

Guideline for the Inspection and Maintenance of
**Swimming Pools
and Spa Pools**

in South Australia

Revised 2013



Government
of South Australia

SA Health

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Foreword

Section 109(2)(o) of the *South Australian Public Health Act 2011* (the Act) provides for the prescribing of guidelines to assist in the administration of the Act. This 'Guideline for the Inspection and Maintenance of Swimming Pools and Spa Pools in South Australia' (this Guideline) is a prescribed guideline under regulation 11 of the South Australian Public Health (General) Regulations 2013 (the General Regulations).

Non-compliance with this Guideline does not necessarily constitute a breach of legislation. Should a relevant authority instigate legal proceedings against the owner of a swimming pool or spa pool, it would do so under the specific provisions of the General Regulations or the general provisions of the Act.

This Guideline has been prepared to assist relevant authorities, pool owners, pool operators and the pool industry to maintain satisfactory public swimming pool and spa pool management standards.

It specifically deals with water quality management aspects such as circulation and filtration, automatic disinfection, pH analysis and control equipment, water testing procedures, water replacement and chemical balance of pool water. Other matters covered include pool structure, pool surrounds, amenities, ventilation, safety and chemical storage.

This Guideline includes a comprehensive inspection checklist to assist pool owners and pool operators in maintaining facilities that enable patrons to relax and enjoy safe water recreation activities.

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1. Introduction

The Guideline for the Inspection and Maintenance of Swimming Pools and Spa Pools in South Australia (this Guideline) applies to public swimming pools, spa pools, waterslides and hydrotherapy pools as defined by the South Australian Public Health General Regulations 2013 (the General Regulations).

To provide pool users with an environment that is safe, enjoyable and pleasant, swimming pools and spa pools should be correctly designed, constructed of suitable materials and be provided with equipment that enables them to be operated and maintained in a manner that protects the health, safety and well-being of the users.

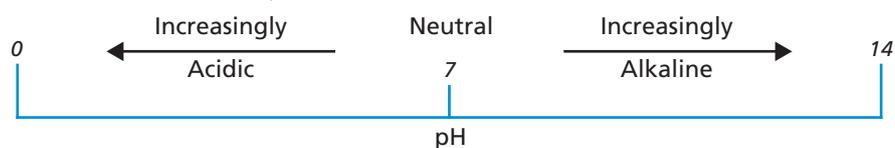
The General Regulations and the Standard for the Operation of Swimming Pools and Spa Pools in South Australia set out the approved methods of disinfection of public swimming pools, spa pools, waterslides and hydrotherapy pools. The prescribed requirements ensure that the water in a public pool is treated in a manner to prevent illness and discomfort to the user.

This Guideline sets the inspection and routine maintenance requirements of pool plant, equipment and surrounds to ensure pool water quality is maintained as prescribed by the General Regulations.

2. Definitions

the Act	<i>South Australian Public Health Act 2011</i>
algae	a very large and diverse group of simple, primarily aquatic and typically autotrophic organisms, ranging from unicellular to multicellular forms.
algaecide	a chemical used to kill algae.
automatic dosing and monitoring equipment	equipment that continuously analyses and controls disinfectant and pH levels in pool water.
backwash	the process of cleaning a swimming pool filter by reversing water flow through the filter.
bather load	the number of persons in a pool at any given period of time.
chlorine	hypochlorous acid/hypochlorite ion (irrespective of the mode of addition or formation).
chlorine gas	A heavy, green highly poisonous gas which is compressed into liquid form for use in pool water as a bactericide and algaecide.
combined chlorine	chlorine that has combined with ammonia, ammonium compounds or organic matter containing nitrogen to form chloramines.
disinfecting agent	a compound or substance which, when applied as instructed to swimming or spa pool water, kills harmful microorganisms.
filter	a device for removing suspended particles from pool water.
filter medium	a substance used to entrap suspended particles as pool water passes through it.
flume	an artificial channel or trough which conducts water and is used to transport persons from a raised platform to a receiving waterslide pool.
free chlorine	chlorine that has not combined and is free to kill bacteria and algae and destroy organic pollutants introduced into the pool water.
the General Regulations	South Australian Public Health (General) Regulations 2013.
knowledgeable person	a person with appropriate knowledge and experience to control, manage and operate a public pool to ensure that the pool water complies with the requirements of the General Regulations under the Act.
lint strainer	a device provided to screen out lint and debris.
make up water	water used to replace lost pool water.
mg/L	milligrams per litre.
operator	a person who has control and management of a public pool, is knowledgeable in its operation and is sufficiently competent to ensure that the pool complies with the requirements of the General Regulations.
owner/occupier	in relation to premises, means a person who has, or is entitled to possession or control of the premises and includes a person who is in charge of the premises. A reference to an owner of premises includes a reference to an occupier of the premises.
pathogenic bacteria	disease causing microorganisms.

pH a scale (ranging from 0 to 14) that indicates the acidity (0 to <7) or alkalinity (>7 to 14). Water with a pH of 7 is neutral.



pool water inlet	a point where the treated water is returned to the pool from the treatment plant.
pool water outlet	a point where pool water is taken from the pool.
primary amoebic meningoencephalitis	a rare fatal disease caused by the organism <i>Naegleria fowleri</i> which enters the body through the nose.
recirculating system	a system of pipes, pumps, filters and devices which enable water to be taken from a pool, subjected to treatment and then returned to the pool.
sand filter	a device utilising sand and gravel as the filter medium.
skimmer gutter	a drainage system provided to collect surface water flow from a pool and return it to the treatment plant or to waste.
skimmer weir	a device provided to ensure that pool water is drawn from the surface for return to the treatment plant or to waste.
spa pool	as defined in the General Regulations.
stabiliser	a compound which is added to pool water to reduce chlorine loss due to sunlight.
superchlorination	the addition of sufficient chlorine to pool water to raise the concentration of free chlorine to at least 10mg/L for the destruction of combined chlorine (chloramines), algae and other impurities.
swimming pool	as defined in the General Regulations.
total alkalinity	a measure of the total amount of dissolved alkaline compounds in the pool water.
total chlorine	the sum of combined chlorine and free chlorine.
total dissolved solids	a measure of the total amount of dissolved inorganic compounds in the pool water.
turbidity	the degree to which suspended particles in pool water obscure visibility.
turnover rate	the period of time it takes to circulate an amount of water equivalent to the total volume of the pool or spa through the filter.
UV+H₂O₂	ultraviolet light plus hydrogen peroxide disinfection system.

3. Circulation and filtration

Pool water management is complex and requires skilled operators to maintain the pool water to the high standards required by the General Regulations. To achieve the necessary level of treatment, pool water must be circulated through a filtration system that produces water that is clear, chemically balanced and disinfected to destroy pathogenic bacteria prior to its return to the pool.

It is necessary to ensure that the system is designed, installed and operated in a manner that will effectively flush the pool water from all areas of the pool in order to prevent the accumulation of dirt, impurities and bacteria. A volume of water equivalent to the total volume of the pool must pass through the treatment process at the frequency (pool water turnover rate) prescribed in the General Regulations for the type of pool.

3.1 System requirements

Systems used for pool water management require many factors to be considered during the design stage to ensure the system is capable of efficiently maintaining the required water quality at all times of operation. The system should be relatively simple to operate and maintain and should be sized in accordance with pool volume and potential maximum bather load.

A flow meter should be incorporated within the design of the pool hydraulic system to provide a means of indicating system performance, pool water turnover rate and hydraulic flow problems, including deterioration of pump capacity and filter clogging.

3.2 Function of the circulation and filtration system

The main function of the circulation and filtration system is the removal of suspended, colloidal and organic matter to ensure the pool water is clear, colourless and odourless.

It is important to ensure that a pool circulation and filtration system is designed to remove a considerable proportion of the water from the surface, as this section of the water body is often grossly polluted in comparison with the rest of the pool water. Floating pollution and contaminated surface water may be removed rapidly from a pool by maintaining a constant flow of surface water into skimmer gutters or skimmer weirs.

3.3 Water quality factors

Water quality depends on the capacity and efficiency of the treatment system, the number of bathers and the operator's skills.

3.4 Water pollution removal

Removal of pool water pollution depends on the rate that water is withdrawn from the pool via the outlets, the surface flow into the skimmer system and the efficiency of the pump and filter.

3.5 Filtration system

The General Regulations require a continuous circulation of pool water through the filters while a pool is in use. The ability of a filtration system to maintain clean pool water is dependent on the:

- > Filter capacity and filter medium
- > Strainer or lint filter and pipe size
- > Skimmer system
- > Number of inlets and outlets
- > Pool water turnover rate
- > Pump capacity
- > Size and shape of the pool
- > Bather load.

3.6 Inlets and outlets

The size, shape and use of a pool can have an effect on pool water flow. Therefore, the number and location of inlets and outlets should be designed to ensure adequate water flow throughout the pool.

3.7 Pumps

Pumps used in the circulation system should be sized to ensure that under all operating conditions the minimum pool water turnover rate prescribed by the General Regulations is met. In practice, this means that the pumping system must have sufficient capacity to achieve the required pool water turnover rate and be able to handle the static and reticulation system friction and pressures.

Reticulation system friction is created by the circulation of pool water through the pipelines, bends, valves, pumps, heaters, strainer or lint filter, pool water filters and associated back pressures as the filters become clogged prior to backwashing. Other factors affecting pump efficiency include slime and scale build up in the pipes and pump wear and tear.

3.8 Filters

Swimming pools and spa pools must be provided with a filtration and circulation system that ensures that a volume of water equivalent to the total volume of the pool passes through the filter at least once in every:

- > 6 hours for a swimming pool
- > 2 hours for a hydrotherapy pool or wading pool
- > 1 hour for a waterslide pool
- > 1/2 hour for a spa pool.

Hydrotherapy pools, waterslides and spa pools should be provided with their own filters. Where a common filter system is provided to multiple pools, the lowest relevant turnover rate must be achieved by the system in accordance with the requirements specified in the General Regulations.

Filters must be backwashed or cleaned as often as necessary to ensure that the pool water turnover rate complies with the General Regulations.

A pool operator should maintain records of filter operation including the number of backwashes, depth of medium and its replacement. If, after a period of operation, a filter requires more frequent backwashing it is probable that the filter or the operator procedures require investigation or attention.

Filter medium efficiency may deteriorate more rapidly in heated pool water than in non-heated pool water so filter medium may require more frequent maintenance.

4. Automatic disinfection, pH analysis and control

All public swimming pools and spa pools must incorporate automatic equipment that continuously analyses and controls the pH and disinfectant levels whilst the pool is available for use by the public.

The equipment must display the results of the analysis and provide reading in a manner that will enable the owner to maintain a permanent record of the results. Records must be made available to an authorised officer on request and must be kept for a period of two years.

If the output device does not have an automatic recording capability, the pool owner should ensure that manual readings are taken at least hourly when the pool is in use and recorded into a log book indicating the date, time, pH level, and disinfectant level.

Where possible the automatic analysis and control equipment should be provided with security devices to prevent tampering or interference with the set values.

All automatic analysis and control equipment must be checked for accuracy and reliability. The pool owner must ensure that the pH and disinfectant levels are manually tested as often as is necessary to confirm the reliability of the equipment's operation. Results of all manual tests must be recorded. The automatic equipment should be periodically calibrated in accordance with the manufacturer's recommendations.

In the event that automatic analysis, control and recording systems malfunction, the owner must ensure that manual tests are conducted and the appropriate adjustments are made so that the pool water is maintained as required by the General Regulations. Results of manual tests must be recorded in the log book. If the pool water quality cannot be maintained in accordance with the requirements of the General Regulations the pool should be closed.

Manual pool disinfection and pH control are only permitted as an interim measure pending repair of the automatic equipment. Pool owners and / or operators should consult with the relevant authority regarding manual operation.

5. Chemical balance of pool water to control scale

The formation of insoluble calcium carbonate in pool water leads to scale formation on the internal surfaces of the pool, in the pipework and in the filter system. This leads to a restricted flow through the pipes, reduced filtration efficiency and shorter filter runs.

In 1936, Professor Langelier published works dealing with the calcium carbonate forming characteristics of water. He developed a formula known as the Langelier Index which can be used to predict whether pool water will either deposit or dissolve calcium carbonate. The formula lists five parameters which affect the formation of calcium carbonate scale. They are pH, temperature, calcium hardness, total alkalinity and total dissolved solids.

The formula is:

$$\text{Langelier Index} = \text{pH} + \text{TF} + \text{CF} + \text{AF} - 12.1$$

Where:

- > The measured pH value is substituted directly into the formula
- > The temperature, calcium hardness and total alkalinity are represented by the factors TF, CF and AF respectively as determined from table 1
- > An average factor of -12.1 is included to represent the total dissolved solids.

To determine the scale forming or corrosive tendencies of pool water the following procedures apply:

1. Measure the pool water pH, temperature in degrees Celsius, calcium hardness in mg/L and total alkalinity in mg/L
2. Using the measured values for the temperature, calcium hardness and total alkalinity and table 1, convert them into the numerical values for the factors TF, CF and AF respectively.

If the measured values do not correspond to the numbers listed in table 1, the values should be rounded to the nearest number listed in the left hand column for that parameter.

3. Add the pH value to the numerical values for TF, CF, AF and then subtract 12.1 to obtain the Langelier Index

A negative Langelier Index value indicates that the pool water will tend to dissolve calcium carbonate and thus have the tendency to be corrosive. A positive Langelier Index value indicates that the water will tend to deposit calcium carbonate and thus have scale forming tendencies. A Langelier Index value of zero indicates that the water is chemically in balance and the water is neither corrosive nor likely to deposit scale. The chemical balance of the water is considered to be satisfactory if the value lies between -0.5 and +0.5.

An example calculation of the Langelier Index is given below:

If the measured values for pH, temperature, calcium hardness and total alkalinity are 8.5, 29°C, 800mg/L and 400mg/L respectively, then the values to be used in the Langelier Index formula are: **pH = 8.5, TF = 0.7, CF = 2.5, AF = 2.6.**

$$\text{Langelier Index} = 8.5 + 0.7 + 2.5 + 2.6 - 12.1 = 14.3 - 12.1 = +2.2$$

This value of +2.2 indicates that the pool water has a tendency to form scale. Corrective measures such as lowering the pH and total alkalinity are required to lower the Langelier Index to within the range ± 0.5 and thereby maintain the scale forming tendencies of the pool water within acceptable limits.

Table 1

Numerical values for use in the Langelier Index formula

Temperature		Calcium Hardness		Total Alkalinity	
Measured value	Numerical value to be used in the formula	Measured value	Numerical value to be used in the formula	Measured value	Numerical value to be used in the formula
°C	TF	mg/L	CF	mg/L	AF
0	0.0	5	0.3	5	0.7
3	0.1	25	1.0	25	1.4
8	0.2	50	1.3	50	1.7
12	0.3	75	1.5	75	1.9
16	0.4	100	1.6	100	2.0
19	0.5	150	1.8	150	2.2
24	0.6	200	1.9	200	2.3
29	0.7	300	2.1	300	2.5
34	0.8	400	2.2	400	2.6
40	0.9	800	2.5	800	2.9
53	1.0	1000	2.6	1000	3.0

Another method for determining whether pool water is chemically in balance is to use the Taylor Watergram as detailed in the Australian Standard AS3633: Private Swimming Pools – Water Quality.

6. Water testing

Whilst the owner of a public swimming pool or spa pool is required to provide equipment that automatically analyses and controls the disinfectant and pH levels, the General Regulations also require that other pool water parameters be maintained within specified levels. If the automatic analysis and control equipment does not monitor the additional parameters, the owner must provide the operator with manual test equipment to enable testing to be done as often as is necessary to ensure that the water quality is maintained within the prescribed values.

6.1 Test equipment

Every pool facility must have equipment to manually measure:

- > Disinfectant concentration
- > pH
- > Total alkalinity
- > Stabiliser concentration, where used
- > Pool water temperature.

Test equipment must be able to accurately measure the range of pool water quality parameters prescribed by the General Regulations.

In the past, orthotolidine was a popular chemical used to monitor swimming pool water for the presence of excess chlorine. While that use has been replaced by other chlorine monitoring methods, orthotolidine is still used in some pool water test kits and it is a known human carcinogen. The material safety data sheet on orthotolidine should be referred to before use.

6.2 Test chemicals

Only fresh test chemicals should be used and to preserve their shelf life they should be stored as per the manufacturer's instructions.

6.3 Sample collection location

To ensure that test results are representative of the water quality in a pool, water samples should be collected at a depth of 300mm to 400mm below the water surface level and as near as practicable to a water outlet.

To verify the efficacy of the water treatment plant, a comparison should be made with test samples taken from as near as practicable to a water inlet and test samples taken at a water outlet to ascertain bather load demands.

For large pool and pools with a non-rectangular configuration, samples should be collected from a location near an outlet and two other locations.

6.4 Frequency of testing

There are a range of parameters that must be monitored to ensure compliance with the General Regulations. They include:

- > Disinfectant concentration (total and free for chlorine systems)
- > pH
- > Alkalinity concentration
- > Water clarity
- > Stabiliser concentration (where used for chlorine systems)
- > Hydrogen peroxide concentration (UV + H₂O₂ systems only)
- > Water temperature.

Testing frequency will vary for individual parameters. However, it must be carried out as often as necessary (at least once a day) to ensure compliance with the General Regulations.

For critical parameters such as disinfectant and pH, the results should be recorded hourly with the remainder at least daily and more frequently where the bather load is heavy.

6.5 Recording of test results

All test results must be recorded in a permanent form and be available for inspection by an authorised officer upon request. They should be recorded in a log book indicating date, time, parameter tested, result of test, and name of person carrying out the test and whether it was a manual test or a result obtained from the automatic analysis and control system.

Additional comments on the recording of test results are covered under Section 4 Automatic disinfection, pH analysis and control.

6.6 Test kits and testing procedures

Due to the range of test kits and test systems available it is not feasible in this guideline to provide details of the various systems and procedures. Refer to the manufacturer's instructions for testing procedures.

6.6.1 Comments on testing procedures

- > Only use fresh reagents
- > Ensure that equipment is clean
- > Do not get reagents on your skin
- > Do not allow glass near the pool area
- > Never pour reagents back into the pool
- > Always rinse test tubes upon completion of the test except where the process requires use of the resultant solution for the next test (e.g. free chlorine and total chlorine).

7. Water replacement

7.1 Introduction

High levels of acid, alkaline compounds or combined chlorine within pool water may result in irritation of the skin, eyes and mucous membranes. Nitrogen, ammonia, amines and other organic contaminants may adversely affect the chemical balance of pool water if concentrations of dissolved solids are in excess of 2000 mg/L for non-salt chlorinated pools and in excess of 14,000 mg/L for salt chlorinated pools.

If these contaminants are present in pool water in large amounts, it will create a heavy disinfectant demand and make it difficult to maintain the level of disinfectant as required by the General Regulations. High concentrations of dissolved solids will affect the pool water quality by:

- > Reducing disinfection efficacy
- > impeding ability to maintain chemical balance
- > Increasing algal growth
- > Increasing staining and scaling of pool surfaces and fittings
- > Giving the water a dull appearance
- > Increasing salty taste.

To reduce the concentration of dissolved solids, organic substances and other contaminants within the pool water it is necessary to totally or partially empty the pool, and refill it with fresh water.

7.2 Spa water replacement

The high water temperature, turbulent water flow, heavy usage and high bather-to-water ratio found in spa pools contribute towards the excessive accumulation of organic contaminants such as urine, perspiration, skin fats and oils, nasal mucus, hair and other debris. This organic material reduces the effectiveness of spa disinfection by consuming disinfectant and promoting growth of undesirable microorganisms. The accumulated organic loading can only be reduced by dumping the spa water and refilling the unit with fresh water. The fresh water must be treated to achieve the required water quality prior to use of the spa.

Regulation 9(4) of the General Regulations outlines the requirements for the replacement of spa pool water.

Whenever a spa pool is drained, the exposed pool surfaces must be cleaned to remove dirt, accumulated body fats, oils and algal growth. Cleaning solutions should be compatible with chemical treatment used in the spa. Protective clothing and gloves should be worn during this process. Before refilling a spa pool, the filter should be backwashed or replaced as per the manufacturer's instructions.

7.3 Backwash water

Water drained from pools and filter backwash water should be disposed of in accordance with SA Water's Swimming Pools Trade Waste Guideline and the Environment Protection Authority's information sheet on Disposal of Swimming Pool Backwash Water. It is always important to properly dispose of backwash water, especially in areas where there is no sewer.

Filter backwash or pool water should not be discharged on to the ground within or adjacent to the pool enclosure. Where possible, it should be discharged to a sewer, common effluent drain or stormwater drainage system if the relevant authority is prepared to accept the discharge. If this is not possible, it should be discharged to subsurface soakage areas sized on hydraulic loading and soil percolation capability. Under no circumstances should this water be discharged into a septic tank system.

8. Algae control

Algae are a very large and diverse group of simple, primarily aquatic, organisms of which two varieties of importance are found in pools. One variety floats freely in the water and a more persistent variety imbeds itself into pores and crevices of the water contact surfaces. The presence of sunlight, carbon dioxide, mineral matter and nitrogenous compounds or atmospheric nitrogen and other organic nutrients are essential for algal growth.

Algae will harbour and foster bacterial growth and retard the action of some disinfectants such as chlorine.

In pools disinfected with chlorine, algal growth is objectionable because it reacts with the chlorine to create odours, cause turbidity, discolour the water and produce slimes that can contribute to accidents in and around the pool. The presence of algae in pool water will also clog filters, necessitating more frequent backwashing.

Heavy algal growth may increase the chlorine demand in pools disinfected with chlorine to a point where the ordinary levels of free chlorine will not kill the algae. It is then necessary to superchlorinate the pool whilst the pool is not in use, by raising the free chlorine level to at least 10mg/L. Following this treatment, the algae should brush off quite readily. If not, the dose should be repeated until the algae has been killed. Dead algae should be removed by physical means prior to the pool being made available for use.

The presence of algae in pool water disinfected with chlorine is an indication that adequate free chlorine is not being maintained.

Algae in pool water can also be controlled by the use of algaecide. They act in two ways – to prevent algae growth (algaestatic) and to kill algae (algaecidal). In most cases the amount required to kill algae in four hours may be 3-8 times greater than the amount required to prevent algae forming over a ten day period. Some algaecides possess a high chlorine demand and therefore, if used in pools disinfected with chlorine, they may deplete the amount of free chlorine available for disinfection. Other algaecides may cause severe frothing in the water and filters.

Porous surfaces or cracks in a pool make it difficult to control or eliminate algae as they may be protected in the porous structure and will give rise to spontaneous growth should the disinfectant or algaecide levels reduce.

It should be noted that certain species of algae will build up a resistance to some organic algaecides and that clear water does not necessarily indicate that the pool is free from bacteria, viruses, amoebae or other disease-causing organisms. It may only indicate that the pool water contains an effective algaecide and that the recirculation and filtration system is operating satisfactorily.

9. Routine maintenance

Routine maintenance of a pool and its associated plant, equipment and surrounds must be undertaken as often as is necessary to ensure that pool users are presented with a hygienic, safe and efficiently operated facility. During routine maintenance it is important to check pool structure and equipment for defects. Poor maintenance will result in damage to the pool structure and equipment and it may be costly to maintain water quality in these circumstances.

There are many types of pools and facilities available to the public and the following points in sections 9.1 and 9.2 are provided as a guide. Each pool should have a maintenance programme specifically designed for that facility.

9.1 Pool, plant and equipment maintenance

To ensure that a pool and its plant and equipment are adequately maintained, the following procedures should be carried out:

- > Ensure that all pool surfaces are clean and well maintained. There should not be any missing, cracked or broken tiles, delamination of surfaces or a build-up of scale, algae, slime, hair, lint, residues or scum
- > Remove floating debris from the water
- > Keep skimmer gutters and gratings clean and remove algae, slime and scum marks caused by surface water substances
- > Check the pool water level and top up as necessary
- > Ensure that the circulation, chemical dosing and automatic monitoring systems are operating effectively. Sensing probes and electrodes should be maintained in a clean working condition
- > Determine whether automatic analysis equipment requires adjustment or recalibration by carrying out manual testing of the parameters monitored by this equipment
- > Manually test the water quality parameters not analysed by automatic analysis equipment to confirm that they meet the requirements of the General Regulations
- > Check the water flow rate through the filters, and backwash if necessary
- > Ensure that there are no leaks in any pipework, joints or pumps
- > Superchlorinate the pool, where chlorine is used as the disinfectant, as frequently as is necessary to maintain the combined chlorine concentration as required by the General Regulations
- > Ensure that if an ultraviolet light plus hydrogen peroxide system is used to disinfect the pool water, the ultraviolet lamps and associated water tubes are clean and operating effectively. The meter recording hours of operation should be monitored to confirm that the life of the ultraviolet lamps has not expired
- > Ensure that all meters are operating correctly
- > Ensure that pool handrails, steps, ladders, diving boards and stands are in a safe and sound condition
- > Ensure that if ramp access and hydraulic lifts are provided, that they are maintained in a safe condition.

9.2 Maintenance of the pool surrounds

Dirt, grass cuttings, litter and other debris found within the pool surrounds may enter the pool water and adversely affect the water treatment processes. Even though these contaminants can never be completely eradicated, they should be controlled in order to ensure that they do not affect the water quality. The following procedures should be carried out to minimise the impact on water quality:

- > Clean all paved areas daily, or more frequently during busy periods. The cleaning method may involve the use of a dry or wet process. The process should not result in contaminants entering the pool water
- > Provide adequate waste receptacles as required by regulation 7 of the General Regulations
- > Maintain lawns, gardens areas and the pool surrounds in general in a clean and tidy condition. Particular attention should be paid to the removal of grass cuttings, paper and other debris, to reduce the chance of it ending up in the pool water
- > Maintain surface water drains so that they are free of blockages.

10. Amenities

10.1 Toilets, showers and changerooms

Toilet, shower and changeroom facilities should be provided as required by the Building Code of Australia. It should be noted that where the relevant authority is of the opinion that premises have inadequate facilities for sanitation or personal hygiene, it may require additional facilities to be provided.

The toilets, showers, changerooms and fixtures within should be kept in good condition and should be thoroughly cleaned as often as is necessary to maintain them in a clean condition at all times.

Patrons should be encouraged to shower prior to using the pool.

10.2 Food service

Where facilities are provided for the sale of food or drinks they should be located separate from the bathing areas. Patrons should be prevented from entering the pool or its immediate surrounds whilst consuming food or beverages.

The use of glass containers should be discouraged.

11. General section

11.1 Bathing load

There are three reasons why overloading of pools should be avoided:

- > Excessive build-up of pollution
- > It becomes uncomfortable and dangerous to swim
- > It is hard to observe if any bather is in difficulty.

For pools such as wading pools, which are typically small and shallow with a high surface to volume ratio, the bather load is usually high and water quality should be monitored closely. The organic load from bathers together with sunlight can quickly lower the amount of free chlorine available in the pool water. Splashing in the pool also serves to increase the loss of chlorine.

It is essential that wading pools are adequately disinfected as they are used predominantly by young children who are very susceptible to infection. A wading pool must have a maximum pool water turnover rate of two hours.

11.2 Pool water temperature

To prevent stress to bathers the temperature of the pool water should be maintained at a comfortable level.

11.3 Depth markings

For the safety of users the depth of pools should be prominently and clearly indicated, in writing which is at least 100mm in size, at:

- > The minimum and maximum depths
- > Locations where there is a sharp change in the gradient of the pool floor
- > Intervals along the length of the pool; the frequency will depend upon the size and configuration of the pool
- > Positions where they can be easily seen from the water and the pool side.

Ladders should be provided at the deep and shallow ends of the pool.

11.4 Ventilation

If a pool is enclosed, adequate ventilation should be provided for the comfort of the users and the removal of vapours, odours and gases.

If an air handling system is provided it should be installed, operated and maintained in accordance with the Australian Standards, AS 1668, Part 2 and AS 3666 or as required by the relevant authority.

11.5 Salt chlorinators

Salt chlorinators should be sized in relation to pool capacity, bather load and chlorine demand and should be operated correctly so as to ensure compliance with the provisions of the General Regulations.

Salt chlorinators generate chlorine only whilst the pump is operating. Therefore, continuous operation of the pool water treatment system is required in most cases.

Frequent maintenance of the chlorine generating electrodes is required.

Due to the high sodium chloride level in the pool water it is necessary to ensure that all metal fittings are corrosion resistant.

If a salt chlorinator is not able to satisfy the chlorine demand, the pool water should be supplemented with chlorine from an alternate supply to ensure that the minimum free chlorine levels are maintained as prescribed in the General Regulations.

11.6 Storage and handling of pool water treatment chemicals

The storage and handling of pool water treatment chemicals should be in accordance with the provisions of the:

- > *Dangerous Substance Act 1979*
- > *Work Health and Safety Act 2012*
- > *Controlled Substances Act 1984*
- > AS/NZS 2927:2001 The storage and handling of liquefied chlorine gas
- > AS 4326 – 1995 The storage and handling of oxidising agents
- > AS 1894 – 1997 The storage and handling of non-flammable cryogenic and refrigerated liquids.
- > AS 4331 – 1995 The storage and handling of gases in cylinders
- > AS3780 – 1994 The Storage and handling of corrosive substances.

11.6.1 Storage

All chemicals used in pool water treatment and maintenance at the facility should be stored:

- > In a cool, dry and well-ventilated place
- > Out of the reach of unauthorised persons
- > Preferably in a locked room
- > In their original containers
- > At ground or near ground level to minimise the possibility of the chemicals being accidentally dropped or spilled
- > So that liquid chemicals are kept well away from and not stored on top of or above solid chemicals
- > In a bunded area in order to contain any spills or leakages.

Pool water treatment chemicals should not be stored in the same room as substances such as motor fuel, turpentine, pesticides, oils or other chemicals used in the operation of the facility.

The inappropriate storage of chemicals may be dangerous; in the event of a spill or leak, as the chemicals may mix and react explosively or produce toxic substance. For example:

- > Acids will react with sodium or calcium hypochlorite to release toxic chlorine gas
- > Chlorinated cyanurates will react with acid or alkaline substances and may explode due to the release of chlorine dioxide
- > Calcium hypochlorite may spontaneously combust or explode if it contacts organic or oxidisable and combustible substances such as chlorine or petroleum products.

No smoking signs should be displayed in the areas where pool chemicals are stored, prepared or applied.

11.6.2 Handling

All persons while handling pool chemicals should:

- > Use caution
- > Wear appropriate clean protective clothing, eye protection and respirators to prevent chemicals coming into contact with their skin, eyes or clothing and to avoid breathing any chemical dust or vapour
- > Handle all chemicals in accordance with the label instructions
- > Use a separate measure for each chemical. Each measure should be clean, dry and made from a suitable material
- > Wash their hands before and after handling chemicals
- > Handle chemicals in a manner to prevent spillage. Chemicals should be dispensed over a plastic sheet so that any spillage can be easily removed for disposal. NEVER return spilled material to its container as it may have become contaminated with other chemicals and could be hazardous
- > Always follow the manufacturer's mixing instructions when dispensing chemical from its container into a mixing container or pool water. When mixing chemicals, always add the chemical to water and not water to the chemical

- > Follow the manufacturer's instructions for disposing of empty chemical containers. Rinse water should not be discarded into a drainage system, stormwater drain or water course, unless approval for the discharge has been obtained from the relevant authority
- > After dispensing any chemical, the container should be tightly sealed with its original closure. Do not interchange closures
- > In the event of spilling a chemical onto a person, immediately wash away the chemical using plenty of water. A dousing shower should be provide for this purpose
- > Clean up chemical spills in accordance with the manufacturer's instructions.

11.7 Disposal of unwanted pool chemicals

Pool chemicals and their containers should be disposed of in accordance with the manufacturer's instructions or on direction from the relevant authority.

11.8 First aid

Most pool chemicals are harmful if they are swallowed, inhaled or come into contact with the skin or eyes. In addition, there are a number of potential causes of injury within a pool, the plant and storage rooms and their surrounding areas. All pool owners should provide first aid facilities of appropriate size and equipment level and in accordance with the *Work Health and Safety Act 2012*.

12. Faecal release incidents in public swimming pools and spa pools

Human faecal matter may contain bacteria, viruses and other infectious microorganisms that can make people seriously ill. The release of human faecal matter into public pools poses a risk to the health of swimmers, staff and patrons of the pool. Some faecal microorganisms are resistant to chlorine, so special care must be taken when responding to a faecal release incident.

SA Health has developed two fact sheets (*Faecal release incidents – public pool response strategies* and *Minimising the risk of cryptosporidiosis in public swimming pools and spa pools – for pool operators*) that detail decontamination procedures for faecal release incidents and how to minimise and respond to *Cryptosporidium* risks. These fact sheets should be referred to as a best practice guide and can be downloaded from the SA Health website. The procedures in these fact sheets are not prescribed under legislation, but a failure to comply with them may result in a risk to public health and may be considered a breach of general duty under section 56 of the Act.

12.1 Bowel incontinence

There are people in the community with varying degrees of bowel incontinence. This can create problems for swimming pool operators, spa pool operators and users of public pools.

The *Equal Opportunity Act 1984* makes it unlawful for a swimming pool or spa pool operator to prevent entry to a public swimming pool or spa pool of persons on the basis of sex, sexuality, marital status, pregnancy, race, impairment or age.

On the other hand, regulation 10(c) of the General Regulations provides that: 'a person must not while in a public swimming pool or public spa pool, spit, squirt water or release bodily material (other than any such material released through the ordinary course of being in the water)'. The maximum penalty is \$1250.

Management practices for persons with incontinence

It is the responsibility of the pool operator and people with incontinence or their parents or guardians to manage the risks of faecal contamination of public pools. This may include:

- > Toileting prior to entering the water
- > Periodical toileting during the period of time whilst at the pool
- > Undertaking water recreation activities prior to food consumption
- > Wearing incontinence pads and water-proof undergarments under the bathing costume
- > Providing a specific time allocation when the pool is not subject to heavy loading
- > Exclusion of the public for certain periods
- > Setting aside a portion of the pool for persons with impairment
- > Provision of purpose-built facilities.

If a faecal release incident occurs, pool operators should refer to the SA Health fact sheet: *Faecal release incidents – public pool response strategies*.

13. Inspection checklist

The following checklist is provided as a guide to assist relevant authorities and pool operators in the inspection of swimming and spa pool facilities. It should be noted that although the checklist covers many of the areas to be monitored during an inspection it is not an exhaustive list and there may be other areas to be covered, especially for specific use pools.

Areas to be checked	Check for
1. Pool Structure	
<i>Surfaces – internal, external, coping and surrounds</i>	Loose, damaged or missing tiles; cracks; leaks' delamination; scale build up; corrosion; algal deposits; stains; rust; faults in the grouting; sharp edges; cleanliness; drainage to appropriate location; slip resistance.
<i>Control or expansion joints</i>	Loose jointing or gaps; leaks; rust; integrity of sealant.
<i>Skimmer gutters and skimmer boxes</i>	Grating to be clear, free of debris, fixed, secure and in good condition; efficient operation; safety; sharp edges; obstructions; compliance with the requirements of the Building Code of Australia.
<i>Inlets and outlets</i>	Effectiveness; obstructions; safety; compliance with the requirements of the Building Code of Australia.
<i>Fixtures and equipment such as ramps, ladders, handrails, diving boards, hydraulic lifts</i>	Rust; safety; cleanliness; appropriateness of materials of construction e.g. stainless steel for ladders; secure fixing; appropriate location.
<i>Spa pool construction</i>	Compliance with the requirements of the Building Code of Australia.
2. Plant equipment and circulation system	
<i>Balance tank</i>	Water level control device e.g. efficiency operation of ball valve and overflow.
<i>Pipework</i>	Secure fixing; leaks; formation of scale; restrictions in water flow; correct colour coding; sealing of.
<i>Pumps</i>	Efficient operation; leaking glands and connections; vibrations; suitable mounting.
<i>Valves</i>	Efficient operation; correct labelling; secure fixing; leaks; correct operation of non-return valves.
<i>Water filters</i>	Cleanliness; condition of the medium; backwashing requirements.
<i>Flow gauge, meter</i>	Efficient operation; accuracy of readings.
<i>Heater</i>	Correct temperature settings; accuracy of temperature gauge; correct operation of fail-safe devices and alarms.
<i>Backwashing</i>	Frequency; disposal of backwash water in accordance with requirements.
<i>Electrical</i>	Safety; secure fixing; leakage detectors; water proofing of connections, instruments etc.; correct functioning of operating and warning lights.
<i>Lighting</i>	Safety; adequacy; correct operation; light failure.
<i>Ventilation</i>	Effective operation; required rate of air flow; maintenance; cleanliness of filters and record of filter changes.
<i>Chemical injection points</i>	Blockages; correct operation; safe and sound connections.
<i>Automatic controls</i>	Correct operation; frequency of calibration; cleanliness of sensing devices and whether they require replacement; system reliability; frequency of manual testing which is used to confirm sensing device readings. Recording of electrode replacements; calibrations; backwashing frequency; pump maintenance, UV lamp replacements.

Inspection Checklist continued	
Areas to be checked	Check for
2. Plant equipment and circulation system continued	
<i>Maintenance log book</i>	Recording of electrode replacements; calibrations; backwashing frequency; pump maintenance, UV lamp replacements.
<i>Procedures manual</i>	Ready availability and listing of all functions required to be performed.
<i>Floors</i>	Cleanliness; sound condition; non-slip surfaces.
<i>Access walkways, ladders</i>	Secure fixing; safety; non-slip surfaces.
<i>Access to plant room and equipment</i>	Safety; clear and unimpeded access.
<i>Security</i>	Means of preventing unauthorized entry; tamper proofing of dosing equipment, meters, recording equipment and automatic controls.
<i>Manual testing equipment</i>	Availability; cleanliness; suitability; freshness of test chemicals and correct storage.
3. Water quality	
<i>Chlorine levels, pH, alkalinity level, cyanuric acid level, clarity, UV and hydrogen peroxide level</i>	Frequency of reading and compliance with legislation; recording of readings in log book.
<i>Testing procedures</i>	Frequency of readings.
<i>Daily log book or chart recordings</i>	Availability and recording of all test readings; water replacement and breakpoint chlorination frequency; pool water temperature recording.
<i>Water temperature control</i>	Accuracy of gauges; temperature set points; operation of high temperature alarms.
4. Changerooms and ablutions	
<i>Number of facilities</i>	Compliance with the requirements of the Building Code of Australia or the relevant authority.
<i>Cleanliness</i>	The cleanliness and sanitary condition of the buildings, changing facilities, fixtures, fittings and receptacles.
<i>Water closets and urinals</i>	Cleanliness; correct operation; cracks or breakages of the fixtures and fittings.
<i>Showers</i>	Cleanliness of floors, wall surfaces and facilities. Correct operation of shower heads and taps. Absence of mould.
<i>Floors</i>	Non-slip surfaces; correct drainage; cleanliness.
<i>Hand basins</i>	Cleanliness; cracks or breakages; adequate supply of water.
<i>Hand drying facilities</i>	Availability.
<i>Ventilation</i>	Effectiveness; maintenance; cleanliness of filters and registers.
<i>Lighting</i>	Adequacy; effectiveness.
<i>Refuse receptacles</i>	Cleanliness; availability; frequency of emptying; availability of suitable receptacles for the containment of used baby napkins, sanitary napkins, incontinence pads, paper hand towels and other waste.
<i>Facilities for people with disability</i>	Compliance with the requirements as set by the relevant authority.

Inspection Checklist continued

Areas to be checked	Check for
5. Chemical storage and handling	
<i>Chlorine gas</i>	Compliance with requirements; availability of protective clothing and self-contained breathing apparatus; presence of signs.
<i>Carbon dioxide gas</i>	Security of fixing.
<i>Bulk storage</i>	Correct installation of tanks and feed delivery lines; adequate ventilation. Bunding.
<i>Segregation and separation of chemicals</i>	Appropriate storage of chemicals.
<i>Safety</i>	Availability of emergency dousing shower and emergency eyewash; fire extinguishers; appropriate protective clothing and equipment; first aid kits.
<i>Manual handling</i>	Availability of appropriate manual handling equipment.
<i>Delivery</i>	Adequate access for the delivery of chemicals.
<i>Storage facilities</i>	Safety; correct labelling or signage; adequacy.
<i>Chemical feed line</i>	Secure fixing, soundness of lines and connections.

Acknowledgments

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- > Local Government Association of South Australia, Legal Services
- > Swimming Pool and Spa Association of Australia (SA Division)
- > South Australian Swimming Pool and Spa Industry
- > SA Health, Health Protection Programs.

Bibliography

- South Australian Public Health Act 2011* and *South Australian Public Health (General) Regulations 2013*.
- Mitchell, P. Kirk, *The Proper Management of Pool and Spa Water*, Hydrotech Chemical Corporation.
- Hartley, K.J., *Chemistry of Chlorinated Swimming Pools*. Gutteridge Haskins and Davey, 1989.
- Australian Guidelines for Heated Spa Pools*, National Health and Medical Research Council, Commonwealth of Australia, 1990.
- Australian Guidelines for Disinfecting Private Swimming Pools*, National Health and Medical Research Council. Commonwealth of Australia, 1989.
- Building Code of Australia*
- Lang, Bryce, *The Fundamentals of Private Swimming Pool Operation and Chemical Treatment*.
- Clayton, Robert D., Thomas, David G., *Professional Aquatic Management. Second Edition*, Human Kinetics Books. Champaign, Illinois.
- Gabrielsen, M. Alexander, *Swimming Pools – A Guide To Their Planning, Design and Operation. Fourth Edition*, Human Kinetics Publishers Inc. Champaign, Illinois.
- Public Swimming Pools*. American Public Health Association.
- Salvato, Joseph A., *Environmental Engineering and Sanitation*.

Standards

- 1688 Part 2: Mechanical ventilation for acceptable indoor-air quality.
- 2610 Spa Pools
- 2610.1 Part 1: Public spas
 - 2610.2 Part 2: Private spas
- 3633 Private Swimming Pools – Water Quality.
- 3666 Air Handling and water systems of buildings – Microbial control.

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