

S O U T H   A U S T R A L I A N   H E A L T H   C O M M I S S I O N   C O D E

# S T A N D A R D

F O R   T H E

## *Operation of Swimming Pools and Spa Pools in South Australia*

### SUPPLEMENT A

### WATERSLIDES

**DEPARTMENT OF HUMAN SERVICES**

( SOUTH AUSTRALIAN HEALTH COMMISSION )



**Government  
of South Australia**

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SUPPLEMENT A ~ Waterslides

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This guideline is one of a series of guidelines to assist Local Government in the administration of the Public and Environmental Health Act and Regulations.

Should you wish to comment on the information in this guideline, your written comments are welcome and should be addressed to:

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Public & Environmental Health Council  
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## FOREWORD

Under the Public and Environmental Health Act, the Public and Environmental Health Council can initiate measures to promote public and environmental health standards and has the responsibility to keep the operation and administration of the Act under review.

To assist local councils in the administration of the legislation the Public and Environmental Health Council has requested that “Supplement A” to the code “Standard for the Operation of Swimming Pools and Spa Pools in South Australia” be prepared taking into account the provisions of Section 47(5) of the Act and Regulations 3 and 6(1) as they relate to waterslides. For the purpose of Regulation 3, a waterslide is included within the definition of a swimming pool.

“Supplement A” to the code “Standard for the Operation of Swimming Pools and Spa Pools in South Australia” has been prepared to address the issue of water quality in relation to the operation of a waterslide. It details measures necessary to ensure that water quality within a waterslide pool is of a standard that does not prejudice the health or comfort of waterslide users.

Described in detail is the disinfection of waterslide pool water with reference to other important parameters such as pH, water clarity, total alkalinity and water turnover rates that need to be maintained in balance as part of the total water treatment process.

This supplement is aimed primarily for use by agencies responsible for the administration of the Public and Environmental Health Regulations. However, it will also be very useful to the operators of waterslides.

Public and Environmental Health Regulation 3 details the facilities to which the provisions of this supplement apply and defines the circumstances of application.

As provided for under Section 47(5) of the Act and Regulation 6(1)(a), this supplement becomes part of the prescribed code and non compliance with the provisions, except for the waterslide pool water turnover rate, that are applicable to the disinfection process including the maintenance of the waterslide pool water so that it is chemically balanced, is deemed to be a breach of the legislation and subject to penalty as indicated in Regulation 6(3).

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## INTRODUCTION

This code applies to the operation of waterslides as defined by the Public and Environmental Health Regulations, 1991.

Waterslides generally consist of a specially designed flume on a supporting structure with a receiving waterslide pool (for the purpose of the legislation, a swimming pool) at the base of the flume to break the fall of the waterslide user.

Provided that the waterslide structure, operation, supervision of users and water quality requirements are effectively maintained, waterslides can be a lot of fun for the riders.

This code sets out the design criteria, water quality requirements and the management and operation provisions for waterslides. It has been prepared as a supplement to the South Australian Health Commission Code “Standard for the Operation of Swimming Pools and Spa Pools in South Australia” for use by local councils in the administration of the legislation. It is also a useful guide for waterslide owners and operators and will assist them to comply with the provisions of the Public and Environmental Health Regulations and provide a facility that is of a high standard, safe, hygienic and enjoyable for the users.

To ensure that the waterslide water is maintained in a clean, clear and safe condition this code recommends that the water turnover rate be at least hourly.

This code should be read in conjunction with the South Australian Health Commission Code of Practice “Standard for the Inspection and Maintenance of Swimming Pools and Spa Pools in South Australia”.

All legislation, codes of practice, standards or guidelines referred to in this code include amendments made from time to time, unless otherwise stated. The provisions of this code do not derogate from the need to comply with other laws of the State.

## DEFINITIONS

<i>chlorine</i>	hypochlorous acid/hypochlorite ion (irrespective of the mode of addition or formation).
<i>combined chlorine</i>	chlorine that has combined with ammonia, ammonium compounds or organic matter containing nitrogen, to form chloramines.
<i>disinfecting agent</i>	a compound or substance which, when applied as instructed to waterslide water, kills harmful micro-organisms.
<i>flume</i>	an artificial channel or trough which conducts water and is used to transport persons from a raised platform to a receiving waterslide pool
<i>free chlorine</i>	chlorine that has not combined, but is free to kill bacteria, algae and destroy organic pollutants introduced into the waterslide water.
<i>knowledgeable person</i>	one who is able to control, manage and operate a waterslide to ensure that the water complies with the requirements of the Public and Environmental Health Regulations.
<i>mg/L</i>	milligrams per litre.
<i>occupier</i>	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.
<i>operator</i>	the person who has control and management of the waterslide, is knowledgeable in its operation and is sufficiently competent to ensure that the waterslide complies with the requirements of the regulations.
<i>owner</i>	in relation to premises, includes an occupier of the premises.
<i>pH</i>	a scale (ranging from 0 to 14) that indicates the amount of acid or alkali present in the water. Water with a pH of 7 is neutral.
<i>stabilizer</i>	a compound such as cyanuric acid which is added to waterslide water to reduce chlorine loss due to sunlight.
<i>superchlorination</i>	the addition of sufficient chlorine to waterslide water to raise the level of free chlorine to at least 10mg/L for the destruction of combined chlorine (chloramines), algae, and other impurities.
<i>swimming pool</i>	includes any waterslide, wave pool, hydrotherapy pool or other similar structure designed for human use, other than: (a) a spa pool <i>or</i> (b) a tidal pool or other similar structure where water flows in and out according to the operation of natural forces.
<i>total alkalinity</i>	a measure of the total amount of dissolved alkaline compounds in the waterslide water.
<i>total chlorine</i>	the sum of combined chlorine and free chlorine.
<i>turnover rate</i>	the period of time required to achieve complete exchange of the waterslide water through the filter.
<i>waterslide</i>	consists of a specially designed flume on a supporting structure with a receiving splash pool at the base of the flume.
<i>waterslide pool</i>	an artificial body of water used to receive persons discharged from a waterslide flume.
<i>mWs/cm<sup>2</sup></i>	microwatt seconds per centimetre squared.

## MANAGEMENT

Where a waterslide is available for use by the public the owner of the facility must ensure that the waterslide is under the control and management of a person who is knowledgeable and competent in the operation and maintenance of pool water. Whilst the facility is available for use by the public it is the responsibility of the owner and the waterslide operator to ensure that the quality of the waterslide water is maintained in accordance with the requirements of the Public and Environmental Health Regulations.

For the purpose of Public and Environmental Health Regulation 8 (1) (a) possession of a qualification approved by the South Australian Health Commission may constitute prima facie evidence of the knowledge and competence required of the person in charge of a waterslide. The knowledge and competence of the operator may also be assessed by the standard of the water quality within the waterslide as detailed below.

Owners of waterslides covered by the ambit of the regulations are responsible for ensuring that the waterslide is correctly operated. Failure to do so could result in legal proceedings being implemented for non compliance.

Where the operator of a waterslide fails to maintain the water quality in the manner prescribed, the authority may deem the operator not to be competent and require the owner to provide a person who is competent.

The owner needs to ensure that sufficient staff are available to supervise the operation of the facility. The minimum staff requirements for the operation of a waterslide are:

- one observer positioned at the top of each flume who is responsible for supervising riders entering the flume
- one observer positioned at the waterslide pool who is responsible for supervising riders discharging from the flume(s) and their subsequent emergence from the waterslide pool.

Each observer must have an unobstructed view of the full length of the flume or there should be a device installed which is capable of indicating to the attendant at the top of the flume that the flume is clear for the next user.

A communication system should be installed to allow attendants at the top and bottom of the waterslide to communicate with each other.

The method for fee charging should not encourage users to run, be rough or boisterous in their endeavours to maximise the number of rides.

## WATER CLARITY

Clarity of waterslide water refers to the clearness or lack of cloudiness of the water and it may be regarded as the distance through the water at which an object can be seen. Under the Public and Environmental Health Regulations the clarity of waterslide water must be such that a matt black disc, or a disc that contrasts with the colour of the bottom of the waterslide pool, 150mm in diameter, is (or would be) clearly visible at the deepest part of the waterslide pool. Removal of suspended and colloidal matter by filtration will assist in maintaining waterslide water clarity.

The purpose of achieving clarity in waterslide water is to:

- confirm the absence of particles which may shield micro-organisms from direct contact with the disinfectant
- enable persons to estimate depth, to see subsurface hazards easily and to detect submerged waterslide users
- provide a safe, pleasant, attractive and appealing appearance to the water.

The internal surfaces of the waterslide pool must provide high light reflection from the under water surfaces. This can help in detecting:

- poor waterslide water quality
- poor cleaning practices
- bathers beneath the surface who may be in difficulties.

## **pH & TOTAL ALKALINITY**

The pH of waterslide water can affect the disinfection efficiency. Where waterslide water is disinfected with chlorine the pH factor is much more critical. The pH, if not correctly regulated can also affect bather comfort and cause deterioration of pool surfaces, metal fixtures, pipework and pumps. Therefore, the pH range must be limited, and its tendency to fluctuate must be controlled by ensuring a minimum level of total alkalinity. For the purpose of this code, total alkalinity is measured as calcium carbonate (CaCO<sub>3</sub>).

Waterslide water disinfected with chlorine or ultraviolet light plus hydrogen peroxide requires a minimum total alkalinity level of 60mg/L. However, where gaseous chlorine is used the minimum total alkalinity level required is 150mg/L. This ensures that the water is chemically balanced and can be effectively disinfected.

Total alkalinity levels greater than 200mg/L may result in scaling of fittings and surfaces, particularly with hard waters. Consequently, hard waters may require treatment prior to being added to a waterslide.

Tables 1 to 3 detail the range of pH and total alkalinity values for disinfected waterslide waters.

## **TURNOVER RATE AND WATER REPLACEMENT**

Due to the high bather loads it is recommended that the waterslide water should pass through the filter at least once in every hour. In those facilities where the water turnover rate requirements vary, the waterslide should be provided with a separate filter.

The waterslide water should be returned to the filtration system by collecting 80% of the flow via the overflow gutters and skimmers and drawing the remaining 20% from below the waterslide pool water surface level via the return suction points.

The waterslide pool needs to be provided with an automatic make up water system capable of maintaining the correct operating level.

## **DISINFECTION & TREATMENT OF WATER**

The following conditions must be achieved whenever a waterslide is available for use:

- the waterslide water must be disinfected by chlorine or by an ultraviolet light plus hydrogen peroxide system so that the disinfection values set out in tables 1 and 3 are maintained
- where chlorine is used the pH, total alkalinity and cyanuric acid (for stabilized waterslide water only) values for the waterslide water are to be maintained in accordance with tables 1 and 2
- where an ultraviolet light and hydrogen peroxide system is used the pH, total alkalinity and waterslide water flow rate must be maintained in accordance with the requirements set out in table 3
- the waterslide must have a filtration system that provides a continuous circulation of the waterslide water through the filter. Ideally the waterslide should have its own filtration system
- all water in a waterslide must pass through the filter as often as necessary to ensure that the water is maintained in a clean and clear condition. As waterslides have high bather loads it is recommended that the water should pass through the filter at least once in every hour
- the waterslide must be fitted with automatic dosing and monitoring equipment that continuously analyses and controls the pH and disinfectant levels in the waterslide water within the range as indicated in tables 1 and 2
- waterslide water clarity must be maintained in a clean, clear condition so that a matt black disc, or a disc that contrasts with the colour of the bottom of the waterslide pool, 150mm in diameter, is (or would be) clearly visible when viewed at the deepest part of the waterslide pool.

## DESIGN & CONSTRUCTION CRITERIA

Waterslides are to be designed to ensure maximum safety and be constructed of materials which are safe, durable, water resistant and easily cleansed and maintained.

The design and materials used are to be in accordance with proper structural engineering practices providing a sound durable structure which will safely sustain all superimposed loads throughout the life of the structure. The waterslide and associated waterslide pool surfaces are to be inert, non-toxic, smooth and easily cleaned. Where covered flumes are used, suitable ventilation is to be provided to ensure an adequate air supply to the users and to remove any airborne odours or contaminants.

All user contact surfaces are to be so assembled, arranged and finished to prevent bodily injury to the users.

During design the following points need to be considered:

- the structure is to be designed to prevent unauthorised access to the waterslide and structural supports
- walkways from the waterslide pool to the top of the flume are to be not less than 600mm in width. These walkways should be provided with:
  - safety fencing and where necessary continuous handrails
  - a well-drained, non-slip, easily cleanable, low heat co-efficient surface
- walkways are to be segregated in such a manner so as to prevent interference or access to the flume
- the starting point is to be provided with:
  - handrails made of stainless steel or a similar durable material
  - a non-slip floor surface
  - a two metre long safety canopy, or a suitable control device to regulate entrance into the flume
- the flume is to be designed to take into account human dynamics and to ensure that the rider stays within the centre line of the flume and cannot fall out
- the curves and turns throughout the flume are to be designed in such a manner so that user impact with the walls does not present a hazard and these portions are to be banked over so that users are retained safely inside the flume under all foreseeable circumstances of operation
- the joints and flume edges are to be designed to prevent water leakage and bodily injury, in particular to fingers, hands and feet
- the flume exits are to be such that users do not hit the sides or the end of the waterslide pool
- the flume discharge is to be graded out in such a manner to prevent injury to the user on discharge into the waterslide pool
- the invert of the flume is to terminate at a depth of 150mm below or 100mm above the waterslide pool water surface.
- high speed waterslides require additional care in the design of the flume exit, waterslide pool depth and width to ensure users can safely discharge into the waterslide pool
- water flow in the flume is to be controlled to ensure that water does not spill over the sides of the flume. This is to ensure that the waterslide users are assured of a safe ride at all times
- the waterslide pool water depth at the end of the flume is to be maintained between 900mm to 1 metre whilst the slide is in use. This depth is to be extended out in front of the flume for a distance of at least three (3) metres
- the internal surfaces of the walls and floors of the waterslide pool are to be finished with a durable non toxic material having a smooth finish and be of such colour to enable visual observation of any person in the waterslide pool at all times whilst the waterslide is in use
- the junctions formed at the intersection of walls and floor of the waterslide pool should be provided with a coving rounded to a radius not less than 150mm nor greater than 300mm

- handrails and exit steps are to be provided at the exit from the waterslide pool. The steps are to be constructed of non-slip materials and the handrails are to be of stainless steel or a similar durable material. Where multiple flumes discharge into the waterslide pool an equivalent number of handrails are to be provided on the exit steps
- depth markers are required to indicate the depth of the water in the waterslide pool. The depth indicators are to clearly indicate both the maximum and minimum depth and indicate depth changes in between. These depth markers are to be clearly visible to all persons entering the waterslide pool from the flume
- the scum gutters and skimmers are to comply with the requirements of the Building Code of Australia
- suction return outlets for the waterslide pool must comply with the requirements of the Building Code of Australia
- water flow is to be towards the suction outlets located so that the water flow carries the waterslide user away from the flume and towards the exit at the far end of the waterslide pool
- at all times whilst the waterslide is in use the water demand and supply for the flume(s) are to be such that the minimum water depth in the waterslide pool of 900mm to 1 metre is not reduced
- the waterslide pool surrounds are to be at least 1.2 metres wide and be constructed of a material that is light coloured, impervious, has a non-slip surface and formed to grade away from the waterslide pool to an approved drainage system
- the waterslide pool edges are to be rounded so as to minimise injury but still enable them to be used as a hand hold for the waterslide users. The upper surfaces of the waterslide pool edge are to be of non-slip material in order to reduce the fall hazard and to facilitate gripping by users in the waterslide pool.

### ***Inspection of flume***

The total length of the flume should be inspected daily prior to use to ensure that no bodily injury will occur to the users as a consequence of faulty or damaged flumes.

If the inspection reveals unsatisfactory conditions likely to cause bodily injury, the waterslide must be closed until repairs are carried out.

### ***General requirements***

#### **Electrical wiring**

All electrical wiring is to conform with the requirements of the Australian Standard AS 3000 and the Electricity Trust of South Australia. No overhead electrical wiring should pass within six metres of the flume and waterslide pool except where a waterslide is enclosed within a building.

All overhead wiring should be encased in conduit firmly secured to the supporting building structure.

#### **Lighting**

Where waterslides are covered or located indoors, adequate lighting, suitable for use in a water environment, is to be provided.

When the waterslide is used at night adequate lighting is to be provided to all areas of the waterslide complex.

#### **Bather warning notice**

A sign displaying the following advice should be positioned in a prominent position at the entrance to the complex and the flume where it can be read by bathers intending to use the waterslide:

- each rider is to immediately leave the waterslide pool on discharge from the flume.
- tandem riding is only permitted for adults who are accompanying small children on the waterslide.
- no person is to cause, suffer or permit rough behaviour or harassment of other persons in the waterslide pool, on the flume, walkways or platforms.
- glass bottles, other articles containing glass and sharp objects are not to be carried or used within the flume, waterslide pool and its surrounds or the walkways.
- waterslide users are not to wear any personal effects such as jewellery, watches or spectacles which are likely to result in personal injury to the user, other users or cause damage to the waterslide.

- persons are not to use the waterslide in a manner which will cause bodily injury to other slide users.
- persons under the influence of alcohol or drugs are not permitted to use the waterslide.
- do not ride this waterslide unless your physical health is sound.
- health authorities warn that it is considered UNSAFE to use a waterslide:- if you are pregnant
  - for persons with limb or back weakness/disability
  - for persons with heart ailments
  - for persons with any condition which could predispose them to further aggravation of their pre-existing condition or injury.
- non compliance with these rules could result in the user being directed to leave the premises.
- management reserves the right to refuse entry to any person at all times, ie. where the person is under the influence of alcohol, drugs or for any other reason considered to create a potential hazard for that user or other persons.

## TABLES

**TABLE 1:** Waterslide water disinfected with CHLORINE

Waterslide water temperature	pH	Total alkalinity mg/L	Unstabilized waterslide water mg/L		Stabilized waterslide water mg/L		
			Minimum free chlorine*	Maximum total chlorine*	Minimum free chlorine*	Maximum total chlorine*	Min-Max cyanuric acid
< 26°C	7.2 - 7.6	60 - 200**	1.0	Free chlorine as measured + 1.0	2.0	Free chlorine as measured + 1.0	30-50
≥ 26°C	7.2 - 7.6	60 - 200**	2.0	Free chlorine as measured + 1.0	4.0	Free chlorine as measured + 1.0	30-50

\* Disinfection values

\*\* If gaseous chlorine is used the total alkalinity value must be in the range 150-200mg/L.

*NOTE: Stabilizers are not to be used in indoor waterslides*

**TABLE 2:** Waterslide water characteristics

<i>Characteristics</i>	<i>Range Min - Max</i>	<i>Comments</i>	
pH	7.2 - 7.6	If pH is below 7.2 then the possibility of: - eye discomfort due to accelerated formation of chloramines - rapid loss of chlorine - etching of exposed cement finished waterslide pools - corrosion of metals	If pH is above 7.6 then the possibility of: - reduction of chlorine disinfection efficiency - increased chlorine requirement - eye discomfort - drying of skin - cloudy water - scale formation
Total alkalinity when disinfected with: - calcium hypochlorite - sodium hypochlorite - salt chlorinator - gaseous chlorine	60 - 200 mg/L 60 - 200 mg/L 60 - 200 mg/L 150 - 200 mg/L	If total alkalinity is below 60, then the possibility of: - pH fluctuation due to weak buffering effect - corrosion of metal	If total alkalinity is above 200, then the possibility of: - high pH - cloudy water - scale formation
Stabilizer cyanuric acid	30 - 50 mg/L	If stabilizer value is below 30,, then the chlorine residual is rapidly destroyed by sunlight	If stabilizer value is above 50, then the time required to destroy the pathogenic organisms becomes unacceptably long
Temperature	28°C Max	If the temperature is too low, then bathers may experience discomfort	If the temperature is too high, then the possibility of: - increased use of chlorine - bather discomfort - increased evaporation - increased scaling potential

*NOTE: Stabilizers are not to be used in indoor waterslides*

**TABLE 3:** Operating criteria for waterslide water disinfection using the ULTRAVIOLET LIGHT PLUS HYDROGEN PEROXIDE SYSTEM

Ultraviolet light	30 000 mWs/cm <sup>2</sup> *
Pool water flow rate	150 L/min
Pool water turnover rate	1 hour **
Hydrogen peroxide (H <sub>2</sub> O <sub>2</sub> ) level	40 mg/L *
pH	7.2 - 7.6
Total alkalinity	60 - 200 mg/L

\* Disinfection values

\*\* Under the legislation the pool water turnover rate for swimming pools, which includes waterslides, is to be at least once in every 6 hours. However, it is recommended that the turnover rate for waterslide water be at least once in every hour.

*NOTE: The ultraviolet light plus hydrogen peroxide system has been approved for use in indoor waterslides having a capacity up to 500 000 litres.*

## ACKNOWLEDGMENTS

This code was developed by a working party comprising representatives from the following organisations:

- Australian Institute of Environmental Health (S.A. Division)
- Australian Institute of Swimming and Recreation Centre Management (S.A. Division)
- Local Government Association of South Australia, Legal Services
- Swimming Pool and Spa Association of Australia (S.A. Division)
- South Australian Swimming Pool and Spa Industry
- South Australian Health Commission, Environmental Surveillance Section.

The Public and Environmental Health Council wishes to convey its sincere appreciation to the supporting organisations for making a representative available and to each member of the working party for their valued technical contribution.

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