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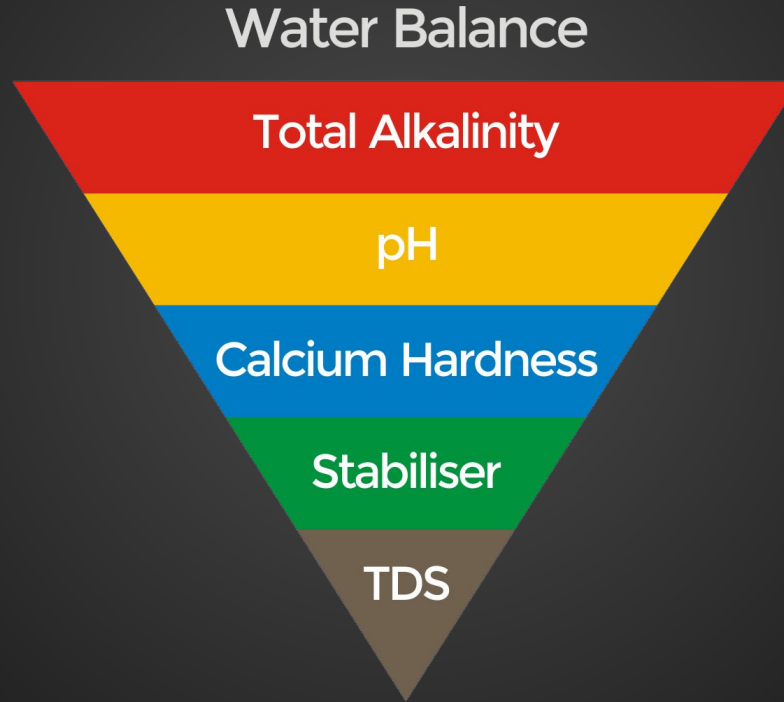
# John Charles

National Sales Manager  
Focus Products Pty Ltd

# Water Chemistry

# What is Water Balance?

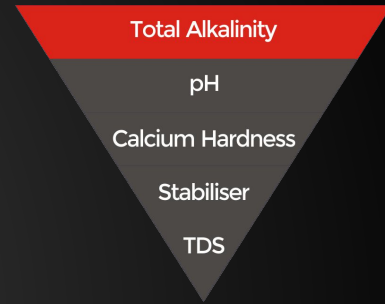
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# Water Balance

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- Total Alkalinity (TA)
- Potential Hydrogen (pH)
- Calcium Hardness (CH)
- Temperature
- Total Dissolved Solids (TDS)
- Saturation Index
- Metals



# Total Alkalinity

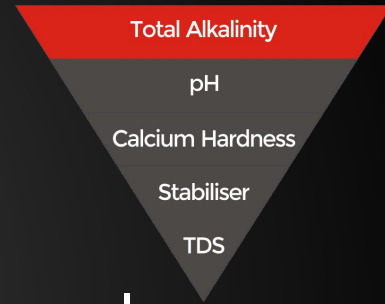
## Definition

The measure of water's ability to resist pH change

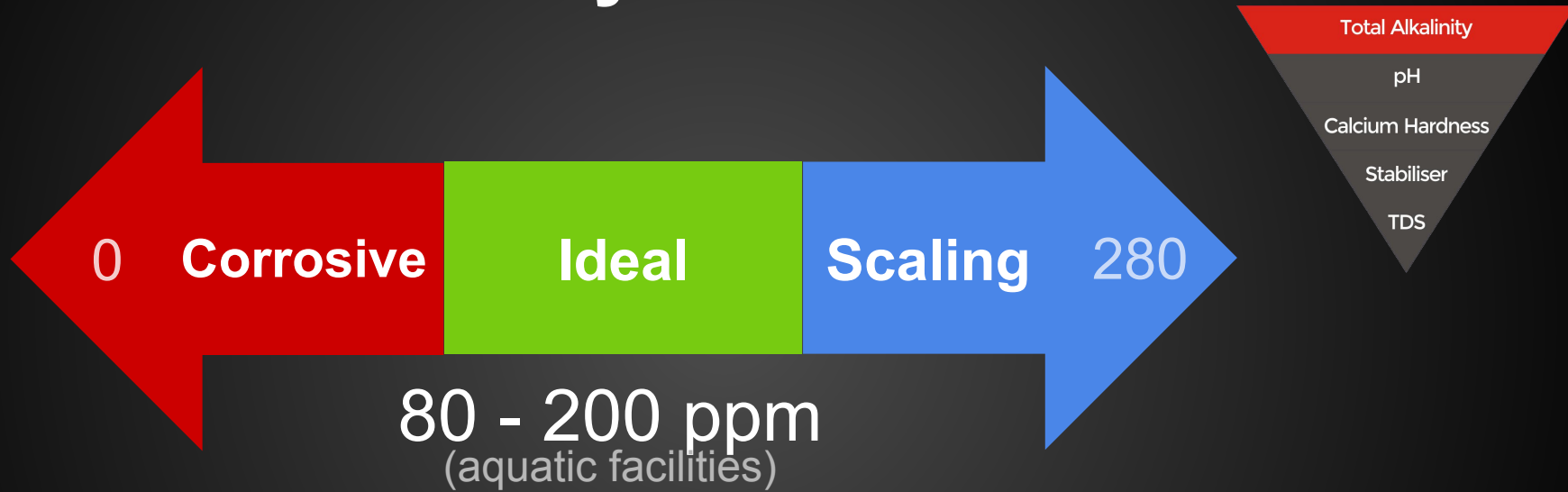
- Reserve amount of alkaline materials present in pool water.
- Made up of hydroxides, carbonates and bi-carbonates.

## Purpose

- Helps stop the pH from rapid changes



# Total Alkalinity



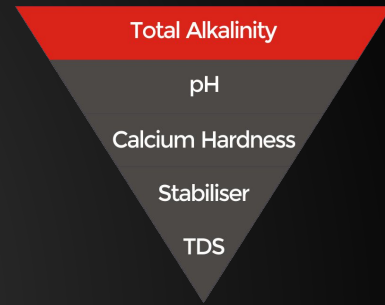
Public Health Regulations 2012 Schedule 1 - recommends minimum 80ppm and maximum 200ppm\*

\* High and low ranges are variable due to sanitation method and/or manufacturer's recommendations

# Total Alkalinity

## Factors that influence TA

- Source water.
  - Tap, bore, creek, rainwater tanks etc.
- Form of sanitation.
- Bathers.
- Acid rain.
- Dilution of pool water.

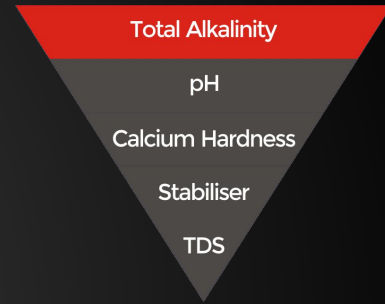




# Total Alkalinity

What happens if TA is too low?

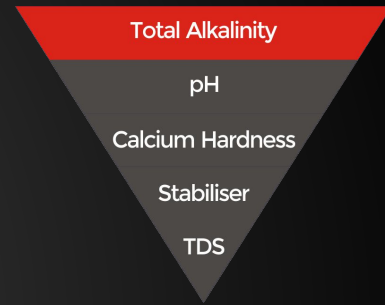
- Affects overall water balance.
- Rapid pH change or “pH Bounce”.
- Swimmer discomfort with sore eyes and dry skin.
- Can cause water to be corrosive.
  - Deterioration of interior.
  - Dissolves metal fittings and equipment.
  - Contributes to staining.



# Total Alkalinity

What happens if the TA is too high?

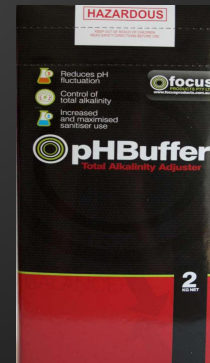
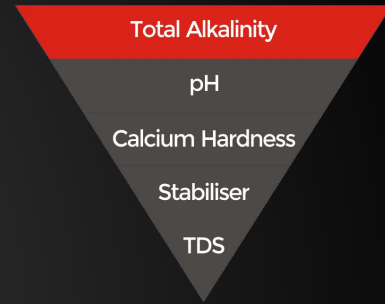
- Effects overall water balance.
- Difficult to maintain ideal pH.
- Increases acid demand.
- Swimmer discomfort with sore eyes.
- pH constantly tending to increase.
  - Causing cloudy water.
  - Scale formation on surfaces and fittings.
  - Sanitisers become less effective.



# Total Alkalinity

To increase TA

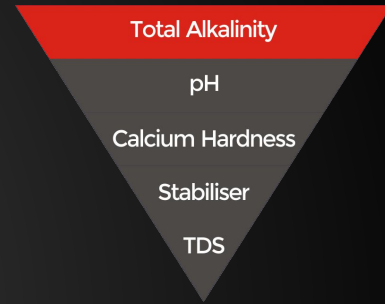
- Addition of Sodium Bicarbonate (Buffer)  
1kg in 50,000L will raise TA approximately 10ppm  
(will also increase pH slightly).



# Total Alkalinity

To decrease TA

- Addition of Sodium Bisulphate (Dry Acid)  
480g in 50,000L will lower TA approximately 10ppm.
- Addition of Hydrochloric Acid  
1L in 50,000L will lower TA approximately 10ppm.



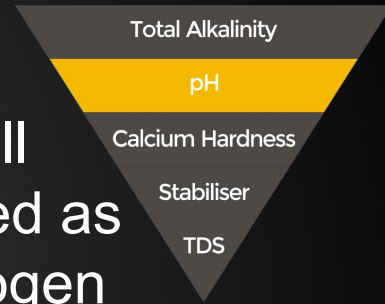
# pH

Definition: pH is a convenient measure of the overall acidity or alkalinity (not TA) in the water. It is defined as the negative logarithm of the concentration of hydrogen ions (H<sup>+</sup>) in the water.

$$\text{pH} = -\log_{10}[\text{H}^+]$$

## Purpose of pH control

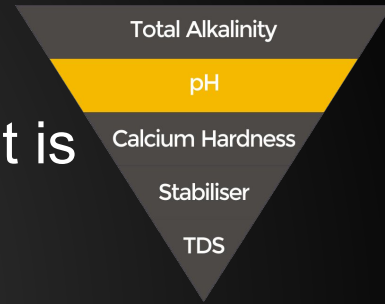
- Bather comfort
- Essential part of water balance
- Optimum sanitiser performance



# pH

The pH scale is logarithmic, meaning that every unit is 10 times higher than the previous one.

- a pH of 6 is 10 times more acidic than a pH of 7
- a pH of 3 is 10,000 times more acidic than a pH of 7
- recommended pH range for pool/spa water is slightly alkaline
- assists bather comfort considering...the pH of the human body is about 7.5



# pH



## Low pH

Increased chlorine usage  
Higher risk of chloramine formation  
Skin and eye irritation  
Etching of concrete and grout  
Wrinkling of vinyl liner  
Corrodes equipment and accessories

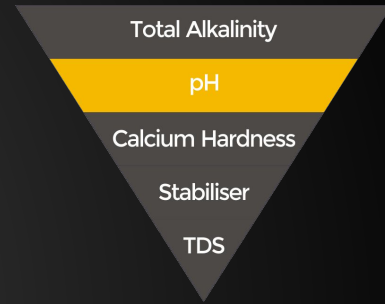
## High pH

- Poor chlorine efficiency
- Increased risk of scale formation
- Skin and eye irritations
- Potential for cloudy water
- Shorter filter cycles
- Excessive backwashing

# pH

There are a vast number of potential causes for pH change in pool water, some of these include;

- Pool chemicals.
- Ozonators (the hydroxide by-product of ozone generation drives pH up).
- Environmental contamination (dust, bushfire fall-out, agricultural sprays and general pollution).
- Rainfall.
- Bather wastes.
- Algae.

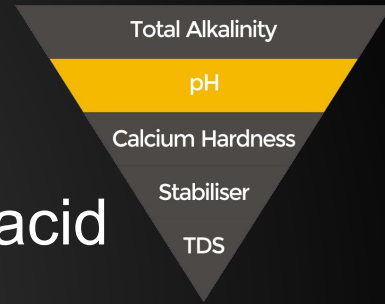




# pH

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At the recommended pH range (7.0 – 7.8) free chlorine exists in the form of both hypochlorous acid and hypochlorite ions.



# pH and its effect on Sanitiser

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- If the pH is too high, most of the chlorine will be present as the hypochlorite ion ( $\text{OCl}^-$ ), which has only 1/50 the killing power of hypochlorous acid.
- If the pH is too low, the hypochlorous acid becomes too active and burns itself out of the water.

A pH of 7.4 is chosen as the 'ideal' because it is the best compromise between having a sufficient percentage of chlorine present as hypochlorous acid and being non-corrosive towards swimmers, pool surfaces and equipment etc.

# pH

## Effects of pH on sanitiser efficiency

GOOD % of Hypochlorous Acid (HOCL)	pH level	BAD % of Hypochlorite Ions (OCL)
90	6.5	10
73	7	27
66	7.2	34
45	7.6	55
20	8	80

Total Alkalinity

pH

Calcium Hardness

Stabiliser

TDS

# pH

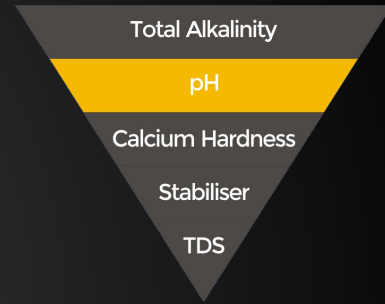
How to adjust pH in pool water;

To increase pH

- Addition of Sodium Bicarbonate (Buffer) dosage rates vary depending on starting point.
- Addition of Sodium Carbonate (Soda Ash).

To decrease pH

- Addition of Hydrochloric Acid (dosage rates vary depending on starting point).
- Addition of Sodium Bisulphate (Dry Acid) (dosage rates vary depending on starting point).



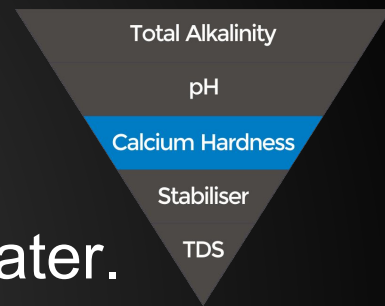
# Calcium hardness

## Definition

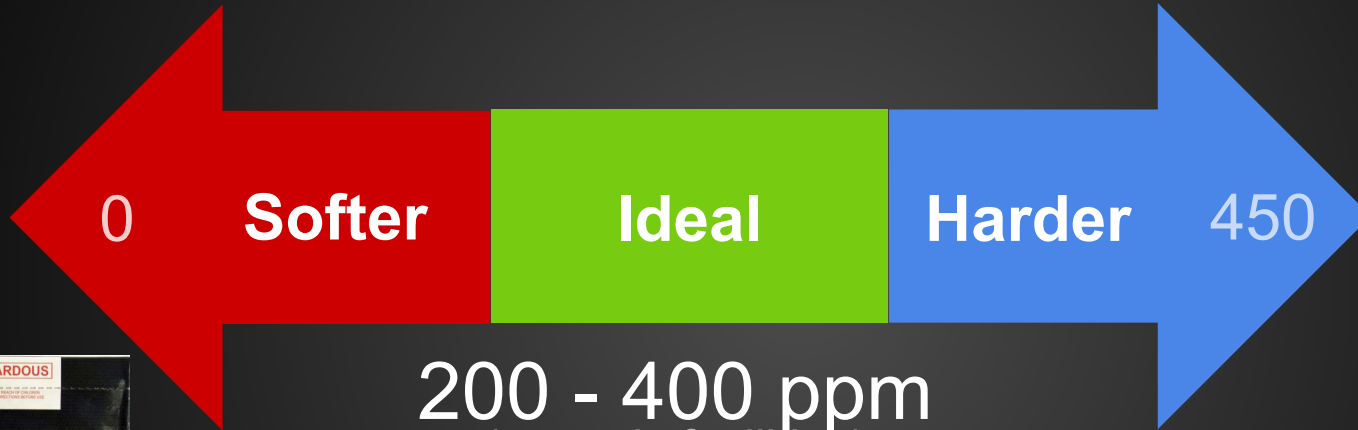
- Measure of dissolved calcium salts in the water.

## Purpose

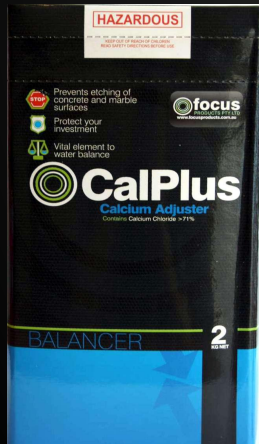
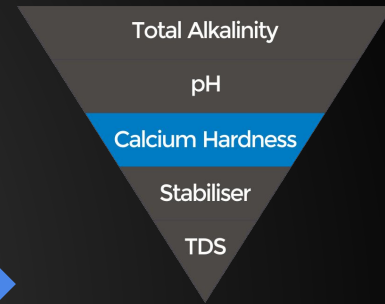
- To satisfy water's natural hunger for calcium.
- Essential part of water balance to protect concrete surfaces.



# Calcium hardness



200 - 400 ppm  
(aquatic facilities)



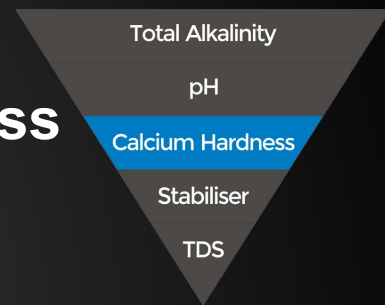
# Calcium hardness

## Low Calcium Hardness

- Etching of concrete and grout.
- Increased corrosion.
- Pitted concrete surfaces.
- Minute pores for algae growth.
- Harder to clean.

## High Calcium Hardness

- Scale formation.
- Cloudy water.
- Roughened surfaces due to scale deposits.
- Inefficient filtration and circulation.
- Reduced heater efficiency.

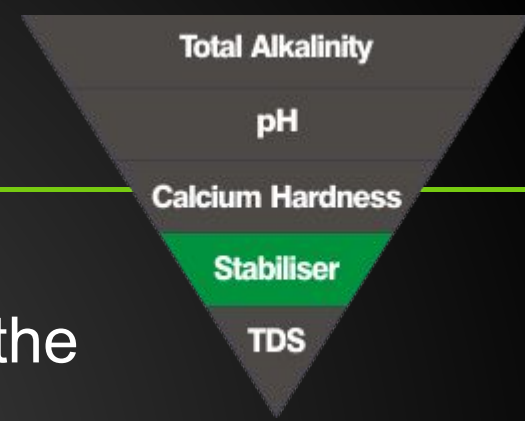


# Stabiliser

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Health department regulations governing the use of stabiliser are as follows

- Outdoor commercial pools – the legislated maximum level permitted in QLD is 50ppm.
- Indoor commercial pools – the legislated maximum level permitted in QLD is 0ppm.





# Stabiliser

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Correctly stabilised water requires less chlorine, saving the pool owner money. More importantly, the chlorine remains in the water where it protects the swimmers, destroying bacteria, pathogens and other undesirable organisms and keeping the water clean.

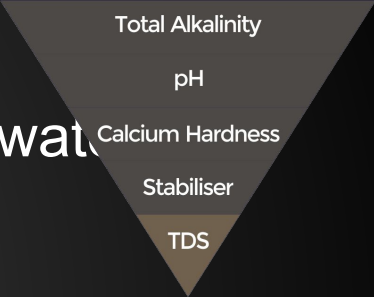
# Total Dissolved Solids

Total of all dissolved chemicals and minerals in the water including salt and;

- Carbonates
- Chlorides
- Calcium
- Stabilisers
- Sulphates

For salt pools the salt level normally measures at about 80% of the TDS

For non-salt pools the maximum is 2500 ppm, the pool water should then be diluted.

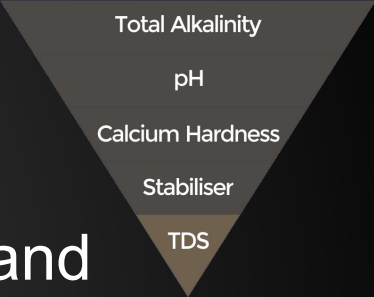


Total Alkalinity  
pH  
Calcium Hardness  
Stabiliser  
TDS

# Total Dissolved Solids

What happens if TDS is too high?

- Reduces effects of maintenance chemicals and sanitisers.
- Can lead to cloudy water problems.
- Increased risk of scale formation and staining.



Total Alkalinity  
pH  
Calcium Hardness  
Stabiliser  
TDS

# Saturation Index

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The Saturation Index, devised by Dr Wilfred Langelier, indicates the pool water balance by taking into account the following five factors;

- pH
- Total Alkalinity
- Temperature
- Calcium Hardness
- Total Dissolved Solids

When these parameters are in balance, the water will neither be corrosive or scaling.

# Sanitation

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## Definition

- To kill bacteria, to make the water safe to swim in 24/7.

## Purpose

- To destroy bacteria as it enters pool water, within 30 seconds.
- To achieve this aim sanitiser must be present in a residual amount.

# Sanitiser

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The role of a sanitiser (or disinfectant) is to destroy bacteria as quickly as it is introduced into the pool. To do this, the sanitiser must be continually present in the water in a measurable and active residual amount. Water can become contaminated from a wide variety of sources, including but not restricted to the following.

# Sanitiser

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- Rainfall.
- Dust.
- Insects.
- Birds (e.g. Ducks).
- Animal wastes.
- Human wastes.
- Atmospheric fall-out.
- Top-up water.

# Chlorine Sanitisers

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When choosing a Sanitiser for a commercial pool the most important thing to consider is your pool water stabiliser and calcium chemistry levels.

Make the smarter choice to reflect your balance levels.

There are three options in the category as follows:

- Stabilised Chlorine
- Sodium Hypochlorite
- Calcium Hypochlorite



# Sanitiser

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## Possible effects of low sanitiser levels

- Unsafe water (harmful bacteria can grow).
- Cause of ear, throat, bowel infections.
- Algae blooms - cause of green, mustard & black spot algae.
- Cloudy water - build up of contaminants - body fats and oils.
- Build up of Chloramines (combined chlorine)
- Cannot be removed by filtration, increases chlorine demand.
- Cause of eye, skin irritations and smelly water.

# Sanitiser

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## Factors that influence chlorine residuals

- Bacteria.
- Algae.
- Organic matter - leaves, twigs, grass etc.
- Swimmer's wastes - sweat, urine, phlegm, make up and especially sun tan lotions.
- Sunlight (UV rays).

# Sanitiser

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## Factors that influence chlorine residuals

- Shallow water.
- Increased water temperature.
- Mechanical energy of waterfalls, fountains etc.
- Inefficient filtration.

# Chloramines

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# Chlorine Sanitation

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- Regarded as the most effective sanitiser
- Breaks down into different chemicals
  - hypochlorous acid ( $\text{HOCl}$ ) acid hypochlorite ion ( $\text{OCl}$ )
- Kills micro-organisms and bacteria
  - Attacks lipids in cell walls, destroying the enzymes and structures inside
- Ideally the Total Chlorine and Free Chlorine should always be the same

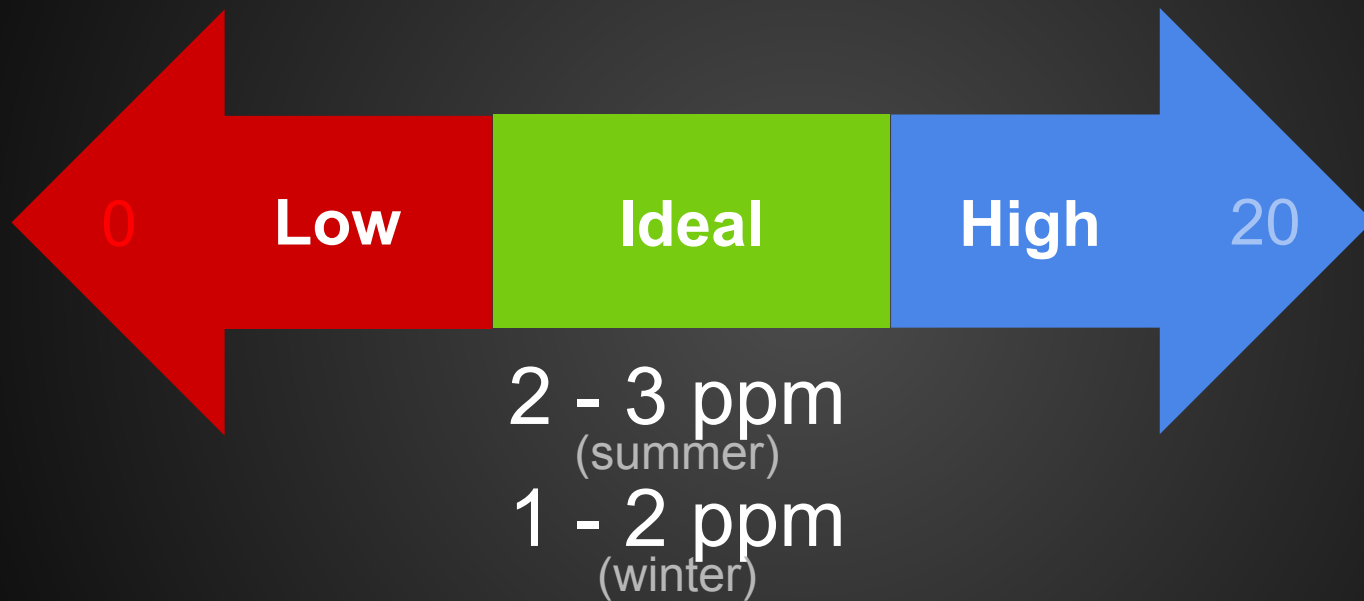
# Free Chlorine

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- All “present” chlorine in pool water should be free and available to provide continuous protection for the bather/s
- Free chlorine does the hard work of killing bacteria and oxidising contaminants
- Must be maintained at all times

# Ideal Free Chlorine

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# “Combined” Chlorine

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- Free chlorine combines with contaminants, becomes combined chlorine (chloramines)
- In water chloramines have very little sanitising ability and no oxidising ability
- Chloramines gives off an odour and is not a reflection of too much chlorine



# Waste Types

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- Cosmetics
- Suntan Oils
- Urine
- Rain
- Animals
- Dust

# Shock the Waste

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- Raise Free Chlorine to a very high level
  - after heavy bather load or heavy rain.
  - Remember to remove the blanket !!
- Breaks down the combined chlorine
- Reduces chlorine demand
  - allowing higher Free Chlorine levels
- Oxidising the waste/contamination
  - as important as sanitising!

# Clean 'N Swim / Oxyshock

- Non Chlorine
- Shocking Agent
- will not combine with organic contaminants to form chloramines
- gentle on pool interior surfaces.
- dissolves quickly
- will not bleach or fade vinyl liners or painted surfaces.
- The excellent solubility of monopersulphate makes it easy to use
- does not increase the chlorine level, therefore the pool need not be closed
- Short pool closure



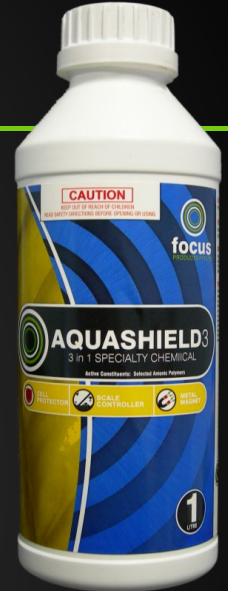
N.B. It is not a disinfectant and must be used with an approved halogen, typically Chlorine or Bromine.

# Power Products

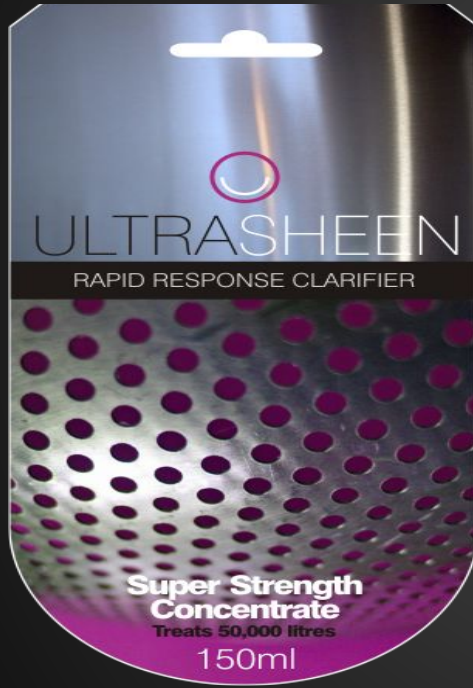
Helping you work smarter not harder

# Aquashield 3

- Acts as a metal magnet to assist in the prevention of metal staining
- Controls scale build up on pool surfaces e.g. Quartz
- Acts as a calcium inhibitor by protecting the equipment from calcium build up
- Perfect for pools topped up with dam or bore water.



# Ultrasheen



- A rapid response clarifier
- Super concentrated to remove suspended/insoluble particles from water
- Ultrasheen is added at the rate of 1 sachet (150ml) per 50,000lts

# Waterpolish Plus



- Restores sparkle and polish to the pool water
- Binds small particles together so they can be filtered out
- New Extra Strength Formula

# Thank you