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Contents

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1. Introduction

Spa pools are becoming more and more popular in Hong Kong. The physical structure of spa pools, their high water temperature, as well as intensive usage, all favour the growth of various micro-organisms. Maintaining the pool water quality can be challenging.

A spa pool is a self-contained body of warm, agitated water designed for sitting or lying in up to the neck, and not for swimming. The pool water is heated, filtered and chemically disinfected. A spa pool is not drained, cleaned or refilled after each user, but after a number of users or a maximum period of time.

A commercial spa pool is a spa pool installed in a commercial establishment or public building, and generally used by people visiting the premises. Typical sites for commercial spa pools include hotels, health clubs, beauty salons, gymnasia, sports centres and clubs, swimming pool complexes, and holiday camps.

These guidelines are intended to help people who manage and/or operate spa pools to control the risks from infection to their staff, the users, and anyone else potentially exposed to the spa pool water or aerosols from it.

2. Recreational Water Illnesses

Spa pools, if poorly designed or operated, can be major public health hazards. Spa pools are much smaller than swimming pools and have a much higher ratio of users to water volume, so the amount of organic material in spa pools is far higher than in swimming pool water. These conditions can allow pathogens to readily grow in spa pools. Water disinfection is, therefore, a key control measure, but the raised temperature and high organic content of spa pool water can make it difficult to maintain effective disinfection.

A variety of infective agents are associated with the recreational use of water and these can affect the skin, ears, eyes, gastrointestinal and respiratory tracts.

2.1 Gastrointestinal diseases

Gastroenteritis, typhoid fever, cryptosporidiosis and bacillary dysentery can occur if water is polluted.

2.2 Respiratory diseases

Cold, sinusitis and sore throat can occur in areas of close contact or improperly treated pool water.

The agitated water may lead to formation of aerosols that can be inhaled. This means even people not in the immediate vicinity of the spa pool can breathe in the aerosol. This is particularly important with legionellae.

2.3 Eye, ear, nose, throat, and skin infections

Presence of infective agents can contribute to eye, ear, nose, throat and skin infections. Close physical contact and the presence of fomites (such as towels) can spread athlete's foot, impetigo and warts.

3. Infection Control

It is multi-pronged and involves the appropriate system (risk assessment and management, standard operating procedures, dealing with accidents, incidents and emergencies, inspection, audit, continuous quality improvement, record keeping, etc), the appropriate personnel (staffing, supervision, training, competency, etc), the appropriate control measures (filtration, disinfection, pool regulations, signage, user education, etc), and the appropriate environmental controls (water quality monitoring, ventilation control and load factor, etc).

4. User Hygiene

4.1 Users with diarrhea must not use spa pools.

4.2 Before using spa pools, users should wash and shower, and also use the toilets and wash their hands afterwards.

4.3 Instructions for Users

Pool operators should provide users with written instructions on appropriate spa use. (refer to Appendix I). The behavioral factors of users will directly affect the risk of illness, e.g. the length of immersion time, the number of users at a given time and various actions of users such as splashing and immersing heads in the water.

4.4 Health Precautions

For pregnant women or users with any of the conditions listed in Appendix II, consultation with a physician before spa use is recommended. Pool operators should provide users with the list of health precautions.

5. Cleansing of Pool, Equipment and Pool Surroundings

The pool and the entire system should be cleaned and disinfected regularly and systematically. A regular routine of cleaning procedure is recommended.

5.1 Daily Cleansing Routines

a Clean the concourse, shower, toilet and changing areas with appropriate level of disinfectant, e.g. sodium hypochlorite (mixing one part of 5.25 % bleach with 99 parts of water, providing 500 ppm available chlorine), then rinse well with plenty of water, finally mop it dry.

b Remove grease on water surface, hair and visible dirt (with the help of vacuum where necessary).

c Cover spa pools, if possible, to reduce the levels of environmental contamination (e.g. debris and dirt).

d Dry any collection of water around the pool, especially at corners and sewage exhaust, to prevent the formation of breeding ground for mosquitoes and germs.

e If bathing costumes or towels are supplied to users, they should be cleaned and disinfected after each use.

5.2 Weekly Cleansing Routines

a Backwash filters weekly or more frequently as the filter pressure differential dictates.

b Clean pool wall, pool floor, handrails and stairs to remove bad marks.

c Clean the shower facilities to remove accumulated dirt and soap.

d Check tiles for any breaks.

5.3 Superchlorination

Superchlorination is not recommended as a routine or even occasional method of shock dosing to compensate for inadequacies in pool treatment. It is generally bad practice, and can generate unwelcome byproducts. But if something has gone wrong – poor results from microbiological testing perhaps, or a catastrophic breakdown in treatment – it may be necessary to superchlorinate. It can also be a way to deal with contamination by diarrhea, as some intestinal pathogens (e.g. Cryptosporidium oocysts) are resistant to normal levels of chlorine residual.

5.4 Draining and cleansing of pool

Considering the practicability factor, it might be justifiable to drain less frequently for large size pools, which have comparatively lower contamination load, than the smaller ones. In general, the spa pool system should be drained and cleaned, normally once a week.

6. Pool Contamination

6.1 If a contamination incident has occurred in a spa pool, the safest action is to empty, clean and disinfect it, before refilling and reopening, especially for small pool.

6.2 Faeces in Pool

a The procedure depends on whether the stool is formed and can be removed intact. Solid faeces should immediately be removed from the pool using a scoop or fine mesh net and flushed down the toilet (not put in any pool drains). There must be certainty that all the faeces have been captured and disposed of. If not, and there is possible widespread distribution of the faeces in the pool, then the pool should be closed and the advice below for runny faeces considered. All equipment that has been used in this process should be disinfected using a 1%

solution of hypochlorite. If the pool is operating properly with appropriate disinfectant residuals and pH values, no further action is necessary.

b In event of runny faeces, close the pool; remove and dispose of as much of the material as possible (e.g. vacuum, sweep); superchlorinate the pool to 20 ppm for 13 hours or 50 ppm for 5 hours; when disinfectant residual and pH are at normal levels for the pool, reopen the pool. Any UV or ozone plant should be switched off and by-passed during superchlorination. The pool plant, including valves etc, should withstand superchlorination.

6.3 Vomitus in Pool

The pool should be temporarily cleared of users, to allow the pollution to disperse and any infective particles to be neutralized by the residual disinfectant. Tests for residual disinfectant and pH levels should be satisfactory before allowing people to use.

6.4 Handling Spills of Blood, Body Fluids, or other Potentially Infectious Materials on the Poolside

a If spills occur, the surfaces should be decontaminated immediately with adequate staff protection. For recommendation of appropriate personal protection, please refer to section Personal Protective Equipment of Infection Control Guidelines, published by Centre for Health Protection.

b Cleanse the visible blood spillage matter with disposable absorbent material. Mop the area with a cloth or paper towels wetted with one part of household bleach (5.25 % hypochlorite solution) in 4 parts of water, leave for 10 minutes. Then rinse with water.

c For spillage of other body fluids such as vomitus, cleanse the visible matter with disposable absorbent material and then disinfect with one part of household bleach (5.25 % hypochlorite solution) in 49 parts of water, leave for 15 – 30 minutes. Then rinse with water.

6.5 Training and Competency of Maintenance Staff

The staff should be aware of the potential health risks and have the necessary procedures, equipment and chemicals in place and accessible at all times. All pools should have a written procedure, as part of their emergency action plan, stating what action to take in the event of a contamination incident. Staff must be trained in these procedures, and the training recorded. There should also be a schematic drawing of the installed water treatment, which is vital for the informed operation of the pool and in the investigation of problems including outbreaks of infectious disease.

7. Water Quality Management

Pool operators should ensure that the pool has been maintained at a standard in accordance with the following requirements.

7.1 Disinfectants

Primary disinfection will kill bacteria and viruses (and provide a residual to prevent cross-contamination); secondary disinfection (ozone or ultraviolet) increases the kill of infective organisms, especially Cryptosporidium.

a Chlorine

Chlorine is the commonly used disinfectant for the pool water. It is effective, fast acting and has residual activity. Its active components are hypochlorous acid (HOCl) and hypochlorite ion (OCl^-), the former being the much stronger disinfectant.

Free chlorine level (FC) is the measure of both HOCl & OCl^- levels. Its disinfectant activity is pH dependent; the more alkaline the water is, the weaker the disinfectant activity. It should be between 3 – 5 ppm. Combined chlorine level (CC) is the measure of chloramines, which is formed by

reaction of chlorine and nitrogen compounds in the pool. It must be less than 1 ppm. Total chlorine level (TC) is defined as TC = FC + CC. It is important to measure the FC, CC and pH levels of the pool, ensuring the disinfectant power of chlorine.

b Ozone or Ultraviolet

Ozone or ultraviolet is not used as the sole disinfectant in pool but is used on-site in conjunction with chlorine. Where ozone or ultraviolet is used with chlorine, a reduction of free chlorine level is permitted.

7.2 Water Balance

To ensure the disinfectant acting effectively in water for disinfection, while protecting the users from any adverse effect and maintaining the pool and equipment from the damage of corrosion or scale formation, the water balance needs to be maintained at optimal level.

7.2.1 pH

a The ideal pH is 7.4, and the pool water should be kept with a pH value of 7.2 – 7.8.

b As pH increases, free chlorine loses disinfectant activity.

c At pH 7.5, about 50 % of free chlorine is available to kill infective organisms.

7.2.2 Total Alkalinity

a It is a measure of the number of alkaline ions present in the pool. The ions act as a shock absorber to prevent pH fluctuation.

b The ideal range should be 80 – 200 mg/l (measured as $CaCO_3$).

7.2.3 Calcium Hardness

a Too low or too high calcium hardness in pool water will cause corrosion tendency or scaling formation.

b The ideal range should be 75 – 150 mg/l (measured as $CaCO_3$).

7.3 Clarity

For safety and effective disinfection, pool water must be clear. Particulate matters that cloud the water can shield micro-organisms from direct contact with the disinfectant. They should be removed by filtration.

7.3.1 Maintaining Clarity

Pool filters are not designed to remove bacteria, but to make the water in the pool clear. Clarity can be maintained by adjusting the turnover period.

Routine and frequent backwash of the filter and cleansing of pump should be performed.

7.3.2 Water clarity can be checked by the following methods.

a. Visual check of floor markings or other features on the pool bottom at its greatest depth. The markings should be clearly visible when viewed from side of pool.
b. Check the clarity of water in Nephelometric Turbidity Unit (NTU), which should not exceed 0.5 NTU.

7.4 Water Temperature

The temperature of water in the pool should be maintained in the range of 35 – 37 ℃ and should not exceed 40 ℃.

7.5 Microbiological Quality

7.5.1 Spa pools should be tested once a month for microbiological quality. Spot checks will be necessary if there are problems with the plant, after contamination (or as part of an investigation into an outbreak of illness) or if the pool has been shut down for any reason. Adverse results will also involve further tests.

7.5.2 Sampling should be taken with the pool in use, preferably when heavily loaded

or immediately afterwards. The deep end is the best place, and away from inlets. Pools with complex water flows to different areas may demand several samples.

7.5.3 Samples taken for analysis must be clearly labelled with the client's name, site, sample point, date and time and the analysis required. They should be accompanied by the on-site test results taken at the time of sampling – free chlorine, combined chlorine and pH. These are necessary for the correct interpretation of bacteriological results.

7.5.4 Pool water must meet the following bacteriological standards:

a *Escherichia coli* should be absent in pool water samples of 100 ml each, taken at any time at any location in the pool.

b The total bacterial count as determined by the 48-hour plate count method at 37 ℃ does not exceed 200 colony forming units (CFU) per ml of pool water.

7.5.5 Testing for *Pseudomonas aeruginosa*, *Staphylococcus aureus* or *Legionella pneumophila*, may be considered as part of a wider investigation into the water quality when health problems or outbreaks of infectious diseases are suspected.

7.5.6 Water sampling bottles should be supplied from the testing laboratory. They should be robust and must contain a neutralizing agent for the disinfectant in use. To take the sample, the stopper or cap is first removed, making sure that nothing touches the inside of the bottle or cap. The bottle is immersed neck downwards about 15 cm (or 6 inches) and then tilted to face horizontally towards the direction of water flow and allowed to fill. Once filled, immediately remove the bottle from the water and replace the stopper or cap. Samples should be protected from light and placed in an insulated container maintained at approximately 2 - 8 ℃ and sent to the laboratory without delay to arrive there ideally within 4 hours of sampling.

7.6 Water testing methods and frequency

a Chlorine level

Only the kits using the DPD (N,N-diethyl-p-phenylenediamine) colorimetric method to measure free chlorine level should be used. The free chlorine level in the pool water should be tested at least twice per day, increasing up to hourly when in heavy use.

b pH Level

A colorimetric measurement method or a pH meter should be used, and allow measurement of pH in intervals not greater than ± 0.2 pH unit of reference range. The pH in the pool water should be tested at least twice per day, increasing up to hourly when in heavy use.

c Total Alkalinity and Calcium Hardness

They should be measured by titration methods using appropriate indicators such as methyl orange, bromoscresol green or bromophenyl blue. Both tests are done when water balance is disturbed.

d Clarity

A visual check of pool water clarity should be carried out at least once daily before the pool is open for use.

e Water Temperature

The water temperature measurement should be carried out prior to the use of the pool on each working day.

f Logbook

A logbook should be kept at the pool location, and must be produced for inspection upon request by any authorized officer. It should contain details of pool operations, including tests to be performed, results of all chemical and microbiological tests on pool water samples, and water temperature and clarity. All logbook entries should be signed and dated. (Appendix III)

8. Air Quality Management (for indoor pools only)

8.1 Ventilation

Ideal ventilation should be of 6 to 12 air changes per hour.

8.2 The ambient temperature of the pool area should be preferably maintained at less than 10 ℃ below the temperature of the pool water. Air temperature from 22 to 28 ℃ is suitable for pool users.

8.3 The relative humidity in the pool area should be maintained at a level as low as possible with the range from 50 to 70 %.

8.4 Room temperature and relative humidity should be checked daily. The results should be recorded in a log book. (Appendix III)

Summary of Air and Water Quality Parameters and Testing Frequency

Pool parameters	**Parameter Range**	**Minimum testing frequency**
Air temperature	22 – 28 ℃	Once daily
Air humidity	50 – 70 %	Once daily
Free chlorine	3 – 5 ppm	Twice daily
Combined chlorine	< 1 ppm	Twice daily
pH	7.2 – 7.8	Twice daily
Water temperature	35 – 37 ℃	Once daily

Clarity	Floor markings on the pool bottom at its greatest depth can be clearly visible when looking from the side of the pool.	Once daily
Total alkalinity	80 – 200 mg/l (measured as $CaCO_3$)	As necessary
Calcium hardness	75 – 150 mg/l (measured as $CaCO_3$)	As necessary
Total bacterial count	≤ 200 CFU/ml	Monthly
E. coli	Absent in 100 ml	Monthly

Remark: The above values are for pools using chlorine as the main disinfectant. Owing to various methods of pool disinfection, filtration and construction, individual operators can follow their pool manufacturer's directions or maintenance authority's advice for the pool parameters, provided that the pool water is safe and hygienic.

9 Pool Safety

9.1 Summoning aids or communication devices should be installed in the pool area, e.g. telephone, call bells, etc.

9.2 Training of staff in rescue procedures and regular pool rescue drills are recommended.

9.3 First aid facilities should be available and well maintained.

9.4 Ensure good visibility of submerged objects.

9.5 Avoid wet floor along poolside.

9.6 Make sure all entry and exit are cleared from obstacles.

9.7 Prevent entrapment injuries with appropriate drain design and configuration.

9.8 All incidents in pools / pool areas should be recorded in an incident logbook.

10 Pool Maintenance

10.1 Corrective and regular preventive maintenance

a. Water heater system
b. Water circulation system (pumping system)
c. Water filtration system (filter system)
d. Water disinfection system
e. All electrical installations
f. All cleaning equipment

10.2 Annual Overhaul

Pools should be inspected thoroughly, after being emptied of pool water, of the tiles, grouting and fittings at least annually. Scales damaged grouting and stained tiles (results of poor pH control and impaired water balance) should be dealt with.

References

1. Basic issues in infection control: personal protective equipment. Infection Control Branch, Centre for Health Protection. Available at http://www.chp.gov.hk/files/pdf/personal_protective_equipment.pdf
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3. Code of practice: the management and treatment of swimming pool water. Pool Water

Treatment Advisory Group. May 2015.

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5. Guidelines for safe recreational water environments volume 2: swimming pools and similar environments. World Health Organisation. June 2006.
6. The control of legionella and other infectious agents in spa-pool systems. Health and Safety Executive. 2017.
7. Swimming pool water: treatment and quality standards for pools and spas. Pool Water Treatment Advisory Group. 2009.

Appendix I

Instruction Sheet for Spa Pool Users

Before using spa pool

1. Do not use spa if having diarrhea.
2. Do not consume alcohol.
3. Do not overfeed or be too hungry.
4. Do take a shower.
5. Do go to toilet and wash your hands.
6. Check if you have any skin rash, an irritation, a cut or a graze, which may be predisposed to infections.
7. Check if you are fit for spa use with your physician if necessary.

At the time of using spa pool

1. Care must be taken with wet floor.
2. Notify pool staff if you have any discomfort.
3. Do not run around the pool concourse.
4. Do not jump or dive into the pool.
5. Do not immerse your head under water.
6. Use the handrail when walking steps.

After using spa pool

1. Take a shower.
2. Return used garment back to the designated racks / baskets.
3. Notify pool staff if you have any discomfort or adverse reactions.

Appendix II

Health Precautions

If you have any of the conditions listed below, please consult your doctor whether you are fit for using spa pools.

1. Hypertension / Hypotension
2. Respiratory diseases, e.g. asthma, chronic obstructive pulmonary disease, tuberculosis, pneumonia
3. Ischemic heart disease, vascular disease
4. Stroke
5. Infectious skin conditions, e.g. tinea pedis
6. Other skin conditions, e.g. rash, psoriasis, allergy
7. Epilepsy
8. Open wounds
9. Diabetes
10. Conjunctivitis, otitis
11. Pregnancy
12. Venereal diseases
13. Faecal or urinary incontinence
14. Urinary tract infections
15. Renal failure
16. Radiotherapy within recent 6 weeks
17. Fever
18. Dizziness
19. External fixators / Drains in-situ / Catheters in-situ

Appendix III

Sample of Spa Pool Maintenance Record

Date	Time	Air temperature (℃)	Relative humidity (%)	Chlorine level (ppm)			pH level	Water temperature (℃)	Water clarity	By staff
				Free	Combined	Total				