more frequent testing to ensure proper chemical balance. Bather load, temperature, type of use and type of pool may cause a shift in chemical parameters throughout the day. Increased testing is warranted in the following cases:

- After chemicals are added to the pool, as measurements can vary widely at this time.
- During periods of high use.
- With use of erosion feeders for adding disinfectant (as they dissolve, their ability to add chlorine decreases).

Critical parameters such as free chlorine and pH require frequent testing to verify they are within the acceptable range. Where testing reveals a deviation from the acceptable range, corrective action must be taken immediately to ensure satisfactory disinfection is occurring in the pool to prevent bacterial growth. Other parameters are generally not subject to as much variation throughout the day and do not require as frequent testing.

3. Chemical Testing Equipment

Suitable testing equipment is to be provided for the reliable determination of disinfectant residuals, hydrogen ion concentration (pH), total alkalinity, calcium hardness, and cyanuric acid. Other parameters that are frequently tested include total dissolved solids, and oxidation-reduction potential.

Testing equipment must be kept on–site. Test kits are best kept in a cool, dark place to prevent the deterioration of chemicals. Chemicals and reagents are to be replaced frequently, as per the manufacturer's recommendations. In many cases this entails replacing reagents every year.

Accurate test results allow the operator to verify the pool chemistry is in balance or take corrective action when necessary to ensure effective disinfection and reduce corrosion and scaling. In order to get accurate results, testing must be done using appropriate equipment and following the manufacturer's instructions.

Tests need to be conducted in accordance with the test kit manufacturer's instructions and recommendations and should be undertaken by individuals trained to do the testing and who know how to respond to a specific reading. Testing equipment needs proper maintenance and similarly, chemical controllers should be maintained and calibrated according to manufacturer's recommendations.

Test kits that use the 'DPD (diethyl-p-phenylene diamine) method' are recommended for testing free and combined chlorine. Test kits using the 'OTO method' (orthotolidine) should not be used as they present health hazard risks to the user as they only test for total chlorine and do not differentiate between free and combined chlorine.

4. Records

Reference Section of Regulation: *Section 19*
Operators must ensure that a daily record is kept for each pool and must be available onsite for inspection by the health authority on request. Records must include:

- All injuries sustained at or within the pool.
- All occurrences of fecal and vomit contamination at or within the pool.
- The amount and types of chemicals added to the pool water.
- Results of pool water tests performed under the regulation or as required by the health authority.

All records should be:

- accurate;
- clear and legible;
- Indicate the date and time the test or corrective action was taken;
- Include the name of the individual making the entry and
- stored for seven years and readily available on request by the health authority.

A sample record sheet is found in Appendix C which may be copied and adopted.

Good recordkeeping helps to resolve problems, track chemicals used, and troubleshoot unexpected results. For example, it is very helpful to know the exact amounts of chemical required to affect a particular amount of change in pool chemistry.

5. Water Clarity

Reference Section of Regulation: *Section 10(2)(a)*
The regulation requires that water must be clear enough that the pattern of the main drain is clearly seen by a person standing on the edge of pool overlooking main drain. Alternatively, it shall be sufficiently clear that the pattern of the pool drain can be clearly seen by a person standing on the edge of the pool at the deep end or that a black disc 150 mm in diameter on a white background, located on the bottom of the pool at its deepest point. This criterion is a practical test for the pool clarity that can be easily done when the pool is in use.

Clear water is not only aesthetically pleasing, but allows lifeguards and patrons to see swimmers in difficulty under water. Clear water also reduces the opportunity for injury from collision with an unseen object or to see hazards that may have gotten into the pool such as broken glass. Cloudy or turbid pool water may also adversely affect the ability of disinfectants in the pool water, or indicate other problems with pool chemistry.

6. Water Temperature

Reference Section of Regulation: *Section 10(2)(b) & 16(b)*
The regulation requires that the temperature of pool water must not exceed 37^{o}C, except for a hot tub, which must not exceed 40^{o}C.

It is recommended that pools used solely for competitive swimming be maintained at temperatures of 25°C to 28°C.

Pools are used for a multitude of purposes ranging form competitive sport to leisure and recreation to hot tubs, and ideal water temperatures for each of these activities varies considerably.

Competitive swimmers, lap swimmers and patrons engaging in other vigorous physical activity prefer cooler water temperatures to assist in body temperature regulation. Patrons of leisure pools, such as wave pools, infant and tot pools, and other pools where patrons are not engaged in rigorous physical activity may prefer higher temperatures.

Patrons of hot tubs are the least active of pool users, and use the facility for shorter periods of time. The World Health Organization suggests high temperatures (above 40°C) in spas or hot tubs may cause drowsiness, which may lead to unconsciousness and, possibly, drowning.

The maximum allowable temperature for swimming pools protects the public from heat stroke or other potential heat/exertion risks. The current maximum in the regulation is based on work done for the British Swimming Association on hypo- and hyperthermia, physical exertion and water temperature. It indicated that a swimmer is unlikely to suffer heat stroke in water at 37°C. This suggests facilities with leisure pools should be able to operate legally and safely as high as this water temperature to meet the needs of their patrons.

7. Water Microbiology

Reference Section of Regulation: *Section 10(2)(c)*
The microbiological quality of water must not present risk to the health of bathers.

When water samples are taken directly by pool operators, a copy of all results should be forwarded directly to your local health authority. Poor microbiological testing results will often mean immediate corrective action is needed as required by the health authority.

Your local health authority will assist in deciding on a routine sampling schedule sampling regime, and may require this as part of the conditions on an operating permit.

Many considerations are taken into account when determining a sampling regime, for example:

- How often you should take samples?
- How many samples should be taken at a time?
- Where should the samples be taken from?
- What labs your samples should be tested at?
- What tests should be done?
  - Coliform
  - Faecal Coliform
  - Pseudomonas sp.
  - E. Coli
- How should samples be transported to the lab?

Routine testing of water for bacteriological quality can provide evidence of the effectiveness of disinfection systems and sanitation schedules. Pool water that is found to have poor microbiological quality could indicate there is a problem with the disinfection and recirculation system, or it could also indicate a health risk to your patrons.

8. pH and Alkalinity

Reference Section of Regulation: *Section 10(2)(d)&(e)*
The pH of water must be tested at least twice daily, and maintained at no less than 7.2 and no more than 7.8.

The pH is a measure of how acidic or basic the water is, and is a critical param in pool chemistry. Maintaining pH within the required range of the regulation has a number of benefits:

- Chlorine disinfectants are most effective when the pH falls within a limited range, with an ideal target generally accepted to be about 7.4.
- Reducing eye and skin irritation.
- Reduces scale forming and corrosion.

Pool water pH is affected by many param, including activities in the pool, type of chemicals used, and the addition of chemicals. These factors can cause spikes or drops in the pH, particularly in smaller pools.

Alkalinity is a measure of carbonate and bicarbonate on the water. The alkalinity of water must be tested at least weekly to ensure it is maintained in the range of 80-120 ppm to help the pool resist rapid changes in pH.

9. Chlorine Disinfectant

Reference Section of Regulation: *Section 10(2)(f)*
Chlorine disinfectants used in the pool water must be tested at least twice daily and maintained at the minimum concentrations in Table 2-2. Concentrations should not, however, exceed 5 ppm, as this may result in eye, nose, and skin discomfort.

Table 2-2
Required Minimum Concentration of Chlorine

Column 1- Disinfectant	Column 2 – ≤30°C	Column 3 – ≥30°C
Free Available Chlorine	0.5 ppm	1.5 ppm
Chlorine Cyanurate	1.0 ppm	2.0 ppm

**It is advisable to keep concentrations in the pool 0.5 ppm above the minimum required in Table 2-2 to allow for a drop in response to increased use.*

Combined available chlorine should be kept as low as possible, and must not exceed 1 ppm.

Chlorine pucks are not to be used in skimmers as this is not an acceptable means to chlorinate pools. They can present an immediate chemical hazard to bathers and are an ineffective method of chlorination.

Chlorine is the most widely used disinfectant in regulated pools in B.C. Chlorine is generally added to pool water by adding chlorine gas, or by hypochlorites in liquid or solid form. These are powerful oxidizers that, when used properly can control viruses and bacteria in swimming pool water.

The complexities of chlorine chemistry can be simplified to what can be measured by a basic test kit:

- Free Available Chlorine (FAC) is the portion of the chlorine in the water that does most of the disinfecting and oxidizing.
- Combined available chlorine (CAC) is that which has reacted with organic compounds and remains in pool water.
- Total available chlorine (TAC) is the sum of free available chlorine plus the combined available chlorine as per the formula TAC=FAC+CAC.

As most test kits test only for TAC and FAC, the Combined Available Chlorine can be determined by rearranging the above formula to TAC-FAC=CAC.

There are many factors that affect the effectiveness of chlorine disinfection. Conditions where high concentrations of organic material (e.g. high bather load, sunscreen, leaves from trees, etc.) exist can create a significant demand on disinfectants. This is especially true in smaller pools where it is advisable to keep disinfectants above the minimum level to allow for a drop in response to increased use.

Once free available chlorine reacts with organics to form combined available chlorine (CAC), it is much less effective at disinfection. CAC, can cause objectionable odors, and may cause eye or respiratory irritation to patrons. To avoid these problems, CAC should be removed by super-chlorination (i.e. chlorination with doses that are deliberately selected to produce water free of chemical residuals so large as to require de-chlorination), oxidation, or other means before it reaches the maximum level permitted in the regulation.

Higher water temperatures favor bacterial growth and therefore require a higher concentration of disinfectant.

Operators of salt water systems or erosion feeders should have supplementary forms of chlorine (e.g. calcium hypochlorite, sodium hypochlorite, lithium hydrochlorite, dichlor) available to use in the event that a rapid decrease in the chlorine concentration is required.

Hot Tubs

Although the Pool Regulation requires 1.5 ppm for free available chlorine and 2.5 ppm for bromine, for hot tubs it is recommended that disinfectant should be maintained in the range of 3 ppm – 5 ppm for free available chlorine or 5 ppm – 8 ppm for bromine.

Due to the potential for sudden increases in high bather load, temperatures in excess of 37 degrees Celsius, and relatively small volume water in of hot tubs, higher levels of free chlorine help to ensure chlorine levels do not drop below acceptable levels. This is not as critical in hot tubs with automatic controllers, as they are able to respond more quickly to fluctuations in chlorine levels,

WorkSafe BC should be contacted for information on safe practices for handling chlorine products.

10. Cyanuric Acid

Reference Section of Regulation: *Section 10(2)(h)*
If cyanuric acid is used in pool water, the concentration must be tested at least weekly, and must be maintained at a concentration of not less than 80 ppm. An increase in the amount of free chlorine concentration is also required (see section on "Chlorine Disinfectant" above) when cyanuric acid is used in pool water.

A concentration of 30ppm to 50ppm is an ideal range when used in outdoor pools. C*yanuric acid is not to be used in indoor pools.*

Cyanuric acid is a stabilizer that helps outdoor pool water resist reduce loss of chlorine due to ultraviolet light from the sun. Some commercial chlorine pool disinfectants contain cyanuric acid, or it can be added to a pool on its own. Cyanuric acid is of little value in indoor pools and care should be taken to avoid using products containing cyanuric acid where it is not necessary.

Continued addition of cyanuric acid containing products to a pool can result in elevated concentrations. Once cyanuric acid levels begin to exceed 50 ppm, effectiveness of chlorine as a disinfectant begins to decrease. This can lead to algal and bacterial growth in the pool and on the deck. Once high concentrations of cyanuric acid have accumulated in pool water, they can only be reduced by draining a portion of the pool and diluting it with fresh water.

11. Ozone

Ozone, where used, must always be in combination with a residual disinfectant such as chlorine.

Ozone is an effective sanitizer and oxidizer of organics. Pools that utilize ozone in conjunction with chlorine in the circulation system can effectively reduce the amount of chlorine needed to maintain the required minimum residual. Ozone is not a substitute for a residual disinfectant as it does not carry its disinfection properties into the pool. Ozone therefore must always be used in combination with a residual disinfectant such as chlorine.

WorkSafe BC should be contacted for information on safe practices for working with Ozone.

12. Bromine

Reference Section of Regulation*: Schedule 3*
Bromine disinfectants, where used in place of chlorine disinfectant, must be maintained at the minimum concentrations in Table 2-3, and should not exceed 10.0 ppm. It is advisable to keep concentrations slightly above the minimum level to allow for a drop in response to increased use.

Table 2-3
Required Minimum Concentration of Bromine as an Alternate Disinfectant

Column 1- Disinfectant	Column 2 – ≤30°C	Column 2 – ≥30°C
Bromine	1.5 ppm	2.5 ppm

Bromine may be used in place of chlorine as a disinfectant. While it is widely used in private hot tubs, it is much less commonly used in regulated pools. Although its properties and function are similar to chlorine, it may not be as effective for killing some types of harmful bacteria such as Pseudomonas.

13. Other Chemicals, Measures and Considerations

There are several other chemical param and measures that help maintain the balance of chemicals, give an indication of disinfection capacity of water, and contribute to the long term maintenance of a pool.

a) Calcium Hardness,

The ideal range of calcium hardness is 180-220 ppm as per Table 2-4 below

The 'hardness' of water generally refers to the amount of dissolved calcium and magnesium in pool water. Pool water hardness can be adjusted by dilution, using a water softener, or by increasing calcium by the addition of calcium chloride. The widely accepted range for pool calcium hardness is 180-220 ppm. Water that is low in total hardness is called "soft" while water that is high in calcium hardness is termed "hard". Maintaining pool water outside the recommended range is not advised as it will either corrode pool equipment if the water is soft or may clog (scale) pool equipment if the water is hard. Problems can be expected below 150 ppm and above 300 ppm.

b) Total Dissolved Solids

The ideal range of total dissolved solids is 200-800 ppm as per Table 2-4 below

Total Dissolved Solids (TDS) – can be described as the measure of the sum of all dissolved material in pool water. High TDS can impair the effectiveness of disinfectants and other chemicals, and may contribute to corrosion, cloudiness, scale formation and other pool maintenance issues.

c) Oxidation Reduction Potential (ORP)

Where ORP is measured, it should be maintained in the range of 700 mV-750 mV as per Table 2-4 below

ORP is used as a measure of the presence of oxidizers in the pool water, and is often used in conjunction with an automatic controller.

d) Salt Water Systems

There is currently no specific guideline for salt concentration in pools, however free chorine residuals must still be maintained as required by the regulation – see the section B9 on “Chlorine Disinfection”.

Salt water chlorine generation is an alternate method to traditional chlorine disinfection. Using this approach, the operator produces and uses chlorine on-site. This requires that the operator maintain salt in the pool water at approximately 2500ppm, which is barely perceptible to taste. The salt in the pool water (sodium chloride – NaCl) is converted to sodium hypochlorite (NaOCl) through electrolysis, which typically occurs in specially designed sacrificial battery-like cells located in the pool’s mechanical room. These cells need to be replaced from time to time as per manufacturer’s recommendations to ensure proper functioning of the system.

Operators of salt water systems should respond to fecal accidents or periods of super chlorination by having an alternative chlorine source (e.g. sodium hypochlorite, calcium hypochlorite, lithium hypochlorite) to allow a quick response to fecal accidents and periods where the chlorine demand exceeds the capacity of the chlorine generating system. An alternative would be back up salt generating cells.

e) Potassium Monopersulphate

Potassium monopersulphate may be used to help reduce the concentration of combined chlorine residuals in pool water.

The use of monopersulphate may produce inaccurate total available chlorine readings and operators should use caution not to add too much product. Over time, monopersulphate levels will subside, and chlorine readings will become more reliable.

Potassium monopersulphate is the active agent in most non-chlorine-based pool shock treatments which are used to rid the pool water of excess combined chlorine. It is also known as peroxymonopersulphate, or just monopersulphate, The use of monopersulphate is often attractive to operators to reduce combined chlorine levels because it does not require that the pool be closed for extended periods. Bathers can return to the pool after the chemical is dissolved and evenly distributed, provided the monopersulphate is used in the recommended dosage to pool water (follow product directions). A monopersulphate residual will oxidize chloramines and organic waste in a similar manner as traditional pool disinfectants. Monopersulphate, however, must used in conjunction with a regular chlorine treatment program and not as a substitute. Operators must maintain the required Free Available Chlorine levels while using this product.

For more information on combined and free chlorine, refer to the section on “Chlorine Disinfectant”.

f) Ultraviolet Light

Ultraviolet (UV) light may be used in combination with a residual disinfectant such as chlorine.

Ultraviolet (UV) light is sometimes used in conjunction with chlorine in the circulation system. UV light is not a substitute for a residual disinfectant as it does not carry its disinfection properties into the pool. UV light therefore must always be used in combination with a residual disinfectant such as chlorine. (The maintenance required for UV systems should be per the manufacturer’s instructions)

Table 2-4
Other Water Chemistry Param

Component	Ideal Range	Testing Frequency
Calcium Hardness	180 – 220 ppm (mg/l)	Weekly
Total dissolved solids	200 – 800 ppm (mg/l)	Weekly
Stabilizer (cyanuric acid)	30 – 50 ppm (mg/l) *(Max is less than 80 ppm)*	Weekly
ORP	700 – 750 millivolts	Every 4 hrs

C. QUALIFICATIONS FOR MAINTAINING AND OPERATING POOLS

Operator Training

Reference Section of Regulation: *Section 11*
The operator of a pool must ensure that pool maintenance performed on regular basis. This must be done by or under the supervision of a qualified person trained in pool maintenance. A 'qualified person' is someone who has taken an appropriate program of instruction in pool maintenance (e.g. through courses provided by the BC Recreation and Parks Association, Recreational Facilities Association of B.C., etc) or has the equivalent combination of knowledge and skills.

Table 2-5 below outlines the minimum competencies a basic course should contain to meet this requirement.

For new pools, it is recommended that at least one maintenance technician should be on site for the appropriate amount of time prior to opening required in order to gain a complete knowledge and understanding of the pool systems, their operation, and their potential risk to workers and the public.

Facility personnel, particularly maintenance personnel, must be thoroughly knowledgeable about pool systems and trained in maintaining them. They must understand the potential hazards to pool users that these systems present.

A basic course would be the minimum to meet the intent of the regulation for smaller facilities (see Table 2-5). Larger or more complex facilities should ensure personnel who are responsible for safety and maintenance of the swimming pool are further trained in a more advanced course containing instruction in subjects suggested by Table 2-6 below.

Table 2-5
Basic Pool Operations Course (Min. 8 hrs)

Regulations, Public Health Act, other applicable legislation
Pool types and designs
Pool chemistry
Water testing
Circulation, filtration, and turnover rate
Suction and entrapment hazards
Preventative maintenance
Seasonal maintenance
Safe handling and storage of chemicals
Troubleshooting problems

Table 2-6
Comprehensive Pool Operations Course (12 to 14 hrs)

Review of Basic Course information
Regulations
Increased depth on pool chemistry
Filter sizing
Pumps & motors and their maintenance
General maintenance
Mechanical workings
Risk management
Alternate forms of disinfecting, Ozone
Troubleshooting problems

Your local health authority may:

- Identify qualifications, including upgrading requirements, required of a person who maintains a pool.
- Develop core elements and objectives for pool maintenance courses that will provide training for people who want to acquire pool maintenance qualifications.
- Review any existing pool maintenance courses that are submitted to the health authority to determine if the course provides appropriate and cost effective training.

D. POOL SAFETY PLANS

1. Pool Safety Plans

Reference Section of Regulation: *Section 13*
A pool operator must develop a comprehensive written pool safety plan customized to their facility to ensure the health and safety of pool patrons (see Appendix A for an example table of contents for a pool safety plan). Maintenance technicians and pool staff should participate in the creation of these plans. The plan is to be reviewed and updated as appropriate, or at least annually. This will become a requirement on October 8, 2011.

The plan is to be made readily available to pool staff, and, each staff member is to be trained in the procedures and in the use of the equipment described in the plan.

Main components the plan must include are:

- Procedures to be followed in the event of a serious injury, emergency or incident.
- The type of lifesaving, lifeguarding and first aid equipment to be kept within the immediate vicinity of the pool.
- The number of lifeguards and other staff that are to be on duty while the pool is in use.
- Operating procedures for the pool.
- The program of cleaning and maintenance of the pool including the nature frequency of cleaning and maintenance.
- Maintenance staff training qualifications.

The following sections go into more detail on what is to be addressed in each of these components.

Clear written procedures for preventing and responding to incidents are useful in:

- Staff training.
- Reducing likelihood of adverse events.
- Responding effectively to incidents that impact the health and safety of patrons and staff.

Where moveable equipment, including portable diving stands, starting platforms and swing ropes are provided for the use of bathers, facilities shall ensure that the equipment is in place on the deck only during periods when its use is directly supervised by aquatic personnel. The equipment can be hazardous to patrons if not being supervised.

2. Pool Safety Plan - Procedures for Serious Injury, Emergency or Incident

Reference Section of Regulation: *Sections 13(2)(a)*
Each pool is to develop its own written plan of how to deal with serious injuries, emergencies and other incidents (see Appendix G for examples of fecal accident clean up procedures):

- The plan must include written procedures for handling emergencies efficiently and safely.
- The plan must contain both equipment required and emergency procedures for staff to follow.
- Staff must be trained in the implementation of the plan.
- The plan may also identify practices to reduce risk of emergencies occurring.

The following are situations that may be addressed in a facility's plan:

Medical emergencies: • Near-drowning or drowning • Unconscious/non-breathing/pulse less • 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:* • Gas leak e.g. chlorine, ozone, natural gas, propane • Chemical spill • Fire • Power failure
Health/hygiene emergencies • Fecal/vomit incidents • Disease outbreaks • Blood and bodily fluid exposure (in & out of water)	*Patron-related emergencies:* • Entrapped person • Hostile patron • Missing person
Natural disasters • earthquake, • flood, • lightning	• *Other* • Ambulance access • Incident reporting • Media response • Incident stress debriefing

Facilities without lifeguards must establish and post emergency procedures as well as the location of the phone, first aid kit and emergency exits.

3. Pool Safety Plan – Lifesaving and First Aid Equipment

Reference Section of Regulation: *Section 13(2)(b)*
Emergency equipment, including first aid equipment, sufficient for reasonably foreseeable incidents must be:

- Listed in the pool safety plan.
- Kept within the immediate vicinity of the pool.
- Accessible at all times that the pool is operation.
- In good working condition.
- Checked regularly for defects and the need for maintenance or replacement.

a) Lifesaving Equipment

Lifesaving equipment is to be mounted in conspicuous places and ready for use at all times. Public pools must maintain the life saving equipment listed in their in their pool safety plans. Pools over 10 m^2 in size, and operating as commercial pools must have:

- A non-conductive reaching assist with shepherd's hook at least 3.5 m in length.
- A throwing ring, securely attached to a line of at least 6mm in diameter and having a length of at least (half the width of the pool) + 3 m that is not wrapped around the throwing ring.

b) First Aid Equipment

The following emergency equipment is recommended to be in a pool safety plan, and in place at the facility:

- Minimum of a Level 2 first aid kit as per WorkSafe BC.
- Personal protective equipment including pocket mask and gloves.
- A spine board [with at least 3 Velcro straps and a head-security device].*
- Oxygen therapy equipment (400 litres or greater) with regulator and protective carrying case and a spare oxygen tank.*
- Full set of airways.*
- A.E.D. (defibrillator).*

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

c) Emergency Telephone

Reference Section of Regulation: *Section 14*

In order to facilitate rapid contact with emergency services, the following must be in place in public pools:

- A telephone designated for contacting emergency services free of charge, and its location is marked conspicuously with a sign.
- A procedure and script for contacting emergency services posted in view of the designated emergency telephone.
- Telephone numbers of the nearest available hospital, ambulance service, police department and fire department displayed near the emergency telephone. In most cases this will be “911”.
- Where a land line phone is not available at a commercial pool, an alternate method of contacting emergency services should be established (e.g. emergency radio, cell phone, satellite phone).

4. Pool Safety Plan – Lifeguards and Supervision

a) Unsupervised Pools

Reference Section of Regulation: *Sections 13(2)(c) and 18*

Some pools may operate without supervision by a lifeguard. This includes:

- Commercial pools.
- Hot Tubs.
- Spray Pools.
- Wading Pools.

A commercial pool is one which is over 61 cm (24 in) in depth, less than 170 sq m (1830 sq ft) in surface area , and owned, operated and used only by used only by members, shareholders, tenants or patrons of an educational, recreational, or business enterprise, or a strata corporation. Examples of pools that may fall into this category include most hotel, condominium and apartment pools and hot tubs.

When a commercial pool or hot tub is operated without a lifeguard on duty, a clearly visible notice must be posted at each entrance to the pool stating that no lifeguard is on duty, and that children less than seven years of age must be supervised by an adult.

A commercial pool or hot tub with surface area greater than 10 sq m (108 sq ft) must also have, at poolside, a non-conducting reaching assist with a shepherd’s hook of at least 3.5 m (11.5 ft) in length, as well as a throwing ring, securely attached to a line of at least 6 mm diameter and having a length of at least half the width of the pool plus 3 m.

In specified and limited situations, a public pool may also operate without a lifeguard provided that, during that period of time:

- The only persons permitted access to the pool are members, tenants or patrons of an educational, recreational, or business enterprise (e.g. where the pool is booked for a private function), or
- The only persons permitted access to the pool are persons receiving aquatic instruction who are closely supervised by an aquatic instructor and an assistant.
- A clearly visible sign is posted at each entrance to the pool stating that no lifeguard is on duty and that children less than seven years of age must be supervised by an adult, and
- The pool is equipped with the *lifesaving* equipment required for a commercial pool.

While many pools may not be required by regulation to 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 the patrons.

b) Minimum Staff Requirements

Reference Section of Regulation: *Section 17(2)*

A public pool operator must ensure that, when the pool is open to the public, both a lifeguard and an assistant are on duty performing pool surveillance *(effective October 8, 2011, this requirement will change to indicate that in addition to one lifeguard and one assistant, any additional lifeguards and assistants will be in accordance with the pool safety plan)*. However, if the pool is used only for aquatic instruction, both an aquatic instructor providing close supervision of the persons being instructed and an assistant must be on duty.

If staff, other than lifeguards, is responsible for assisting lifeguards in emergency situations, training should be provided by the employer to ensure those non-lifeguard staff are:

- Conversant with emergency procedures.
- Practiced in their role in that procedure both through formal training and regular in-service training.
- Certified with a current CPR certificate (or Standard first aid).

c) Ratio of Bathers to Lifeguards

The ratio of bathers to lifeguards, beyond the minimum staff identified in b) above, should be determined jointly by facility management and senior aquatic staff. This should be based on facility design, patron activity, patron age groups and other factors to ensure on-going vigilance occurs in all pool areas open for public use.

The minimum staffing levels are required to ensure adequate supervision of persons in the pool, and must be identified in the pool safety plan.

d) Lifeguard Qualifications

Reference Section of Regulation: *Section 17(1)*
A lifeguard is a person who:

- Is at least 16 years of age who is familiar with the pool safety plan
- Is responsible for the conduct and safety of all pool patrons, and.
- Is performing no duty other than pool surveillance.

It is also recommended that all staff be trained appropriate to their position and responsibilities. This may include:

- Regular in-service training.
- Training through external agencies.
- Complete records kept as to in-service attendance and follow-up is performed for those unable to attend or those whose performance is deemed to be unacceptable.
- Providing specialized training in handling related emergencies for lifeguards required to supervise specialized programs or facility features (i.e. scuba diving).

5. Pool Safety Plans - Operating Procedures

Reference Section of Regulation: *Section 13(2)(d)*
Operators and Maintenance Technicians must identify correct operating procedures to ensure the health and safety of pool patrons, as well as staff.

This part of the plan should identify the procedures to be followed to:

- Properly test pool water chemistry.
- Properly adjust pool water chemistry.
- Properly backwash filters.
- Properly clean hair and lint strainers.
- Properly prime pumps.
- Properly apply diatomaceous earth to filters (where used).
- Handle disinfection chemicals and equipment.
- Ensure lockdown (see below) procedures are in place so no one is injured during maintenance
- Ensure written operating standards for play equipment are in place.

Lockdown refers to those circumstances where workers must not put themselves in conditions where a piece of equipment could be inadvertently actuated or where there is possible release of electrical, kinetic, or stored energy, chemicals or hazardous substances, risk of engulfment by water or other means, etc. The requirement is that each worker who works in such circumstance has effectively de-energized, or “locked-out” the equipment and placed a physical lock on the control point.

This list is just a beginning, and more complex pool facilities will obviously require more complex procedures. Where possible, pools should keep a copy of engineering plans and or pool drawings on site to assist with troubleshooting problems.

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

6. Pool Safety Plans - Cleanliness

Reference Section of Regulation: *Section 13(2)(e)*
Operators must identify appropriate cleaning schedules to ensure the health and safety of pool patrons. This part of the plan should include:

- Frequency of cleaning for each part of the pool.
- Chemicals and cleaners used.
- Lockdown procedures to ensure no one is injured during cleaning.
- More complex pools will require more complex procedures.

For more information see section A4 “Cleanliness”.

7. Pool Safety Plans – Maintenance

Reference Section of Regulation: *Section 13(2)(e)*
Operators must ensure that pools are kept in good repair so that no health hazard exists. Operators must also ensure that pools are maintained on a regular basis by a qualified person. A ‘qualified person’ is someone who has taken an appropriate program of instruction in pool maintenance (e.g. courses provided by the BC Recreation and Parks Association, Recreational Facilities Association of B.C., etc – other courses to be included here) or has the equivalent combination of knowledge and skills.

For more information see section C “Qualifications for Maintaining and Operating Pools”.

Each pool must develop its own written maintenance plan and train staff in the implementation of this plan. The plan must contain both equipment needed, and procedures the staff must follow. A schedule for routine maintenance and evaluation of equipment must ensure issues are identified and corrected before they become a problem.

The following situations must be addressed in a facility's maintenance plan:

- Ensuring water intakes do not present a suction hazard to bathers.
- Ensuring nothing in the pool presents an entrapment hazard to bathers such as stairs or other physical structures in the pool water.
- Ensuring all areas of the pool are sufficiently lit so that all areas are visible.
- Regular testing of the function of equipment to ensure it is safe for use, and maintained in accordance with manufacturer's recommendations.
- Regular testing and maintaining of the surfaces of walkways, stairs, decks and platforms to ensure they haven’t become a slip hazard as a result of becoming smooth and/or worn.
- Preventing the formation of ice on walkways, steps and ladders of outdoor pools that are operated in the winter.

- Ensuring all handrails is securely attached.
- Verifying the temperature of hot water (including showers) is below 49^{o}C to avoid scald injuries.
- Ensuring recirculation system, including disinfection equipment and filters, are functioning properly.
- Ensuring water depth is clearly marked in both metric and imperial units of measurement.
- Ensuring safe storage of chemicals.
- Ensuring the facility is free from sharp or blunt objects that are likely to cause injury.
- Ensuring the facility is not deteriorating to allow bacterial or fungal growth, or cause injury.
- Regular testing of ground fault interrupters for underwater lights

a) Preventing Suction Hazards

Reference Section of Regulation: *Section 11(1)(b)*

Special attention in the pool safety plan must be given to establishing operating procedures that ensure water returning to the recirculation system from the pool does not become a suction hazard.

Routine maintenance should be done to ensure that suction fittings and inlets are secure and in good repair.

The operator must ensure that:

- Suction points are designed to prevent a person from being held on to the suction point.
- Inlet fittings are designed to prevent the entrapment of bathers.
- The pool has skimmers or gutters that are designed to prevent the entrapment of bathers.
- 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 by a person
- Circulating pumps have an effective vacuum breaking design measure.
- No equalizer lines terminate in the pool basin.
- Submerged equalizer lines or equalizer fittings in the pool, if they exist, are disabled.
- When covers are replaced, exactly the same covers must be used. If exactly the same model is unavailable, contact the public health engineer for advice on a replacement model.

A complete set of pool drawings should 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 should also be available at the pool. It is recommended that these manuals:

- 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.

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

Suction has been the cause of many easily preventable deaths and severe injuries in swimming pool facilities. Water inlets can cause suction 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 or spa drain has pulled intestines out of the body. 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, presents this hazard.

b) Procedures for Suction or Entrapment Related Emergencies

The pool safety plan must 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 ;
- Any other procedures that are necessary to free a person trapped under water.

c) Chemical Storage and Handling

Reference Section of Regulation: *Section 11(2)(h)*

Chemicals must be stored in a safe manner and location.

Chemical storage location(s) should always be secured from unauthorized entry. Doors should be locked and appropriately signed.

Where disinfection systems other than gaseous chlorine are used (i.e. hypochlorites or bromine), the disinfection chemicals must be kept separate from any acidic products.

The material safety data sheets (MSDS) for other chemicals located on site should be reviewed for specific storage concerns and for incompatibility with other chemicals. A list should be made of incompatible chemicals to make this clear to staff.

- Ensure that these 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.

For specific storage requirements for chlorine gas systems, refer to the "Chlorine Safe Work Practices" manual on the WorkSafe BC web-site, under "publications/ by topic/occupational hygiene"

Chemicals commonly used in pools can be dangerous on their own, or if they react with other chemicals. Spills or leaks can be corrosive, or can react with other chemicals leading to fire, smoke, poisonous gases or other hazards. Chlorine (or bromine) delivery chemicals (e.g. hypochlorites, isocyanurates) and acids will react violently to release chlorine (or bromine) gas.

8. Gas Chlorine Operation and Maintenance

Gas chlorine storage and handling shall be performed in a manner to prevent injury to workers and public, and should include, but not be limited to the following procedures:

- Gas chlorine tank changes are performed by staff fully trained in the procedure and in the emergency procedure in case of a leak.
- Emergency procedure includes contact with local emergency agency familiar with the facility and capable of handling a gas chlorine leak.
- Chlorine leak detector includes a visual and /or audible alarm in an area where staff will take notice immediately.
- Tank change procedure includes two staff members, one changing the cylinder and a second outside the chlorine room observing.
- Tank regulators and related feed equipment be serviced at least annually by a qualified technician.
- Chlorine detectors be tested at least every six months, and calibrated annually by a qualified technician.
- “Pigtails” need to be replaced at a minimum of every two years.

For more information on safe Chlorine gas storage and handling, see the publication “Chlorine Safe Work Practices” published by WorkSafe BC, or contact WorkSafe BC.

B.C. Guidelines for Swimming Pool Operations

Appendix A

Example Table of Contents for Pool Safety Plan

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 Ftage
- Minimum Depth
- Maximum Depth
- Bather Capacity
- Diving Allowed (Y/N)
- Slides (Y/N)
- Pool volume
- Other features (e.g. climbing wall, rope swing)

Lifeguard Certifications (i.e. what are the required skills and certifications for lifeguard personnel)
Injury Prevention
- Waterfront Hazards (e.g. entrance areas to pool, diving boards, slides – how are hazards in these areas mitigated?)
- Lighting and Electrical (e.g. emergency lighting)
- Maintenance (e.g. daily inspections and reporting of results)
- Rules and Regulations – other than the pool and hot tub rules noted below)
- Diving Areas (posting of rules)
- Pool Slides (posting of rules)

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

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

B.C. Guidelines for Swimming Pool Operations

Appendix B

Example Pool Rules

Pool Rules

In our pool you must:

- Wear clean and appropriate bathing attire.
- First take a cleansing shower.
- Ensure all children less than seven years of age are closely supervised (within arm's reach at all times) by a responsible person of at least sixteen years of age.
- Infants and toddlers must wear swim diapers and/or elastic swim pants.
- One responsible person must supervise up to three children who are less than seven years of age.
- 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.

The following is not allowed in our pool:

- Entering the pool while ill (e.g. diarrhea or vomiting) – this includes: open sores, bandages, head colds, discharging ears or noses or infected eyes. Persons with related symptoms should not enter the pool until 48 hrs after cessation of these symptoms.
- 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.

B.C. Guidelines for Swimming Pool Operations

Hot Tub Rules

- No Diving.
- Keep long hair out of the water, away from all filters and drains.
- Always have someone with you when you are in a hot tub.
- Children less than seven years of age must be constantly supervised. Unsupervised use by children is prohibited.
- Keep children less than seven years of age, especially infants, out of hot tubs and spas. Their small bodies overheat too fast.
- Water temperatures must not be hotter than 40ºC (104ºF).
- Elderly people, people with heart disease, diabetes, or high or low blood pressure and people taking medication for cardiovascular or nerve disorders should not use the spa or hot tub without consulting their doctor.
- Don't stay in too long (i.e. ten minutes). Then shower, cool down. Then, if you wish, return for another brief stay. Long exposure may result in nausea, dizziness or fainting.
- Always enter and leave the hot tub slowly and cautiously.
- Don't use when you are under the influence of alcohol or other intoxicants.
- If you are pregnant talk to your doctor before using.
- Do not totally immerse your body.

B.C. Guidelines for Swimming Pool Operations

Appendix C

Example Pool and Hot Tub Water Testing and Maintenance Log

Dates ***Year*** ***Name of Pool*** ***Location***

Date & Time	Initials	Total Chlorine	Free Chlorine	Combined Chlorine	pH	Total Alkalinity	Calcium Hardness	Cyanuric Acid	Chemical Use	Bather Load (note)	Clarity	Flow Rate	Temperature	Comments ❑ Chemicals added / amount ❑ Make-up water added ❑ Backwashed / cleaned filters ❑ Vacuumed ❑ Mechanical breakdown ❑ Swimmer emergency ❑ Fecal accidents ❑ Other tests / maintenance / issues
														Note: Bather load to be based on # of patrons in pool at time of testing.

Recommended Parameters for Swimming Pool and Hot Tub Water Chemistry Parameters:

Parameters	Min.	Max.	Test Frequency
Free Chlorine (<30°C)	0.5 ppm	5.0 ppm	Every 4 hours
Free Chlorine (>30°C)	1.5 ppm	5.0 ppm	Every 4 hours
Chlorine Cyanurate (<30°C)	1.0 pmm	5.0 ppm	Every 4 hours
Chlorine Cyanurate (>30°C)	2.0 ppm	5.0 ppm	Every 4 hours
Bromine (<30°C)	1.5 ppm	5.0 ppm	Every 4 hours
Bromine (>30°C)	2.5 ppm	5.0 ppm	Every 4 hours
Combined Chlorine	<1.0 ppm	<1.0ppm	At least twice daily
pH	7.2	7.8	Every 4 hours
Total Alkalinity	80 ppm	120 ppm	At least weekly
Calcium Hardness	180 ppm	220 ppm	Weekly
Cyanuric Acid (outdoor pools only)	30 ppm	50 ppm	At least weekly

B.C. Guidelines for Swimming Pool Operations

Appendix D

Example Maintenance and Cleaning Schedule

Task	Frequency	Person responsible	Equipment required	Remarks
Check and record water param in pool and hot tub	*7am, 5pm and after busy periods*	*Maintenance technician*	*Pool test kit, thermom, log book*	*Make adjustments to water param as needed*
Inspect decks, diving boards, railings slides, play equipment for condition that may injure patrons	*Prior to opening pool to patrons each morning*	*Head Life Guard*		*Close or restrict access to any area that may be injurious to patrons. Inform management to arrange for it to be repaired.*
Check first aid kit is fully stocked	*Prior to opening pool to patrons in morning*	*Life guard #2*		*Order replacement items as necessary – refer to pool safety plan for full list.*
Check pool drain covers are securely attached	*Prior to opening pool to patrons in morning*	*Life guard #2*		*Close pool if found to be loose or damaged. Inform head lifeguard and management to arrange for it to be repaired.*
Clean and sanitize toilets, sinks, change room floors	*Twice daily or as necessary*	*Custodian*	*Cleaning solution, bleach, gloves, sponge, Mop, bucket*	*Clean with Soap, then sanitize with bleach water solution*
Check temperature of hot water in taps	*Prior to opening*	*Maintenance technician*	*Thermom*	*Adjust to ensure hot water temperature is less than 49 degrees Celsius.*

B.C. Guidelines for Swimming Pool Operations

Appendix E

Example Chemical Storage and Handling Procedures

Name of Product	Location	Do not store next to , or allow to mix with the following:	Special handling considerations	Spill response and clean-up procedures

B.C. Guidelines for Swimming Pool Operations

Appendix F

Important Phone Numbers

Contact	Phone Number
Ambulance, Fire, Police	911
Pool Manager	
Health Authority	
Chemical spill	
Gas Leak	
Poison Control	
Pool Service Company	

B.C. Guidelines for Swimming Pool Operations

Appendix G

Incident Response

Incident	Response Procedure
Medical emergencies *(may expand to include procedures for specific incidents)*	*-Apply first aid as necessary* *-call ambulance* • *Explain nature of emergency* • *Explain best place for them to meet staff* • *Send someone to meet ambulance and direct them to most practical entrance*
Patron's hair caught in water intake	*-shut off pumps* *-cut hair with scissors to extract person* *-clear pool* *-call ambulance* *-First Aid/AR as necessary…..*
Patron held on to pool drain by suction	*-clear pool* *-Shut off pumps* *-call ambulance* *-First Aid/AR as necessary…..*
Missing person	*-clear pool* *…..*
Fecal accident	*-Clear pool* *-Follow fecal accident procedure* *-Record incident in water maintenance log*
Blood or bodily fluid clean up	*-follow WCB guideline*
Hostile patron	
Fire	
Power failure	
Earthquake	
flood	
lightning	

This chart provides examples of:

- common incidents that can foresee ably occur in the swimming pool environment; and
- sample responses for some of these incidents.

This list is not exhaustive, and should be customized to:

- what is likely to happen in your facility;
- the appropriate response given number of staff, level of training, location of facility, etc.; and
- include entire procedures in list, or refer to more detailed procedures elsewhere in plan.

B.C. Guidelines for Swimming Pool Operations

Appendix H

Example Fecal Accident Clean up Procedures for Pool Safety Plan

PROTOCOL FOR HANDLING FECAL ACCIDENTS IN SWIMMING POOL WATER (adapted from VIHA policy and from CDC Atlanta)

A diarrhea fecal accident is a higher risk event than a formed stool accident. With most diarrhea illnesses, the number of infectious germs found in each bowel movement decreases as the diarrhea comes to an end and the person's bowel movements return to normal. Therefore, a formed stool is probably less of a risk than a diarrheal accident that you may not see.

A formed stool may contain few illness causing germs. You won't know. The germs that may be present are less likely to be released into the pool because they are mostly contained within the stool. However, formed stool also protects germs inside from being exposed to the chlorine in the pool so prompt removal is necessary.

There are two different procedures recommended for disinfecting swimming pool water that has been contaminated by fecal/vomit accidents. Depending on the type of contamination, one of these procedures should be followed to protect the public and facility staff from infection or illness.

Procedure A should be followed when the pool water is contaminated with **normally formed stools**. Quick action on the part of the pool operator is likely to kill any pathogens associated with this type of contamination.

Procedure B should be followed when the pool water is contaminated with **watery stool**. Organisms that are sensitive to chlorine, and parasites such as *Cryptosporidium* or *Giardia*, that are not sensitive to chlorine, can be introduced to pool water by liquid diarrheal stools, and special care must be taken to prevent illness associated with organisms.

Procedure A – Pool Water Contaminated With Normally Formed Stool or Vomit

1. Evacuate the pool immediately.
2. Remove fecal material from the pool using a scooping device and dispose of stools into a toilet or if possible vacuum directly to waste.
3. Clean and disinfect all equipment used for removing the fecal material, with a detergent solution, followed by a chlorine solution (e.g. 1 part bleach to 9 parts water) and allow a contact time of at least 15 min.
4. Maintain the chlorine concentration at 2 ppm for at least 25 min before re-opening the pool..
   Note: pH must be maintained between 7.2 and 7.5 to ensure chlorine effectiveness.
5. Test the water to ensure the chlorine and pH meet regulatory requirements prior to re-opening the pool. Take samples for bacterial analysis (i.e. total coliforms and fecal coliforms).
6. Document in your logbook all steps taken, and all analytical results obtained.

Procedure B – Pool Water Contaminated With Diarrhea

1. Evacuate the pool immediately.
2. Remove any visible stool with a scooping device or vacuum and dispose of the material into a toilet or directly to waste.
3. Clean and disinfect all equipment used for removing the fecal material, with a detergent solution, followed by a chlorine solution (e.g. 1 part bleach to 9 parts water) and allow a contact time of at least 15 min.
4. Provide enough chlorine to ensure a CT (Concentration/Time) Value of 15,300.
   Note: A CT Value of 15,300 is any combination of chlorine concentration and time, in minutes that will yield 15,300.
   (e.g. Raising the chlorine residual to 20 ppm, and running the recirculation equipment for 12.75 hrs will provide a CT of 15,300, if the pH is maintained at 7.5 or less and the temperature at 25°C (77F) to ensure chlorine effectiveness. (i.e. 20 ppm X 12.75 hrs X 60 min/hr = 15,300)). (Ensure the pool equipment can withstand the high chlorine concentration)
5. Clean and brush down the walls of the pool, the skimmer housings, and skimmer baskets.
6. Backwash the filters to waste.
7. Disinfect the filters using one of the procedures listed:
   a. **Sand Filters** – Add 30 L of sodium hypochlorite into the filter and let stand 6 to 8 hrs. Amount of sodium hypochlorite added to filters may vary depending on filter size (i.e. Larger filters will require more sodium hypochlorite). Backwash again.
   b. **Cartridge Filters** – Remove the cartridge and clean and disinfect the filter casing thoroughly with 200 ppm solution of chlorine for 1 hr. Rinse and allow the casing to dry completely.
      Diatomaceous Earth (DE) Filters – Clean the DE off the filters, dispose of the DE, and soak the tank and septums in a 100 ppm solution of chlorine for 2 hrs.
8. Disinfect the deck area surrounding the swimming pool with 100 ppm chlorine (bleach) solution or equivalent.
9. Restart the recirculation system and test the water to ensure the chlorine and pH meets regulatory requirements prior to re-opening the pool. Take samples for bacterial analysis (i.e. total coliforms and fecal coliforms – **One sample should be taken for each analysis at a water depth of at least 1 ft below the water's surface**
10. Document all steps taken and all analytical results obtained in your logbook.

Contact your health authority on the next working day to advise them of the actions you have taken.

Procedure C – Fecal Accidents or Vomiting on the Pool Deck, Washrooms or Other Common Areas

From time to time vomiting and fecal accidents occur in areas of the facility outside of the pool basin. Appropriate steps must be taken to clean and disinfect the contaminated area to protect employees and patrons. These steps include:

1. Remove and dispose of all fecal material/vomitus into a toilet.
2. Wash the contaminated area with soap and water, flushing all waste away from the pool.
3. Clean and sanitize the area with a detergent solution, followed by a chlorine solution (e.g. 1 part bleach to 9 parts water) and allow a contact time of at least 15 min.

NOTE: Always wear gloves when cleaning these types of accidents.

B.C. Guidelines for Swimming Pool Operations

Appendix I

Example Lifesaving, Lifeguard and First Aid Equipment for Pool Safety Plan

The following emergency equipment will be located _____:

- A spine board [with at least 3 Velcro straps and a head-security device].
- Oxygen therapy equipment (400 L or greater) with mask, regulator and protective carrying case and a spare oxygen tank, including blankets and sand bags in the event of spinal injuries.
- Full set of airways.
- Pocket mask with oxygen inlet and one way valve.
- Minimum of a #2 first aid kit as per WorkSafe BC requirements.
- Personal protective equipment available for on-duty lifeguards including pocket mask and gloves.

The following Lifesaving equipment will be located at poolside for use at all times the pool is open:

- A non-conductive reaching pole with shepherd's hook at least 3.5 m long, and
- A throwing ring with a 6 mm line securely attached having a length of not less than half the width of the pool plus 3 m.

B.C. Guidelines for Swimming Pool Operations

Appendix J

Example Pool Supervision Schedule

Program	Number lifeguards	Support staff required	Remarks

B.C. Guidelines for Swimming Pool Operations

Appendix K

Other Related Codes and Jurisdictions

This document may reference to other jurisdiction for design and operation criteria. The following is a list of jurisdictions that may have an interest in pool operations.

Agency	Jurisdiction	Rules/Standards/Guidelines
WorkSafe BC **www.worksafebc.com**	Worker safety	Occupational Health and Safety Regulation
	Chlorine	Chlorine Safe Work Practices manual
	Ozone	Ozone Safe Practices Manual
	Confined spaces	
	Noise	
	Air Quality	
BC Safety Authority **www.safetyauthority.ca/**	Elevating devices (waterslides)	Elevating devices safety Regulation CSA Standard Z267-00
Ministry of Forests and Range (and Minister Responsible for Housing). **www.housing.gov.bc.ca/building/**	Building Standards	BC Building Code
	Access for persons with disabilities	
Local Governments **www.civicnet.bc.ca**	Land Zoning Bylaws Business Licenses Building Permits Building Inspections	Community Charter

Appendix L
Useful Conversions and Measurements

Category	Unit		Multiply by	=	Unit
Area	square ft (f^2)	X	0.092903	=	m^2
	square inch (in^2)	X	6.4516	=	cm^2
	square yard (y^2)	X	0.8361	=	m^2
Length	ft (ft or ')	X	0.30480	=	m
	ft (ft or ')	X	30.480	=	cm
	inch (in or ")	X	0.0254	=	m
	inch (in or ")	X	2.54	=	cm
Lighting	lux (lx) (SI)	X	0.0161028	=	W/m2
	lumen (lm) (SI)	X	0.001496	=	W
	lumens/sq ft	X	1	=	ft-candles
	lux	X	0.0929	=	ft-candles
Mass/Weight	ounce (oz)	X	0.0283495	=	kg
		X	28.3495	=	g
	pound (lb or #)	X	0.453592	=	kg
		X	453.592	=	g
Pressure	pound per square inch	X	6894.75729	=	kg/m*sec2(PA)
		X	68947.5729	=	g/cm*sec2
Volume	ounce fluid (floz)	X	29.5734	=	mL
	ounce fluid (floz) (Imp)	X	28.413063	=	mL
	gallon (gal)	X	0.0037854	=	m^3
		X	3.7854	=	L
	gallon (gal) (Imperial)	X	4.54609×10^{-3}	=	m^3
		X	4.54609	=	L
		X	4.54609×10^3	=	mL
	tablespoonful (tbsp)	X	15.0	=	mL
	teaspoonful (tsp)	X	5.0	=	mL
	cubic ft (f3)	X	0.0283168	=	m^3
		X	28.3168	=	L
	cubic inch (cu in)	X	16.3871	=	mL
	drop (gtt)	X	0.08333	=	mL
	cup (c)	X	236.587	=	mL
Velocity	centims/sec	X	0.03281	=	ft/sec
	ms/sec	X	3.281	=	ft/sec
Water Velocity	litres/min	X	4.40×10^{-3}	=	gals/sec
Temperature	(degrees celsius	X	1.8) + 32	=	degree Fahrenheit
	(degrees Fahrenheit	-	32) x 0.55555	=	degrees Celsius

1 milligram per litre (in solution)	= 1 ppm
1 cubic ft of water	= 62.4 pounds
1 cubic ft of water	= 6.24 Imperial gallons
1 US gallon of water	= 8.34 pounds
1 Imperial gallon of water	= 10 pounds