

# AQUATIC FACILITY GUIDELINES

## 5 Plant Operation



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The Aquatic Facility Guidelines have been developed for use by aquatic managers. They provide detailed information covering the management and operation of an aquatic facility.

This document is a companion document to the Facility Management Manual which can be found on the Sport NZ website and the NZ Recreation Association website:

<http://nzrecreation.co.nz/index.php/facilities-home/facilities-guidelines>

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# 1 Introduction

Aquatic facilities require efficient and well-maintained mechanical plant operations to ensure that facilities are safe and operate in accordance with relevant standards and legislative requirements. This includes the operation of pool water circulation, filtration systems, heating and ventilation systems. Regular monitoring and maintenance is required to ensure operating plant and equipment does not malfunction and optimum levels and efficiencies are maintained.

To ensure good water quality is achieved and maintained, the operation of pool plant equipment must be carried out by trained and qualified water treatment operators.

## 2 Water Quality

The New Zealand Standard that governs water quality in swimming pools is NZS 5826:2010 – *Pool Water Quality*. It provides guidance for pool owners and managers to check water quality measurements and maintain water quality to safeguard the health of pool users.

Central to this Standard is risk assessment which provides an opportunity to improve the effective management of pool water quality for all pool operators and users. Pool risk management plans can also be used to operate the pools' water quality outside the requirements of NZS 5826:2010.

NZS 5826:2010 covers methods of water treatment and safe handling of swimming pool chemicals for fresh water and seawater swimming, spa pools and geothermal pools. It also requires all public pools to have 'risk management plans' in place to ensure that swimming pools are operated as safely as possible. Compliance with NZS 5826:2010 is a PoolSafe requirement and it is cited in the Public Health Bill 2007.

The objective of this Standard is to ensure the water in swimming pools is maintained to safe chemical and microbiological levels to:

- Protect swimmers from unsafe organisms that cause disease
- Safeguard swimmers against the discomfort of chemical burns to skin and mucous membranes
- Minimise damage to the pool and associated equipment
- Have a pool which appears clean and sparkling.

### 2.1 Water contamination

Swimming pool water can quickly become contaminated by swimmers who bring dirt, sweat, body fats, faecal matter, oral and nasal discharges into the water, as well as hair and lint from swimming togs. Windblown debris and material from the pool surrounds can also enter the pool and add to the pollution.

### 2.2 Measures to keep water clean

In order to ensure the water remains chemically and microbiologically safe, regular testing is required and the frequency of these tests is specified in NZS 5826:2010. Each facility needs:

- An efficient mechanical filter system and chemical treatment of the water to maintain pool water in a safe and hygienic condition for swimmers
- To be aware of instantaneous bather load, or the maximum number of people using the pool at any one time. On a hot day, loss of disinfecting chlorine through high ultra violet levels and overuse by swimmers can lead to poor performance of the filters and chemical treatment. The resulting degradation of the water can lead to a high health risk for swimmers.

### 2.3 Key information in the NZ Standard

The following information is described in detail in the Pool Water Quality Standard:

**Pool water quality characteristics:** the desired values for correct pH, alkalinity, calcium hardness, Free Available Chlorine, total chlorine levels and other features which make up the required pool water quality characteristics which include the chemical requirements, desired values or operating ranges and frequency of testing.

**Microbiological monitoring:** A requirement of the Standard is for monthly microbiological monitoring to guard against harmful organisms in the water. This testing cannot be carried out by facility staff and requires pool water samples to be sent away to laboratories specialising in water treatment. The local public health office can provide the location of the nearest testing laboratory. Refer to the Introduction chapter for contact details.

**Incident procedures:** Advice is provided in the Standard appendix on the procedures to be followed in the event of a faecal discharge or a diarrhoea incident, which has the potential to introduce *Giardia* or *Cryptosporidium* to pool water.

**Chemical handling:** Guidance is also provided on the safe handling and storage of potentially unstable and explosive pool chemicals.

Another implication of the Standard is that school pools are classified as 'public pools'. For public pools the operation of the water treatment system is the responsibility of people holding NZQA unit standards in swimming pool water quality. The management of pool water quality is required to be under continuous technical supervision with the qualified people readily accessible when the pool is operating".

## 2.4 Pool risk management plan

A Pool Risk Management Plan is a systematic assessment of every aspect of providing safe and aesthetically acceptable pool water. It identifies the events that can cause the water quality to deteriorate and provides appropriate management practices to reduce the likelihood of adverse events and mitigate their effects if they do occur. It covers aspects of pool water quality treatment, contamination and event management.

Key areas covered by the pool risk management plan are:

<b>General monitoring</b>	Covers the risks with the collection of samples of pool water and their analysis
<b>Staff training</b>	The ability of staff to make correct decisions regarding the production and maintenance of good pool water
<b>Media filtration without flocculation</b>	Events that may alter the effectiveness of media filtration and their impact
<b>Media filtration with flocculation</b>	Events that may alter the effectiveness of media filtration using chemical enhancements (flocculation) and their impact
<b>Pre-coat filtration</b>	Events that may occur during the pre-coat filtration process that could affect the effectiveness of the process and their impact
<b>Chlorine disinfection</b>	Assesses events that may result in the chlorine disinfection process failing, and the impact of the failure
<b>Chlorine dioxide disinfection</b>	Assesses events that may result in the chlorine dioxide disinfection process failing, and the impact of the failure
<b>Ozone disinfection</b>	Assesses events that may result in the ozone disinfection process failing, and the impact of the failure
<b>Disinfection by ultraviolet irradiation</b>	Assesses events that may result in the ultraviolet irradiation process failing, and the impact of the failure
<b>pH adjustment</b>	Events that may occur during the pH adjustment process and their impact

<b>Pump operation</b>	Assess the risks from recirculation and chemical dose pumps not working properly
<b>Alternative treatment solutions</b>	Identifies the risks involved with using alternative treatment, not identified elsewhere in the Standard

## 2.5 Microbiological and chemical water tests

Four different tests are carried out monthly to test for microorganisms.

<b>Standard plate count (HPC)</b>	Also known as heterotrophic plate count or HPC. This is a measure of the live bacteria in a pool water sample and may indicate the possible presence of other microorganisms. It gives a general idea of how well the chlorination system is working. High counts of bacteria may be indicative of a problem.
<b>Faecal Coliform count</b>	This is an indicator test, which looks at the presence of bacteria of faecal origin. If faecal coliforms are present, it indicates that there is a possibility that other bacteria associated with the gut such as <i>Salmonella</i> or <i>Campylobacter</i> may also be present. These bacteria can cause sickness.
<b><i>Staphylococcus aureus</i> count</b>	This bacterium can cause skin irritations especially in wounds, cuts or abrasions and can cause sickness if ingested or swallowed. It can be found in infected wounds or in the nasal cavity when someone has a cold.
<b><i>Pseudomonas aeruginosa</i> count</b>	This bacteria can be associated with eye, ear and skin infections and is often associated with spa pools.

*Staphylococcus aureus* and *Pseudomonas aeruginosa* can be relatively resistant to chlorine, and they therefore account for a large percentage of swimming pool and spa associated illness.

## 3 Water Treatment Procedures

The recommended water treatment procedures for compliance with NZS 5826:2010 are outlined below.

### 3.1 Water testing

The pool water in each body of water should be tested regularly through the day for chlorine levels, FAC, CAC and pH, with details recorded for each test. An independent laboratory may also test for these and bacteria levels on a regular basis.

Facilities are required to keep good water records including information on water quality test results, corrective actions, and chemical adjustments or additions. Records should also be kept of bather loads and user incidents that may affect water quality such as faecal accidents.

#### **Seasonal pools**

- Water testing should be undertaken thoroughly before the pool is opened for use and while the pool is being used
- It is not expected that a water-testing regime will be continued when seasonal pools are closed or while the facility is not in use.

#### **Public pools**

Each body of water:

- Should be tested prior to opening every day, including spas
- Every 3 hours for main pools during opening hours
- Every 2 hours for spa pools during opening hours
- For low usage facilities, testing should be undertaken on a regular basis during opening hours to maintain compliance with the standard.

Microbiological testing should be undertaken:

- At the beginning of the season
- Monthly thereafter
- When the pool does not comply with chemical parameters over a period of half a day
- More frequently if there is a problem.

If you are using an online auto-dosing system, you can reduce the water testing frequency to no fewer than two samples a day for FAC and pH testing.



### 3.2 Frequency of chemical testing procedures for swimming pools

As per NZS 5826:2010 Table 2

Test	Frequency
<i>pH</i>	Prior to daily use then every three hours
<i>Alkalinity</i>	Weekly
<i>Calcium hardness</i>	Monthly
<i>Free available chlorine (FAC)</i>	Prior to daily use then every three hours
<i>Total available chlorine</i>	Daily
<i>Cyanuric acid</i>	At the beginning of season, then fortnightly
<i>Cyanuric acid if chlorinated cyanurates used</i>	At the beginning of season, then fortnightly
<i>Chlorine if saline pool water is electrolysed</i>	At the beginning of season, then weekly
<i>Total dissolved solids</i>	At the beginning of season, then weekly

### 3.3 Frequency of chemical testing procedures for spa pools

As per NZS 5826:2010 Table 3

Test	Frequency
<i>pH</i>	Prior to daily use then every two hours
<i>Alkalinity</i>	After filling, then weekly
<i>Calcium hardness</i>	After filling, then weekly
<i>Free available chlorine (FAC)</i>	Prior to daily use then every two hours
<i>Total chlorine (Bromine)</i>	Daily
<i>Total dissolved solids (TDS)</i>	Daily

### 3.4 Microbiological water quality criteria

As per NZS 5826:2010 Table 4

<b>Test</b>	<b>Level</b>
<b><i>Standard plate count</i></b>	Less than 200 per mL
<b><i>Faecal coliforms or Escherichia coli (E.Coli)</i></b>	Less than 1 per 100mL
<b><i>Staphylococcus aureus</i></b>	Less than 100 per 100mL
<b><i>Pseudomonas aeruginosa</i></b>	Less than 10 per 100mL

### 3.5 Chemical water quality criteria for swimming pools and spas

As per NZS 5826:2010 Table 1

Characteristic	Value			Comments
	Lowest	Highest	Desirable	
<b>pH</b>	7.2	8.0	7.4 – 7.6	<p><b>Too low:</b> Rapid dissipation of disinfectant, plaster and concrete etching, eye discomfort, corrosion of metals, vinyl liner damage</p> <p><b>Too high:</b> Low chlorine efficacy, scale formation, cloudy water, eye discomfort. Under proven management systems, pH levels may be above the highest values given.</p>
<b>Alkalinity</b>				
(a) Gas chlorinated pools and pools using trichloroisocyanuric acid	100.0 mg/L	200.0 mg/L	120.0 – 150.0 mg/L	<p>For both (a) and (b)</p> <p><b>Too low:</b> pH bounce, corrosion tendency</p> <p><b>Too high:</b> Cloudy water, increased scaling potential, pH tends to be too high.</p>
(b) Pools with other forms of chlorine	50.0 mg/L	200.0 mg/L	60.0 – 120.0 mg/L	
<b>Calcium hardness</b>	40.0 mg/L	300.0 mg/L	Refer to SI (Saturation Index)	<p><b>Too low:</b> Etching and corrosion</p> <p><b>Too high:</b> Scaling and cloudy water</p>
<b>Free available chlorine (FAC)</b>				
(a) Swimming pool				
Chlorine alone	1.5 mg/L	7.0 mg/L	2.5 – 5.0 mg/L	<p>For both swimming pools and spa pools, a heavy pool bathing load may require operation at or near maximum levels</p> <p>See the risk management plan for FAC management</p>
Chlorine + other	0.5 mg/L	5.0 mg/L	1.0 – 2.5 mg/L	
(b) Spa pools and hot tubs				
Chlorine alone	2.0 mg/L	7.0 mg/L	3.0 – 5.0 mg/L	<p>Chlorine + Other means Chlorine plus Ozone, UV or ClO<sub>2</sub></p>
Chlorine + other	1.5 mg/L	7.0 mg/L	3.0 – 5.0 mg/L	

Characteristic	Value			Comments
<b>Combined available chlorine (CAC)</b>	Not detectable	1.5 mg/L	Less than 0.5 mg/L	High combined chlorine results in reduced chemical efficiency. Take remedial action to establish break point chlorination High combined chlorine residuals give rise to a sharp chlorinous odour and eye irritations.
<b>Total bromine Swimming pools</b>	4.0 mg/L	10.0 mg/L	4.0 – 6.0 mg/L	If using chlorine test kit multiply the reading by 2.2 for total bromine
<b>Total bromine Spas</b>	4.0 mg/L	10.0 mg/L	5.0 – 7.0 mg/L	
<b>Cyanuric acid</b>	25.0 mg/L	100.0 mg/L	30.0 – 60.0 mg/L	<b>Too low:</b> Chlorine residual rapidly destroyed by sunlight <b>Too high:</b> reduces the chlorine's efficacy
<b>Total dissolved solids (TDS)</b>		Less than 2000.0 mg/L above make-up water just for spa pools.	Less than 1000.0 mg/L above make-up water just for swimming pools	TDS indicates a build-up of impurities which should be controlled by partial drain/refill with fresh water, typically at a rate of 30 L/ person/day These TDS limits do not apply to salt chlorinated pools. Follow the manufacturer's instructions.

### 3.6 Technical advisors on water quality and plant operations

<p><b><i>Environmental Laboratory Services – Eurofins</i></b></p> <p>Eurofins Christchurch  Unit 1/8 Dakota Crescent  Wigram 8042  Christchurch</p> <p>Tel: 03 343 5227  Fax: 03 343 5226  <a href="mailto:info@eurofins.co.nz">info@eurofins.co.nz</a>  <a href="http://www.eurofins.co.nz">www.eurofins.co.nz</a></p>	<p><b><i>Environmental Laboratory Services – Eurofins</i></b></p> <p>Eurofins Wellington  85 Port Road, Seaview  Lower Hutt  Wellington</p> <p>Tel: (04) 576-5016  0800 576 5016  Fax: (04) 576 5017  <a href="mailto:info@eurofins.co.nz">info@eurofins.co.nz</a>  <a href="http://www.eurofins.co.nz">www.eurofins.co.nz</a></p>	<p><b><i>Opus International Consultants</i></b></p> <p>Sarah Cresswell  PO Box 30 845,  Lower Hutt 5040  Phone: 04 587 0666  Mobile 027 273 6623  <a href="mailto:sarah.cresswell@opus.co.nz">sarah.cresswell@opus.co.nz</a></p>
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- Templates:**
- Water testing procedures
  - Water testing instructions
  - Water test range and solutions



# 4 Managing Filtration and Circulation Systems

## 4.1 Operations

There is a range of filtration systems used by aquatic facilities and it is important that routine checking and specialised maintenance are carried out to ensure reliable system operation, economic performance and maximum component performance.

The general requirements for plant management are:

- Operational checking
- Preventative maintenance
- Call outs for faults
- Plant room and equipment presentation.

The periods between programmed preventative maintenance should be set based on the equipment operating under average conditions. Where components are not duplicated to allow for maintenance work to be undertaken, the maintenance programme will need to be planned to coincide with the facility maintenance programme and facility closure.

Operational checking of a non-specialised nature and some operational recording can be undertaken by pool staff. These checks can be valuable aids in detecting abnormal operations leading to more significant fault conditions. These checks can be carried out on a weekly and monthly programme.

All routine operational checking, maintenance and replacement or major overhaul of plant components should be recorded. Callouts should also be recorded and reviewed as they can assist in establishing where additional routine maintenance may be required or where a different type of component is necessary.

When equipment maintenance is being carried out, normal safety procedures must be followed. It is essential that all plant and equipment is rendered inoperative and kept safe while being worked on. All electrically operated equipment must be isolated so it cannot be operated from a remote switch.

Service personnel need to be instructed on the facility's health and safety policies and need to have access to equipment manuals and records. Appropriate service personnel should only work on equipment that they are qualified to work on.



**Templates:** Daily plant checks  
Plant room checklist  
Operational check schedule – boiler room  
Planning chart for preventative maintenance

## 4.2 Handling chemicals

Pool chemicals should be considered hazardous. Prior to chemical use and storage, staff should refer to the relevant material safety data sheets (MSDS) and use systems that comply with the Hazardous Substances and New Organisms (HSNO) Act. Three chemicals used at pool facilities (Chlorine, Diatomaceous Earth and Calcium Hypochlorite) are regulated under HSNO and require facilities to have an approved handler. An approved handler must undertake training and hold an Approved Handler Test Certificate. Approved handler certification qualifies people to handle very hazardous substances safely and to provide guidance and assistance to other people handling the substances.

Failure to follow correct chemical handling procedures could result in serious injury or death. Occupational Safety and Health (OSH) requirements and manufacturer's chemical handling and storage requirements should be followed. Safety data sheets are available for all chemicals and should be obtained from the supplier or manufacturer of the product.

In general terms, chemical storage areas should be cool, dry, well ventilated and secure, and there should be provision for separation of chemicals.

Chlorine-based compounds are the most volatile compounds used for swimming pool treatment and special care should be taken with them. They should not be mixed with organic compounds or any other products and, in particular, cyanuric acid-based products should not be stored with chlorine-based products.

Instructions on emergency procedures, safe storage and handling procedures should be prominently displayed in the area where chemicals are handled and mixed. Full personal protective equipment (PPE) must be provided and worn when handling chemicals. It is important that all staff who use this equipment are fully aware of the correct way of wearing the PPE, and it must correctly fit all staff. One size does not fit all!

Follow manufacturer's or supplier's instructions when disposing of chemicals.

**Template:** Emergency spill procedure flowchart



*Further information*

<http://www.osh.dol.govt.nz>

<http://www.business.govt.nz/worksafe/notifications-forms/hsno-activities-certification-qualifications-licensing/certification-of-people/approved-handlers>

### 4.3 Managing filters

There is a range of machinery, equipment and systems used in the aquatic industry, which are unique to each facility. The plant room should have detailed procedures and instructions for the operation of equipment in the facility and these should be referred to at all times.

Having clean filters is essential to the effectiveness and operation of the water filtration system and pumping equipment. The performance of filters can be monitored through pressure or vacuum gauge readings or by visual observations of media. Staff need to monitor the levels of water quality and pressure gauge readings regularly and refer to their NOP for guidance on when replacement of filtration media used is necessary.

Depending on the system used, some facilities may decide to include regular filtration cleaning/backwashing as part of their weekly routine for smaller pools such as spa and toddler pools.

Cleaning filters will generally involve either backwashing or use of chemicals that will require disposal.

### 4.4 Waste disposal

All pools generate waste that needs disposal, whether it is waste water from pools or chemicals used in filtration systems. It is important to be aware of the local bylaws surrounding waste disposal.

When dumping pool water into the local waste water system, it is good practice to reduce the chemical levels in the water prior to discharge, ensure a slow release of water at times when the waste water system is not in high use, so the system does not become overloaded.

Under no circumstance should pool waste water be discharged into a storm water system.

## 5 Heating and Ventilation

The essential requirements for heating and ventilating a covered pool are:

- Elimination of odours from pool chemicals and humans
- Prevention of condensation
- Maintaining the air temperature to be acceptable to the average swimmer.

For a covered pool, the prevention of condensation created by evaporation from the pool surface is vital. Evaporation is at its minimum when the hall air temperature is close to the pool temperature. Equally important is the ability of the ventilation plant to replace the air at a sufficient rate to prevent moisture and odours. Air replacement and heating is a significant use of energy and therefore the ventilation system needs to be maintained to ensure optimum efficiency. Heating and ventilation plant installations that include systems to recover heat from exhausted air are recommended.

Effective mechanical ventilation of the boiler plant room area is also essential to prevent contamination of electrical equipment and erosion of boiler tubes by chlorine-laden air from the pool hall.

### 5.1 Use of electrical equipment

Care when using electrical equipment is always important, but even more so in an aquatic facility due to the presence of water. All portable electrical equipment, including leads, should be tested and tagged annually by a registered service technician or electrician. Whenever used, portable equipment should always be plugged into a residual-current device (RCD) electrical outlet or a portable RCD should be used.

Common electrical equipment at an aquatic facility include; inflatable blowers, pool vacuum cleaners, poolside scrubbers, water blasters and wet vacuums. When using cords poolside, staff need to be aware of hazards in terms of cords being close to water, especially puddles on the ground, and cords need to be positioned so as not to cause a hazard for customers and staff walking past.

All contractors working on the site should have all their electrical equipment tested and tagged, and they must be shown which electrical outlets have RCD on them as part of their health and safety induction to the facility.

## 6 Cleaning

Clean and tidy public areas give positive messages to customers and can encourage them to help keep the facility tidy. Cleaning all public and staff areas is also essential for health and hygiene. During the day changing rooms and toilets should be regularly checked and cleaned where required, in addition to the daily cleaning as specified in the NOP. Staff need to be careful of customers while cleaning during the day. The area should be closed while cleaning, and safety signs displayed where appropriate. Use of noisy cleaning equipment in changing rooms when being used by customers should be avoided as this distracts from an enjoyable customer experience.

Poolside should be cleaned daily. Attention should be paid to cleaning the tiles surrounding the pool, and the scum-lines in the pool.

It is also important that plant rooms are kept tidy and cleaned regularly. The effective use of a pool facility is dependant on reliable plant operation. Clean, uncluttered, freshly painted plant-rooms will normally reflect the attention paid to regular preventative maintenance and effective plant operation. A cluttered and messy plant room can also become a hazardous environment for those who work in them.

**Templates:**

- Cleaning public facilities procedures
- Public changing rooms checklist
- Staff changing room checklist



## 7 Templates and Worksheets

- 7.1 Water testing procedures
- 7.2 Water testing instructions
- 7.3 Water test range and solutions
- 7.4 Water test sheets – main pool
- 7.5 Water test sheets – spa pool
- 7.6 Daily plant check
- 7.7 Plant room checklist
- 7.8 Operational check schedule – boiler plant
- 7.9 Planning chart for preventative maintenance
- 7.10 Fault call out report
- 7.11 Emergency spill procedure flowchart
- 7.12 Cleaning public facilities procedures
- 7.13 Public changing rooms checklist
- 7.14 Staff changing rooms checklist

## 7.1 Water testing procedures

### Minimum frequency of chemical testing procedures for swimming pools

As per NZS 5826:2010 Table 2

Test	Frequency
<i>pH</i>	Prior to daily use then every three hours
<i>Alkalinity</i>	Weekly
<i>Calcium hardness</i>	Monthly
<i>Free available chlorine</i>	Prior to daily use then every three hours
<i>Total available chlorine</i>	Daily
<i>Cyanuric acid</i>	At the beginning of season, then fortnightly
<i>Cyanuric acid if chlorinated cyanurates used</i>	At the beginning of season, then fortnightly
<i>Chlorine if saline pool water is electrolysed</i>	At the beginning of season, then weekly
<i>Total dissolved solids</i>	At the beginning of season, then weekly

### Minimum frequency of chemical testing procedures for spa pools

As per NZS 5826:2010 Table 3

Test	Frequency
<i>pH</i>	Prior to daily use then every two hours
<i>Alkalinity</i>	After filling, then weekly
<i>Calcium hardness</i>	After filling, then weekly
<i>Free available chlorine (FAC)</i>	Prior to daily use then every two hours
<i>Total chlorine (Bromine)</i>	Daily
<i>Total dissolved solids (TDS)</i>	Daily

## Microbiological water quality criteria

As per NZS 5826:2010 Table 4

Test	Level
<i>Standard plate count</i>	Less than 200 per mL
<i>Faecal coliforms or Escherichia coli (E.Coli)</i>	Less than 1 per 100mL
<i>Staphylococcus aureus</i>	Less than 100 per 100mL
<i>Pseudomonas aeruginosa</i>	Less than 10 per 100mL

## Chemical water quality criteria for swimming pools and spas

As per NZS 5826:2010 Table 1

Characteristic	Value			Comments
	Lowest	Highest	Desirable	
<b>pH</b>	7.2	8.0	7.4 – 7.6	<p><b>Too low:</b> Rapid dissipation of disinfectant, plaster and concrete etching, eye discomfort, corrosion of metals, vinyl liner damage</p> <p><b>Too high:</b> Low chlorine efficacy, scale formation, cloudy water, eye discomfort. Under proven management systems, pH levels may be above the highest values given.</p>
<b>Alkalinity</b>				<p>For both (a) and (b)</p> <p><b>Too low:</b> pH bounce, corrosion tendency</p> <p><b>Too high:</b> Cloudy water, increased scaling potential, pH tends to be too high.</p>
(a) Gas chlorinated pools and pools using trichloroisocyanuric acid	100.0 mg/L	200.0 mg/L	120.0 – 150.0 mg/L	
(b) Pools with other forms of chlorine	50.0 mg/L	200.0 mg/L	60.0 – 120.0 mg/L	
<b>Calcium hardness</b>	40.0 mg/L	300.0 mg/L	Refer to SI (Saturation Index)	<p><b>Too low:</b> Etching and corrosion</p> <p><b>Too high:</b> Scaling and cloudy water</p>
<b>Free available chlorine (FAC)</b>				<p>For both swimming pools and spa pools, a heavy pool bathing load may require operation at or near maximum levels</p> <p>See the risk management plan for FAC management</p> <p>Chlorine + Other means Chlorine plus Ozone, UV or ClO<sub>2</sub></p>
(a) Swimming pool				
Chlorine alone	1.5 mg/L	7.0 mg/L	2.5 – 5.0 mg/L	
Chlorine + other	0.5 mg/L	5.0 mg/L	1.0 – 2.5 mg/L	
(b) Spa pools and hot tubs				
Chlorine alone	2.0 mg/L	7.0 mg/L	3.0 – 5.0 mg/L	
Chlorine + other	1.5 mg/L	7.0 mg/L	3.0 – 5.0 mg/L	
<b>Combined available</b>	Not	1.5 mg/L	Less than	High combined chlorine results in

Characteristic	Value			Comments
<b>chlorine (CAC)</b>	detectable		0.5 mg/L	reduced chemical efficiency. Take remedial action to establish break point chlorination  High combined chlorine residuals give rise to a sharp chlorinous odour and eye irritations.
<b>Total bromine Swimming pools</b>	4.0 mg/L	10.0 mg/L	4.0 – 6.0 mg/L	If using chlorine test kit multiply the reading by 2.2 for total bromine
<b>Total bromine Spas</b>	4.0 mg/L	10.0 mg/L	5.0 – 7.0 mg/L	
<b>Cyanuric acid</b>	25.0 mg/L	100.0 mg/L	30.0 – 60.0 mg/L	<b>Too low:</b> Chlorine residual rapidly destroyed by sunlight  <b>Too high:</b> reduces the chlorine's efficacy
<b>Total dissolved solids (TDS)</b>		Less than 2000.0 mg/L above make-up water just for spa pools.	Less than 1000.0 mg/L above make-up water just for swimming pools	TDS indicates a build-up of impurities which should be controlled by partial drain/refill with fresh water, typically at a rate of 30 L/ person/day  These TDS limits do not apply to salt chlorinated pools. Follow the manufacturer's instructions.



## 7.2 Water testing instructions

### 7.5 Water testing procedure

#### To calibrate the photometer.

- Switch the unit on using the ON/OFF switch.
- Select Cl (chlorine test) using the MODE key.
- Fill a clean vial with the water sample up to the 10ml mark, replace the cap and dry the outside of the vial using a paper towel. Place the vial into the sample chamber with the triangle on the vial aligned with the triangle on the sample chamber.
- Press the ZERO/TEST key.
- The display will show 0.0.0, this means that the photometer has calibrated itself.

#### (a) To test for F.A.C (free available chlorine)

- Remove the vial from the sample chamber.
- Without handling the tablet, add one DPD No.1 tablet to the vial. Using a clean stirring rod, crush the tablet and stir to dissolve. Replace the cap and dry the outside of the vial using a paper towel. Place the vial into the sample chamber with the triangle on the vial aligned with the triangle on the sample chamber.
- Press the ZERO/TEST key.
- The result is shown on the display in mg/l free chlorine.

#### (b) To test for T.A.C (total available chlorine)

- Remove the vial from the sample chamber.
- Without handling the tablet, add one DPD No.3 tablet to the vial. Using a clean stirring rod, crush the tablet and stir to dissolve. Replace the cap and dry the outside of the vial using a paper towel.
- **Wait for a colour reaction time of two minutes.**
- Place the vial into the sample chamber with the triangle on the vial aligned with the triangle on the sample chamber.
- Press the ZERO/TEST key.
- The result is shown on the display in mg/l total chlorine.

#### (c) To test for C.A.C (combined available chlorine)

- Combined available chlorine = Total available chlorine – Free available chlorine.



## 7.3 Water test range and solutions

### 7.9 Water Test Range and Solutions

#### FAC

Main Pool: 2.0ppm minimum

Main pool is below 2.0ppm but above 1.5ppm leave to recover but re test in 30mins. If the result is under 1ppm ring the operations team leader and check the hypo tank.

Main Pool: 5ppm maximum

A reading above 5ppm is a warning sign of other issues inform the operations team leader.

Spa Pool: 2ppm minimum

If the pool is below 2ppm then manually dose 500mls (15%) and re test in a further 20mins, inform the operations team leader if this problem continues as the spa pool may need to be closed.

Spa Pool: 8ppm maximum

If the spa pool reaches 8ppm plus then closes the spa to public, turn off the chlorine pump and turn on the bubbles until the level goes down to 7ppm then re open.

Toddlers Pool: 2ppm minimum

Toddler's pool is below 2.0ppm leave to recover but re test in 30mins. If the result is under 1ppm or doesn't recovery close the pool to public and ring the operations team leader. Manually refill from Main pool re check in 20mins.

Toddlers Pool: 5ppm maximum

The Toddlers pool can not go higher and will need to be shut to public, dump water. Inform the operations team leader.

Learners Pool: 2ppm minimum

If the learners pool is below 2.0ppm but above 1.5ppm manually dose with 1 litre (15%) re check in 30mins. If the result is under 1ppm or doesn't recovery close the pool to public and ring the operations team leader.

Learners Pool: 5ppm maximum

The learners pool can to a maximum of 8ppm before it needs to be shut to public, but once the learners pool goes over 6ppm turn off the chlorine pump, dump water. Inform Operations team leader.

#### CAC's

If any of the pools reach a CAC reading of 2ppm you need to inform the Operations Team Leader and follow the guide below.

Main Pool – dump water for 5mins

Learners Pool – dump water 10mins inform Operations Team Leader, we may need to close

Toddlers Pool – dump totally and refill

Spa Pool – Backwash, Totally dump if it gets to 2.5ppm

#### Alkalinity

Below level 60; add bi carbonate to increase – 5kg for every 15 increase





## 7.6 Daily plant checks

Record details of abnormal readings in comments field and inform Team Leader / Manager.

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

	Y/N							Comment
<b>Upstairs plant room</b>								
All red lights on								
Any fault lights on heat pump board								
Private Spa Plant Room								
Circulation pump going								
Heater on and going (record temp)								
Any leaks								
Tabs total in chlorinator? (max. 1 tab)								
<b>Poolside spa plant room</b>								
Circulation pump going								
Heater on and going								
Any leaks								
Is heat pump downstairs going (record temp)								
Chlorine computer on								
<b>Main plant room</b>								
Chlorine computer on								
Check CO <sup>2</sup> bottles. (pH control) – any empty?								
Is salt level above red line – clean out scum from top of salt tank, tidy up rubbish, 10 bags?								
Circulation pump going								
Is UV system going (record reading)								
Pressure gauges normal – below backwash mark								
Boiler No.1 going								
No.2 going								
Any fault lights on								
Boiler ventilation going								
Any leaks								
Compressor between 45 – 85psi (record)								
<b>Learner's plant room (tunnel)</b>								
Slurry tank above half full, hose up DE spills								
Cathodic protection light on?								
Is UV system going (record reading)								
Any red lights on control panel								

Water level reading				
Water level in the filter tank at the correct level				
Main pool temperature				
Learners pool temperature				

Comments
<i>Any comments or unusual sounds or readings please record below.</i>
Morning checks
Afternoon checks
Evening checks

## 7.7 Plant room checklist

### Plant room checklist

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Check	Quantity	Faults	Description
<i>Automatic controller dosing lines</i>			
<i>Pre-coat mixing tank</i>			
<i>Sodium bicarbonate tank &amp; pumps</i>			
<i>Sodium bisulphate tanks &amp; pump</i>			
<i>Boiler room e.g. fault lights</i>			
<i>Chlorine dosing lines e.g. splits</i>			
<i>CO<sub>2</sub> dosing lines upper &amp; lower levels</i>			
<i>Heat exchangers e.g. fault lights</i>			
<i>Blowers – splash</i>			
<i>Blowers – spa</i>			
<i>Pool filters</i>			
<i>Pool pumps and motors</i>			
<i>Lint pots</i>			
<i>Control panel (downstairs)</i>			
<i>Balance tanks (leaks and faults)</i>			

<b>Check</b>	<b>Quantity</b>	<b>Faults</b>	<b>Description</b>
<i>Gloves - light duty</i>			
<i>- heavy duty</i>			
<i>Jackets</i>			
<i>Pants</i>			
<i>Respirators</i>			
<i>Breathing apparatus</i>			
<i>Gumboots</i>			
<i>Hard hats</i>			
<i>Hearing protection</i>			



## 7.8 Weekly operational check schedule - boiler plant

Weekly									
Date:		Checking Done By:							
Check	Normal	Actual				Abnormal conditions			
		wk 1	wk 2	wk 3	wk 4	wk 1	wk 2	wk 3	wk 4
Check boiler flow temperature Gauge P.	78 – 90°C								
Check primary circuit water pressure Gauge Q.	At red Marker								
Check admin circuit return Temp Gauge K.	78 – 90°C								
Leakage or abnormal noise from boilers									
Both circulating pumps running?									

## 7.9 Monthly operational check schedule - boiler plant

Monthly		
Date:	Checking Done By:	
	Reading	Abnormal Conditions
Isolate burner at control switch and reinstate. Witness normal start up.		
Previous gas meter reading		
Current gas meter reading		
No of days since previous reading		
Total gas used since last reading (m <sup>3</sup> )		
Average gas used per day since last reading (m <sup>3</sup> )		
Clean up around boiler plant room. Check metal work for corrosion.		

## 7.10 Planning chart for preventative maintenance

Key	
P	Selected Pool Staff
S	Supplier's representative
T	Specialised Trades

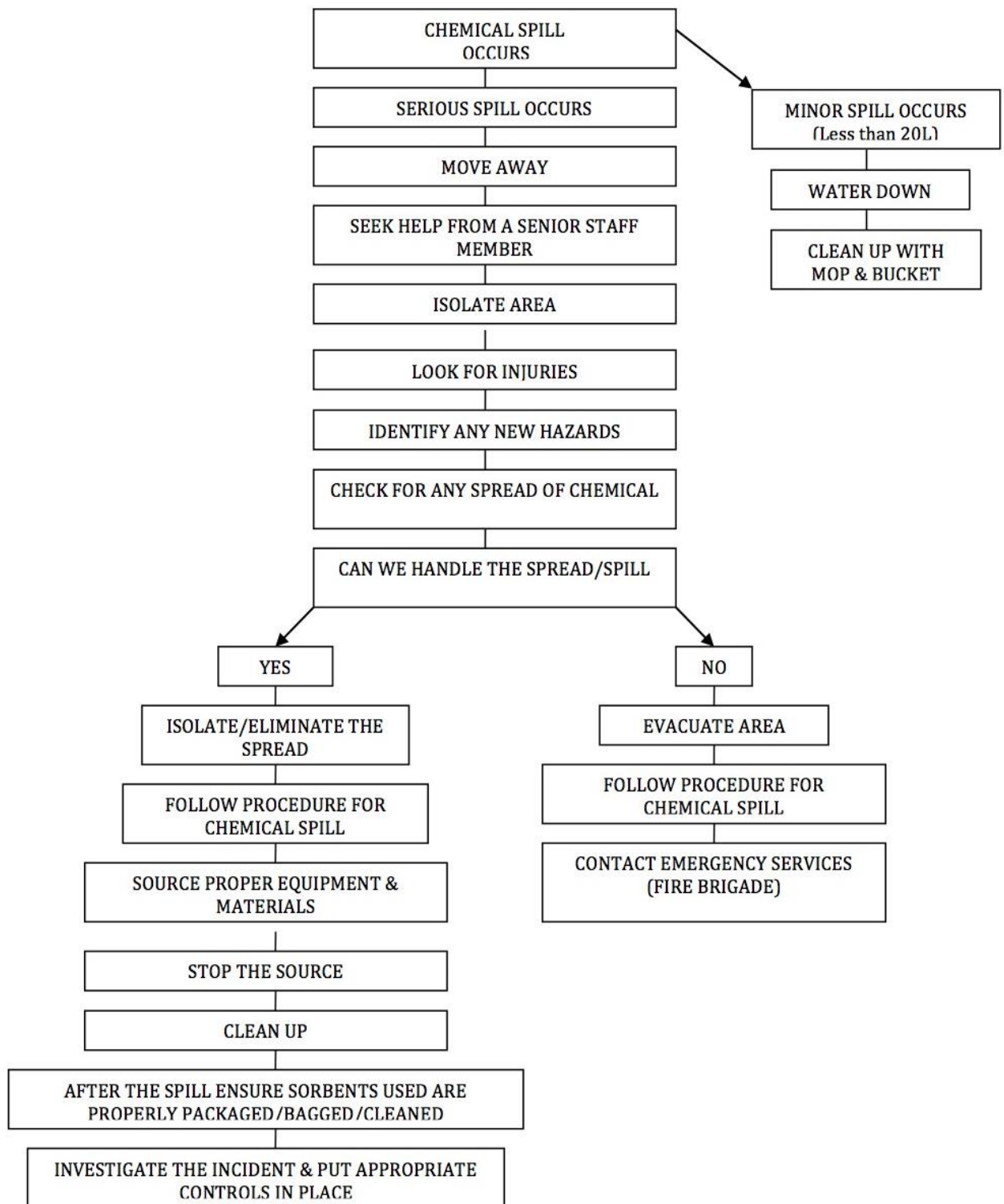
Preventative maintenance checklist (specialised)		Hours if run continuously (24hr/day)								
		24	168	720	2,016	4,032	8,760	17,520	26,280	43,800
		Frequency of checks								
Equipment Item	No. Units	D	W	M	3M	6M	Y	2Y	3Y	5Y
Gas train & burners	2						T		T	
Axial flow fans	4					T	T		T	
Unit heaters (change rooms)	3						T			T
Powered roof ventilators	2						T		T	
Ductwork system									T	T
Glandless circulating pumps	3						T		T	
Base plate circulating pumps	3					T	T			T
Heating coils	2								T	T
Heating circuit pipe work							T		T	T
Air filter housings	2						T			T
Control panels	4						T		T	
Electric motors	1						T		T	
Hot water boiler & flue	1					T	T			
Automatic control systems							S			
Submersible pumps	6					T	T			S
Heat exchange	2					T	T		T	

Operational checking (non specialised) by pool management staff										
Equipment Item	No. Units	D	W	M	3M	6M	Y	2Y	3Y	5Y
Boiler plant		P	P	P						
Pool heat exchanger		P	P	P						
Pool hall ventilation plant		P	P	P						
Changing room ventilation plant		P	P	P						
Control panels M1, M2		P	P	P						

## 7.11 Fault callout report

Report sheet number:	Time of call out:		
Fault notified by:			
Date:	Time:		
Fault symptoms: (give details)			
Urgent / Non urgent	Serviceman's specialisation:		
Serviceman's name:			
Time of arrival:	Time of departure:	Elapsed time:	Date:
Description of fault found: (by serviceman)			
Action taken:			
Special comments:			
Serviceman's signature:			
Acknowledgement of report by owners' representative:			
Signed:	Date:	/	/
			Cost: \$

## 7.12 Emergency spill procedure flowchart



## 7.13 Cleaning public facilities procedures

### Poolside

#### Equipment needed

- Disinfectant, scrubbing brush, gloves

#### What and how to clean

- Hose down to wet the floor
- Scrub the floor using disinfectant
- Hose down all disinfectant and rubbish into the drain
- Remove all excess rubbish that cannot be hosed down the drain
- Do not lift the drain covers to hose rubbish in. This will only block the drain
- Lock-up shifts should only need a hose down and pick up of any rubbish.

### Men's / women's toilets

#### Equipment

- Scrubbing brush, toilet brush, disinfectant, squeegee, cloth, gloves

#### What to clean

- Toilet bowls, floors, showers, walls, seats, sinks, drains, mirrors, urinals

#### How to clean the toilets

- **Toilet bowl:** scrub the bowl out with disinfectant and brush then wipe the seat with disinfectant and cloth
- **Floors:** pick up all the rubbish and hose the floor. Disinfect the floor and scrub with scrubbing brush. Squeegee to nearest drain
- **Showers:** scrub the floors and the walls with disinfectant and scrubbing brush and hose to drains
- **Walls:** check the walls for tagging and any marks that shouldn't be there, and remove
- **Seats:** check for tagging and remove with graffiti remover and a cloth
- **Sinks:** wipe down with disinfectant and cloth
- **Mirrors:** wipe down with glass cleaner and paper towels
- **Ceilings:** remove all toilet paper from ceilings
- **Drains:** clear rubbish and hair from drains
- **Urinals:** (men's only): scrub down with disinfectant and hose down.

## Family changing rooms

### Equipment

- Scrubbing brush, disinfectant, squeegee, cloth, and gloves

### What to clean

- Floors, showers, walls, seats, sinks, drains, mirrors, urinals

### How to clean

- **Floors:** pick up all the rubbish and hose the floor. Disinfect the floor and scrub with scrubbing brush. Squeegee to nearest drain
- **Showers:** scrub the floors and the walls with disinfectant and scrubbing brush and hose to drains
- **Walls:** check the walls for tagging and any marks that shouldn't be there and remove
- **Seats:** check for tagging and remove with graffiti remover and a cloth
- **Sinks:** wipe down with disinfectant and cloth
- **Ceilings:** remove all toilet paper from ceilings and walls (if any)
- **Drains:** Clear rubbish and hair from drains.

## Sauna

### Equipment

- Scrubbing brush, Clean All, stainless steel cleaner, scrubbing pad, gloves, chlorine, face mask

### What to clean

- Shower walls and floor and cubby hole floors, drinking fountain, sauna floor, and sauna seats.
- Pick up rubbish.

### How to clean

- Using scrubbing pad and stainless steel cleaner, clean around drinking fountain removing all body fat and /or dirt
- Using scrubbing brush and Clean All, scrub down all shower walls and floors removing scum and dirt from walls and floors. This includes cubby hole floors. Hose into drains and pick up excess rubbish
- Pick up rubbish under sauna seats and around the back of sauna machine. Scrape off gum
- Remove seats and scrub with disinfectant and hot water. This is to remove the body fat
- Wearing protective gear, spray chlorine where black mould is present, under seating, on the walls and behind sauna machine
- Let chlorine set for 5 minutes then wash off making sure to give it a good hose
- With the framework you would need more hot water. Pour hot water over the framework to remove the fat and scrub down framework with scrubbing brush
- Last thing to do is the floors. Scrub with disinfectant.



## Windows

### Equipment

- Spray bottle of window cleaner, squeegee and dry cloth.

### What and how to clean

- Clean all windows inside and out
- Spray window and wipe off with squeegee
- Use dry cloth to wipe residue.

## Chrome surfaces

### Equipment

- Stainless steel powder, damp cloth, dry cloth and gloves.

### What and how to clean

- Clean all chrome surfaces, fences, handrails, poles etc.
- Using the damp cloth, apply stainless steel powder to the chrome surface and wipe clean
- Once clean, wipe residue with a dry cloth.

## Kitchen

### Equipment

- Disinfectant, dish liquid, mop, bucket, cloth, broom, scrubbing pad, rubbish bags.

### What to clean

- Oven (inside and out), floors, tables, microwave, dishes, bench, sink, fridge (inside and out), rubbish bins.

### How to clean

- **Oven:** (inside and out): get some warm water with dish washing liquid in it and a scrubbing pad and scrub top of oven and the inside
- **Tables:** wipe table with a cloth and warm water with dishwashing liquid
- **Dishes:** fill the sink with warm or hot water and dish liquid. Wash all dirty dishes and wipe down the bench
- **Sink:** when you have done the dishes clean the sink and the drains
- **Microwave:** take the glass plate out and wash it. Clean the microwave out with a warm, damp cloth. Return glass plate in once microwave is clean
- **Refrigerator:** take out old food and wipe down fridge with warm damp cloth both inside and out
- **Floors:** Sweep up all rubbish and place in bin. Mop down floors with disinfectant and hot water
- **Rubbish bins:** Change bin if needed.

## 7.14 Public changing rooms checklist

Men's public changing room			
Check	Quantity	Faults	Description
Door hinges			
Door locks			
Seats			
Lights			
Showers			
Hand basins			
Rubbish bins			

Women's public changing room			
Check	Quantity	Faults	Description
Door hinges			
Door locks			
Seats			
Lights			
Showers			
Hand basins			
Sanitary bins			
Rubbish bins			

Family/Accessible public changing room			
Check	Quantity	Faults	Description
Door hinges			
Door locks			
Seats			
Lights			
Showers			
Hand basins			
Sanitary bins			
Rubbish bins			

## 7.15 Staff changing rooms checklist

Men's staff changing room			
Check	Quantity	Faults	Description
Door hinges			
Door locks			
Seats			
Lights			
Showers			
Hand basins			
Rubbish bins			

Women's staff changing room			
Check	Quantity	Faults	Description
Door hinges			
Door locks			
Seats			
Lights			
Showers			
Hand basins			
Sanitary bins			
Rubbish bins			

Accessible staff changing room			
Check	Quantity	Faults	Description
Door hinges			
Door locks			
Seats			
Lights			
Showers			
Hand basins			
Sanitary bins			
Rubbish bins			



