



pool spa patio
EXPO
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LAS VEGAS, NEVADA



Basic Water Chemistry: The 3 P's of Pool Care

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CEUs: 1.0

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Why test & treat water?



Prevent Disease

Water can provide an excellent environment for pathogenic bacteria & virus to grow



Protect Investment

Water can be corrosive and attack surface if not managed properly



Provide Expected Environment

Pool owners want clean and clear water that is ready for use at anytime

Three "P"s of Pool Care

What do pool owners want?



Clean, clear, beautiful water



Easy Maintenance



No Problems

How do we deliver that?



Keys To Success in Swimming Pools & Spas

- Circulation
- Filtration
- Cleaning
- Chemistry
- Testing

Factors Affecting Circulation

Pump size

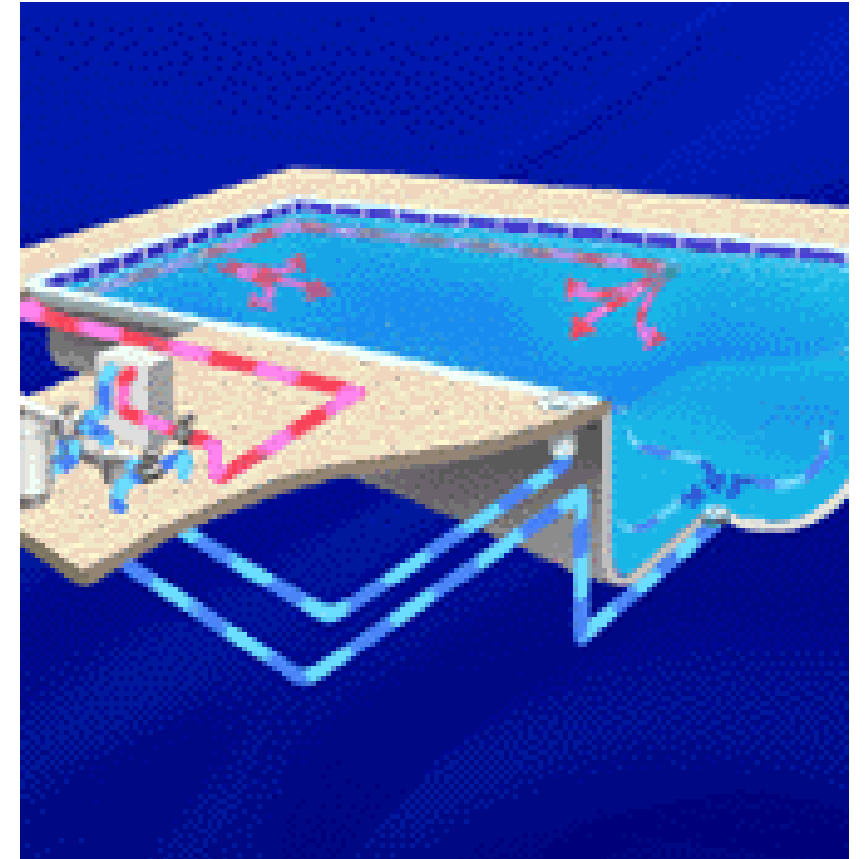
Pump run
time

Pool
shape

Angle of
returns

Swimmers

Dead
spots



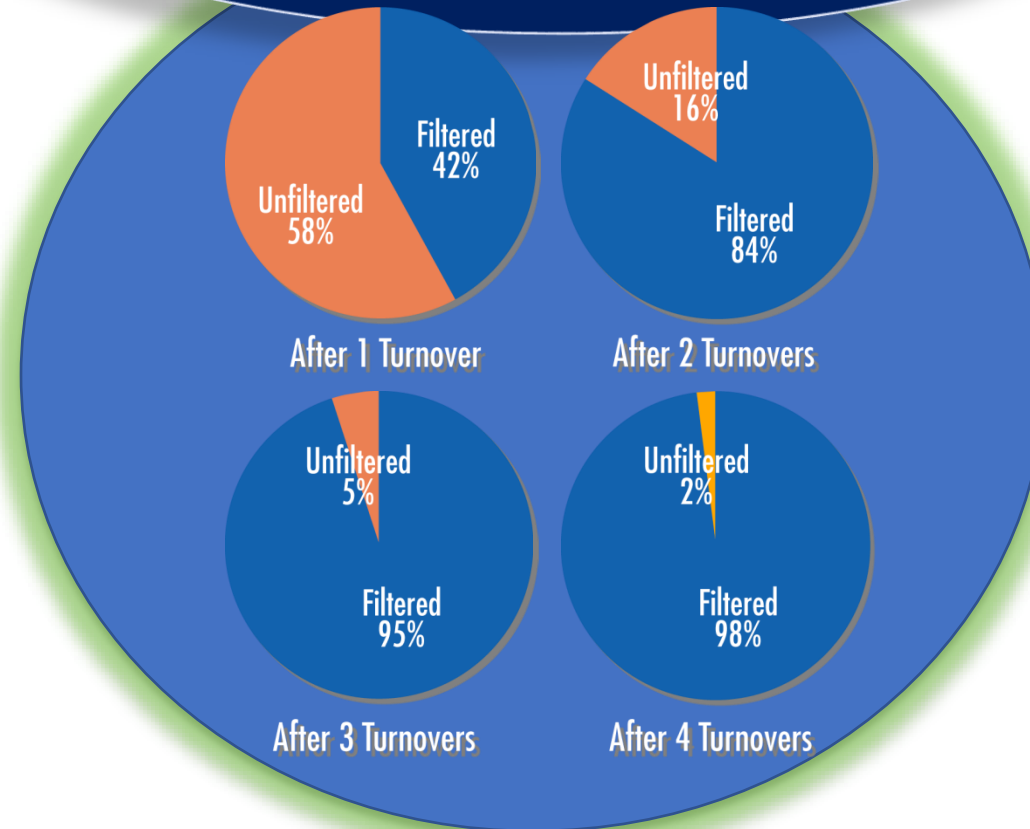
Importance of Circulation

Position return jet at a 45° angle downward



Minimum of 10-12 hours / Ideally 24/7

- Removes un-wanted debris and maintain clear water
- Helps to prevent disease and reduce sanitizer demand
- Provides a better swimming environment
- Variable speed pumps should operate 10-12 hours at higher speed



Filtration

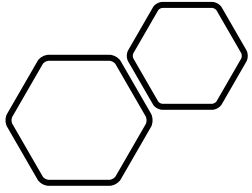
- A filter removes insoluble particles that can cloud the water and compete with bacteria and algae for the sanitizer's attention
- Proper filtration is key to crystal clear water!
- Dirty filters are inefficient



Cleaning

- Vacuum and brush debris
- Routine use of a skimmer net is helpful in removing floating debris to prevent it from settling to the bottom of the pool





Water Chemistry

- Adding:
 - The Right Product
 - The Right Amount
 - The Right Time
- Water must be balanced in ranges AND LSI



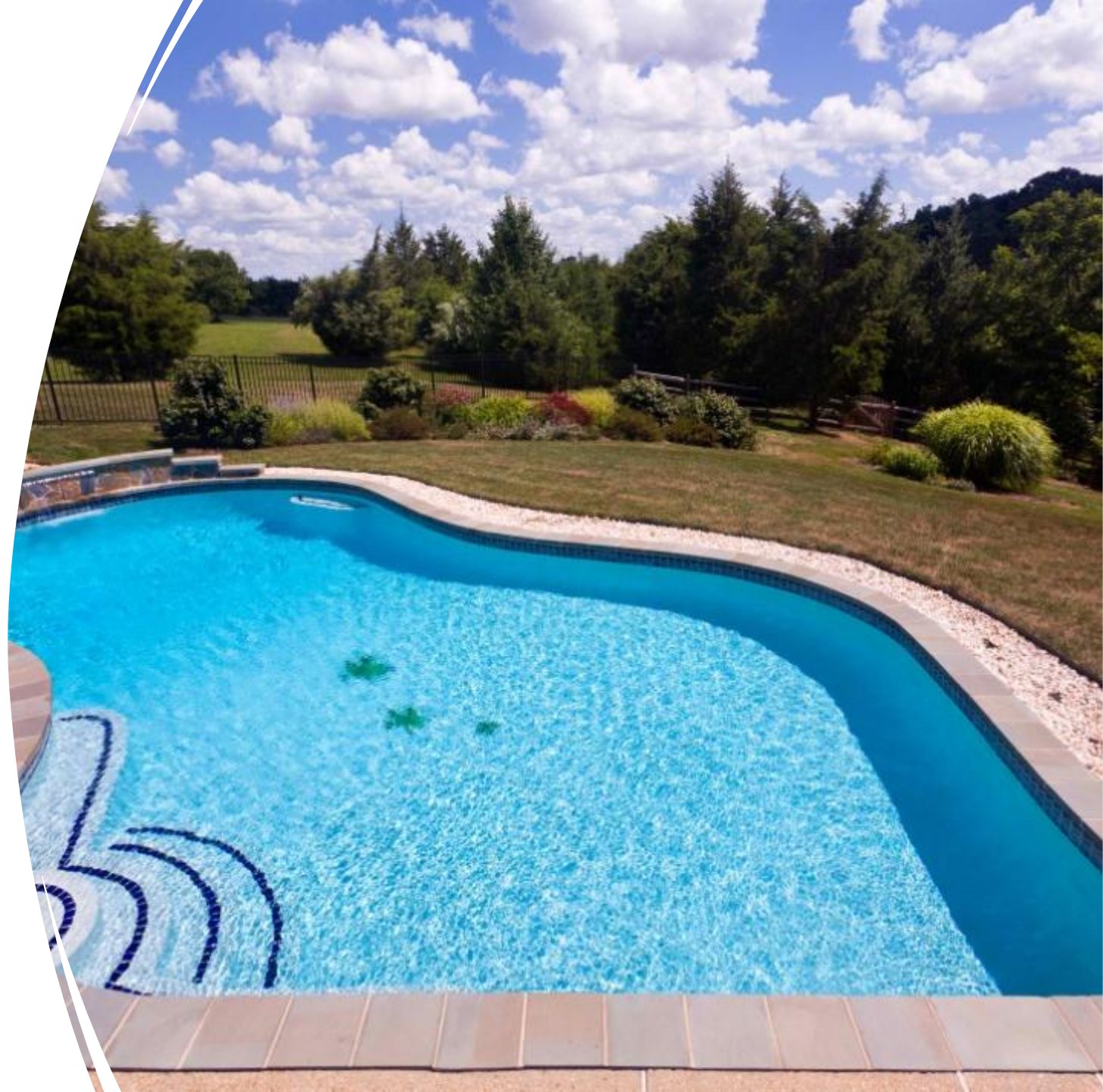


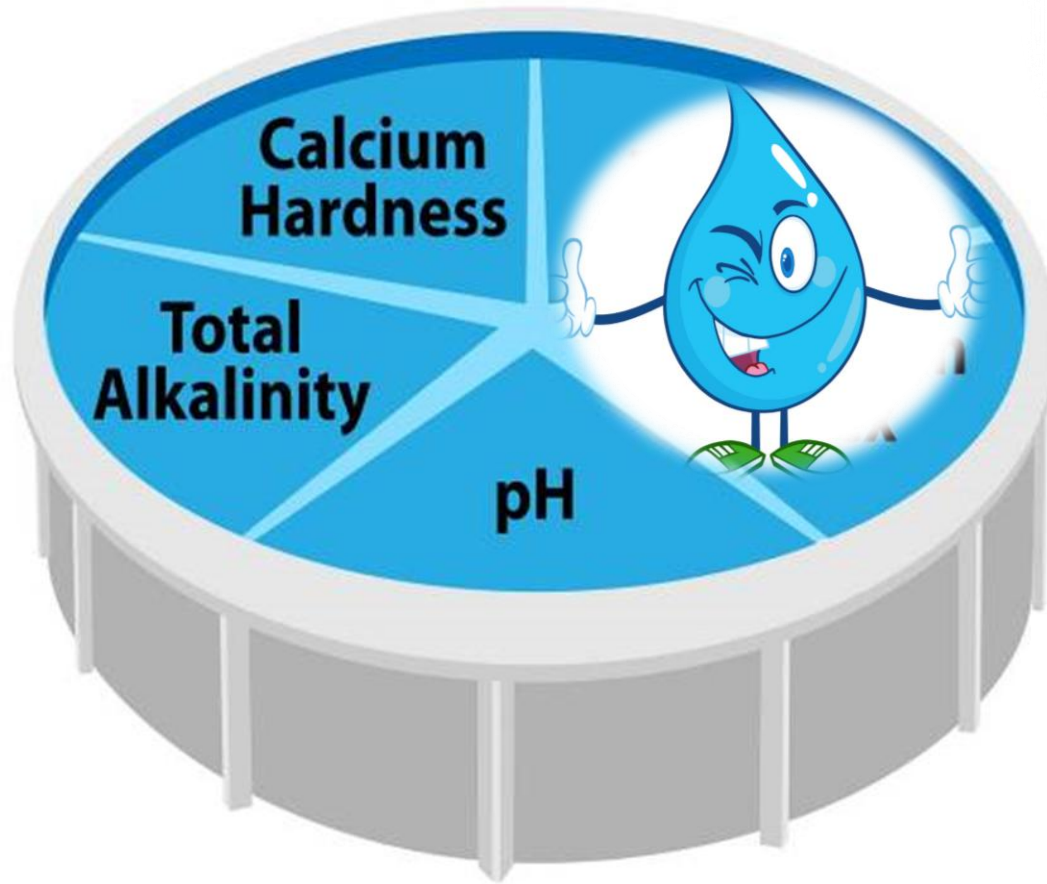
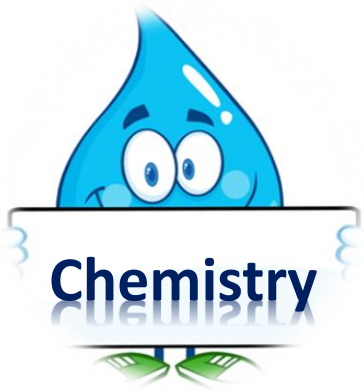
Testing

- By measuring critical water factors, you can make sure the water is balanced and an adequate sanitizer level is being maintained

Keys To Success in Swimming Pools & Spas

- Circulation
- Filtration
- Cleaning
- Chemistry
- Testing





Understanding Water Balance

What is involved in obtaining proper water balance?

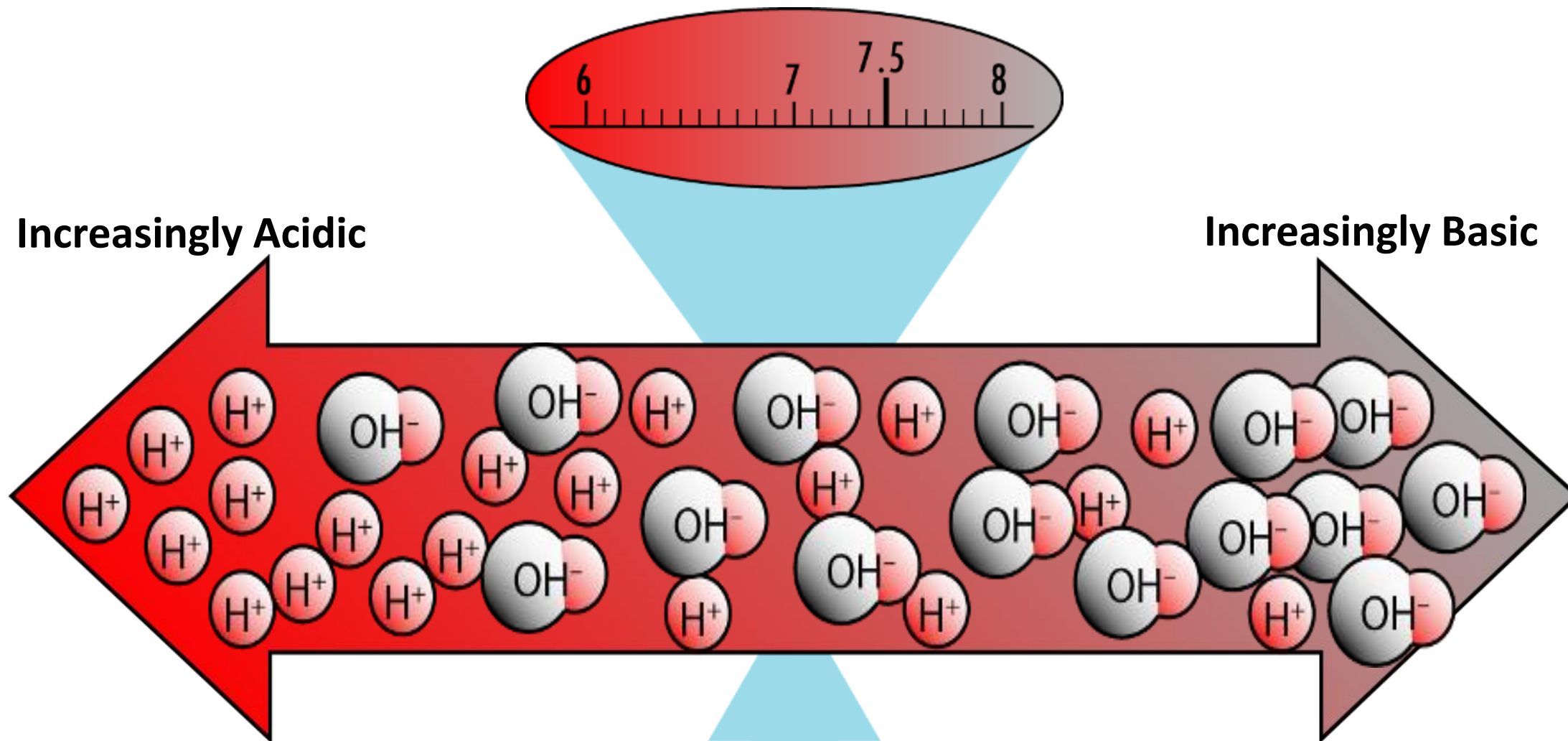
Test	Ideal
Free chlorine	1.0 - 4.0 ppm
Combined chlorine	0 ppm
pH	7.4-7.6
Alkalinity	80-120 ppm
Calcium hardness	150-300 ppm
Cyanuric acid	30-50 ppm
Phosphates	100 ppb or less

Consistent testing is needed!

Why is Water Balance Important?

- Equipment damage
 - Corrosion
 - Scaling
- Surface damage
 - Etching
 - Scaling
- Swimmer discomfort
 - Eye irritation
 - Skin irritation
- Sanitizer inefficiency

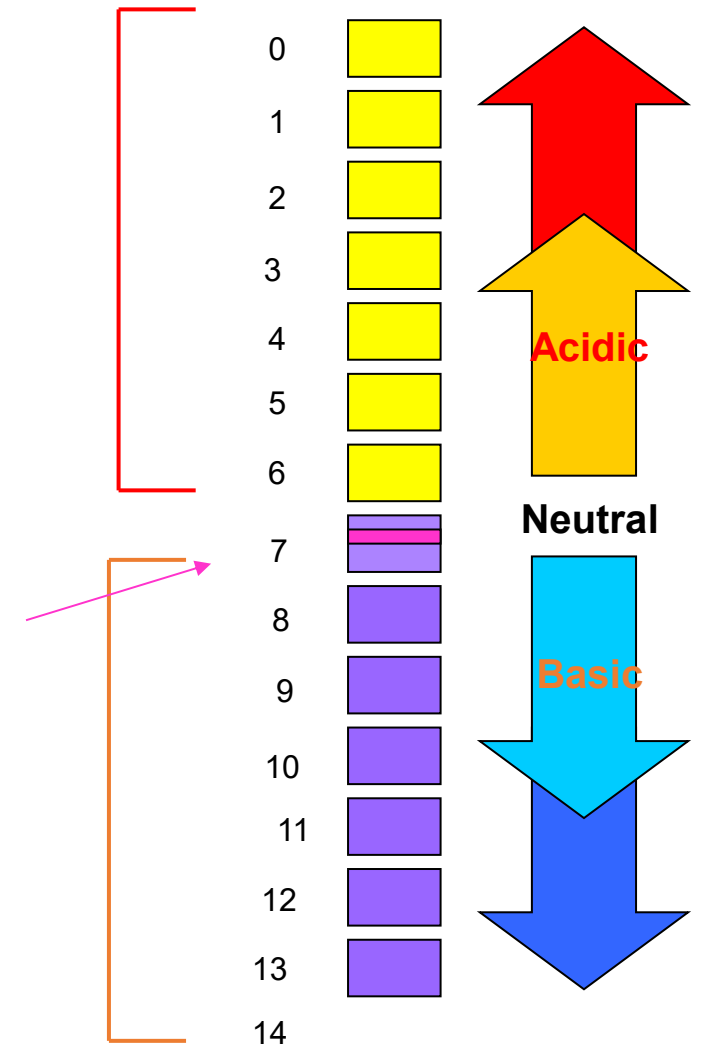




The Problems with Improper pH

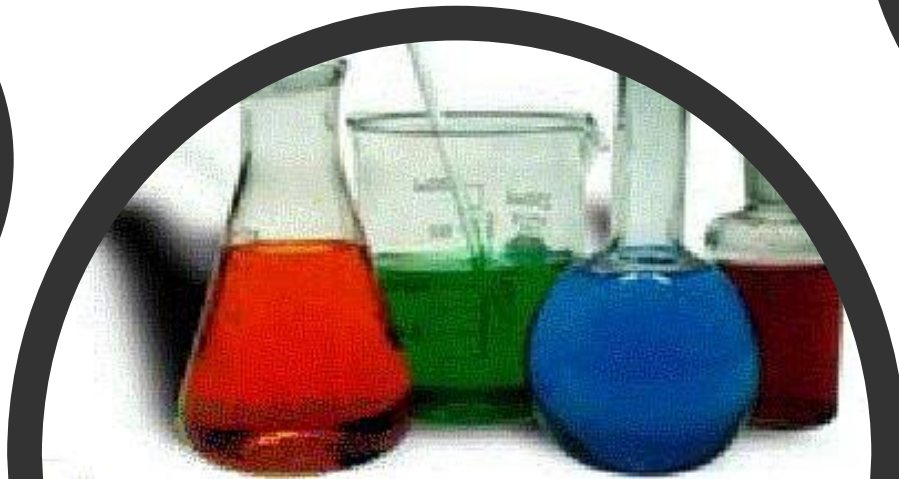
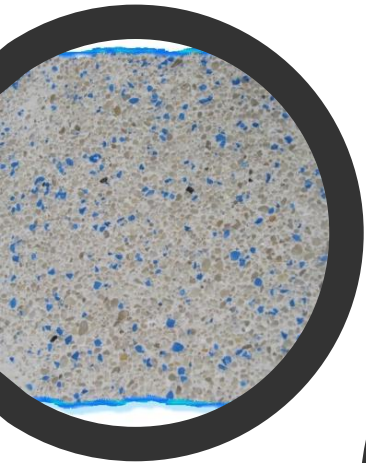
- Clear Water
 - Eye Irritation
 - Corrosion
 - Cl Too Active
-
- Cloudy Water
 - Itchy Skin
 - Scale Formation
 - Inactive Cl

Neutral 7.0
Comfort Zone
7.4 – 7.6



What causes pH to change?

- Swimmers
- Pool surface curing
- Rain
- Chemicals
- Fill water
- Algae
- Use of Salt Chlorine Generators



Total Alkalinity

- A measure of the water's ability to **resist** pH change
- Ideal range for TA: 80 ppm – 120 ppm
- Problems outside this range:

Too Low:

- Corrosion
- Eye & skin irritation
- Sanitizer dissipates
- Rapid pH changes (pH bounce)
- Liner wrinkles
- Pitting & etching

Too High:

- Scale formation
- Discoloration
- Cloudy water
- Overworked filter
- Eye & skin irritation
- pH drift



How pH effects Chlorine

% active (HOCl)	pH	% less active (OCl⁻)
97	6.0	3
91	6.5	9
76	7.0	24
66	7.2	34
50	7.5	50
33	7.8	67
24	8.0	76
9	8.5	91



The Importance of Calcium

Low Hardness

- Corrosion of equipment
- Etching of plaster
- Bathers may complain of discomfort



High Hardness

- Scaling of surfaces and equipment
- Cloudy water
- Bathers may complain of discomfort



Factors Affecting Scale Formation

Increase In Temperature

- Higher temperatures increase molecular motion
- Rapid moving Ca^{+2} , CO_3^{-2} molecules more easily orient themselves
- As CO_2 concentration decreases the reaction is driven toward the formation of CaCO_3

Increase in pH

- H^+ dissociates from CO_3^{-2} more at higher pH level
- $\text{HCO}_3^- \rightarrow \text{H}^+ + \text{CO}_3^{-2}$ (more carbonate formed)

Increase In Concentration

- The greater the ion concentrations, the greater propensity for scale

Non-negotiable Weekly Pool Care

SANITIZE

- Always SANITIZE

OXIDIZE

- OXIDIZE Weekly (or more often)

PREVENT

- PREVENT Algae with periodic algaecide application

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Why is Sanitizing Important?

- Kill bacteria and algae
- Protect swimmers from disease transmission
- Keep water clean and clear
- Sanitizer residual should always be 1-4 ppm

It's All About HOCl

Trichlor

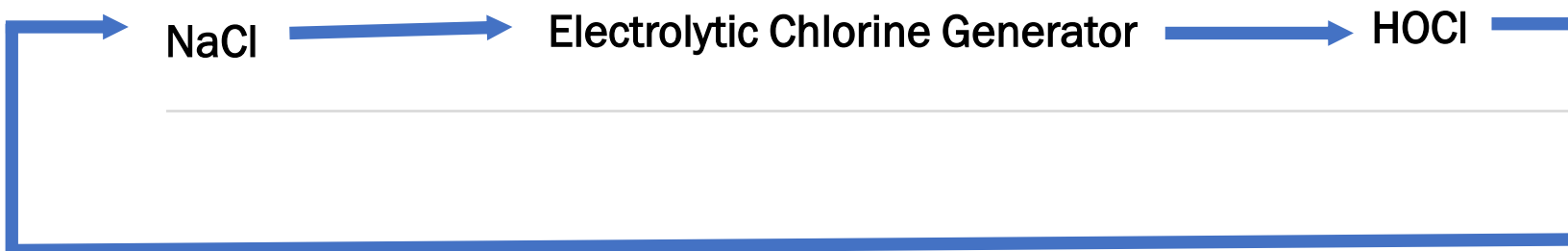
Dichlor

Calcium Hypochlorite

Sodium Hypochlorite

Chlorine Gas

**Hypochlorous
Acid
(HOCl)**



To Consider:

- Salt Pools are Chlorine Pools!
- All chlorine does the same thing: It sanitizes.
- Know how different forms of chlorine impact water balance



Chlorine Facts

- Each type of chlorine has a different effect on pool and spa water
- For example, a chlorine with a higher pH can raise the pH of the pool
- It is important to know what affect each type of chlorine will have on the water balance



Chlorinating Products

Inorganic (unstabilized)

- Does not contain cyanuric acid (stabilizer)
- Gas chlorine and hypochlorites
- Hypochlorites have high pH and can raise pH of water over time

Organic (stabilized)

- Contains cyanuric acid (stabilizer)
- Dichlor has near neutral pH and is quick dissolving
- Trichlor has low pH and is very slow dissolving



Sanitizers-Forms of Chlorine

So....which form is best?

- No easy answer! Choosing the right chlorine is dependent upon each pool's circumstance
- For example: someone dealing with scaling issues would not want to use cal hypo as it has a higher pH AND adds calcium
- Example #2: Someone with a high CYA level would not want to use dichlor or trichlor and add more stabilizer to the pool

Conditioner or Stabilizer

- Prevents loss of chlorine to UV rays from sunlight
- Ideal level:
 - 30 to 50 ppm standard chlorine
 - Always follow local codes and regulations
- Does not dissipate or wear out
- Lost with backwash, splash out, leaks or dilution due to rain
- Sunscreen for chlorine
- There's a premium, easy to add option!

Non-negotiable Weekly Pool Care

SANITIZE

- Always SANITIZE

OXIDIZE

- **OXIDIZE Weekly**

PREVENT

- PREVENT Algae with periodic algaecide application

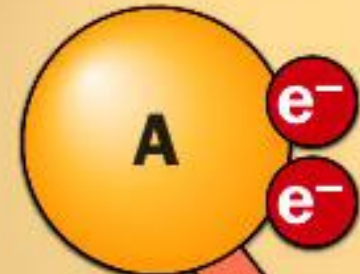


Why is shocking important?

Remove
contaminants

Helps keep
water clear

Prevent
problems before
they begin



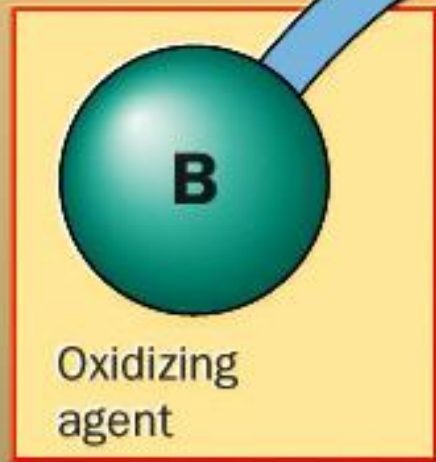
Reducing agent

Oxidation

Compound A loses electrons



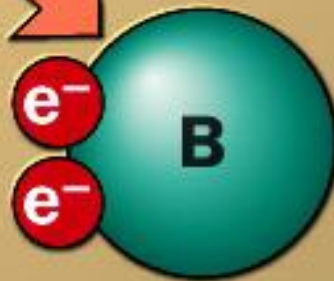
Oxidized



Oxidizing agent

Reduction

Compound B gains electrons



Reduced



Non-negotiable Weekly Pool Care

SANITIZE

- Always SANITIZE

OXIDIZE

- OXIDIZE Weekly (or more often)

PREVENT

- **PREVENT** Algae

Is this your
customer's
biggest
fear?



POOLS ARE ALWAYS UNDER ATTACK!

- Algae are Resilient – can exist nearly everywhere
- Algae are constantly introduced to the pool
- Pools can be very hospitable environment



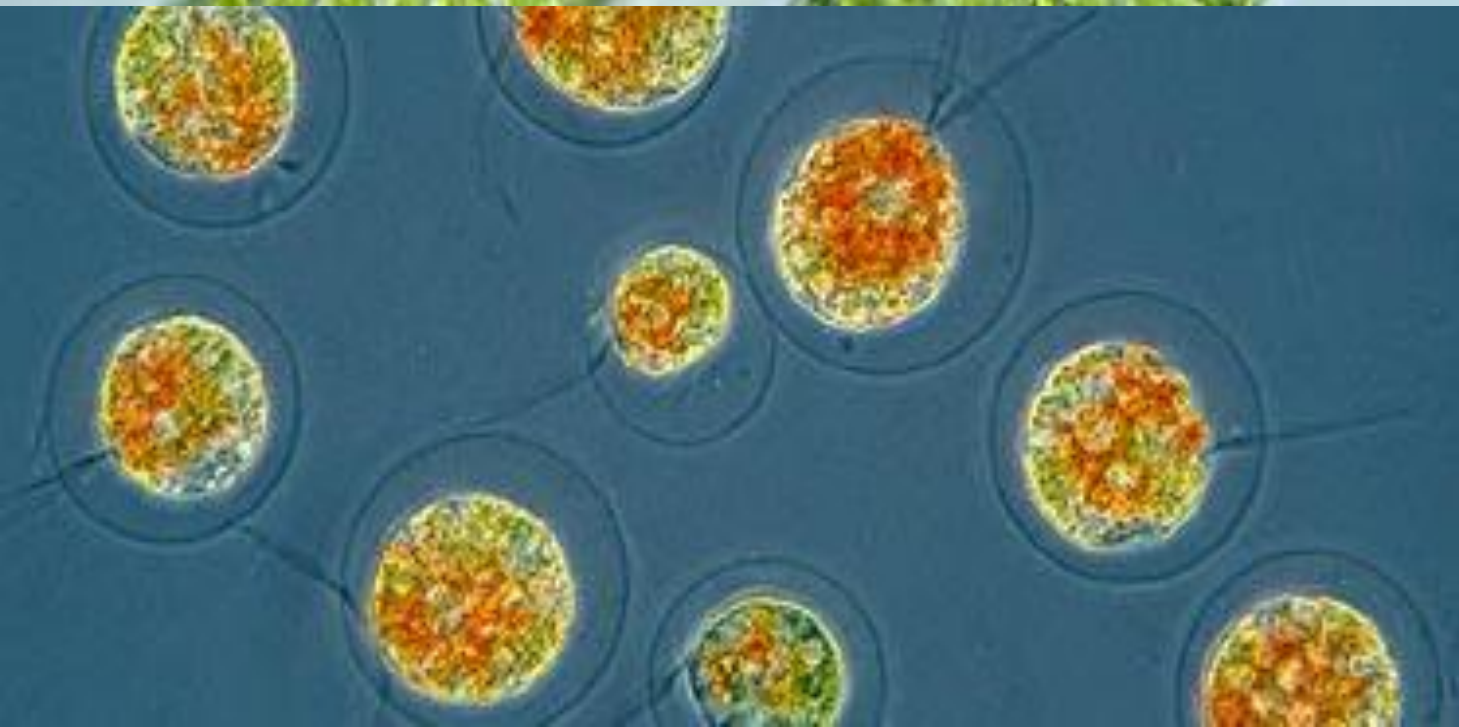


POOL INDUSTRY ALGAE CLASSIFICATION SYSTEM

What color is it?

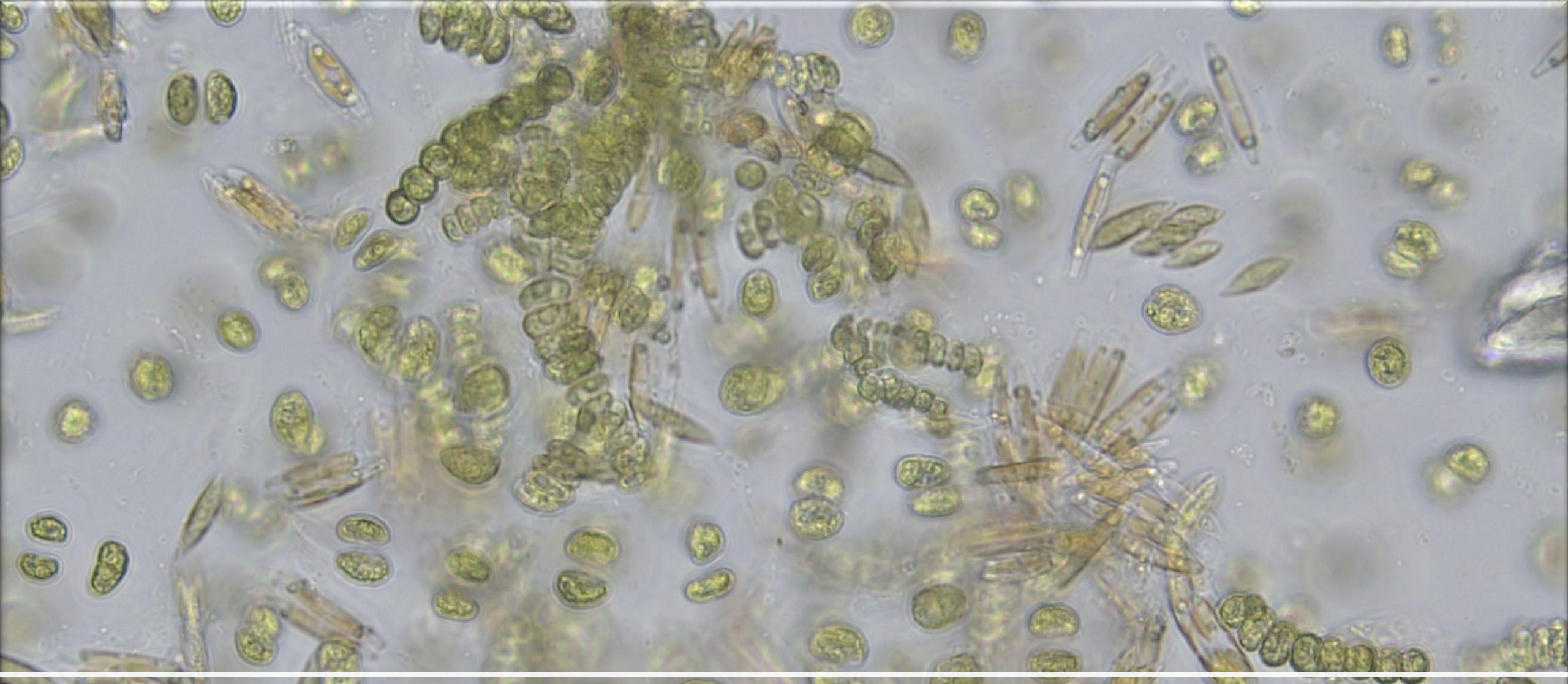
Where does it live?

Green and throughout the water

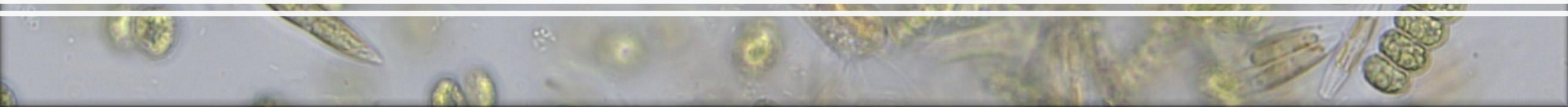


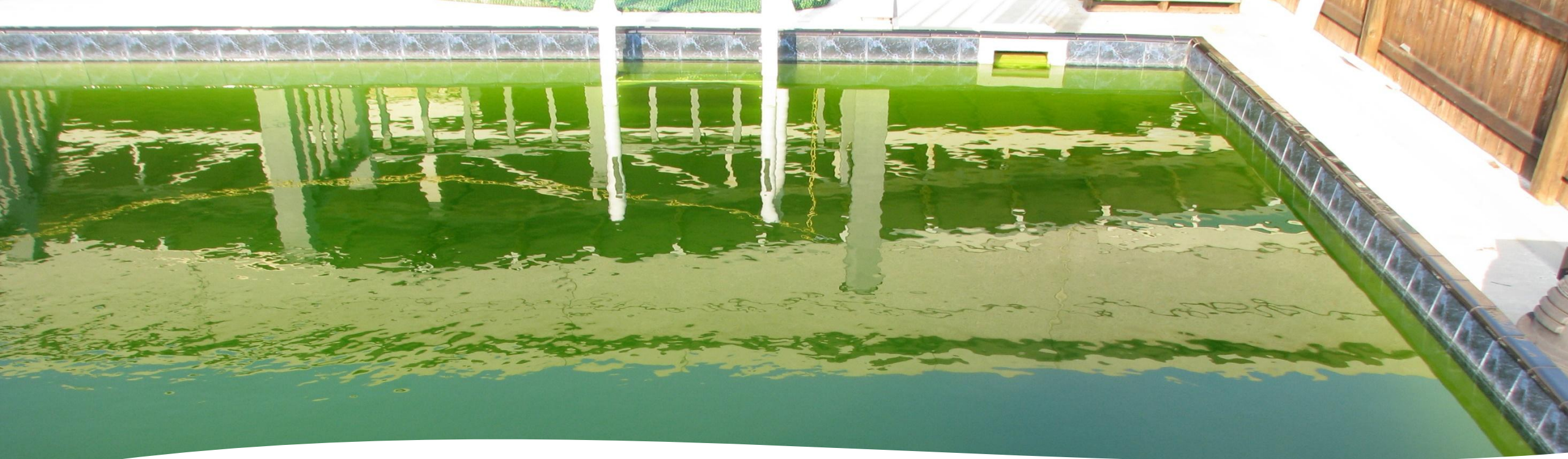
Mustard "Yellow" sediments on the
bottom and sides

Black attaches to the bottom and
sides



Mixed Populations Common



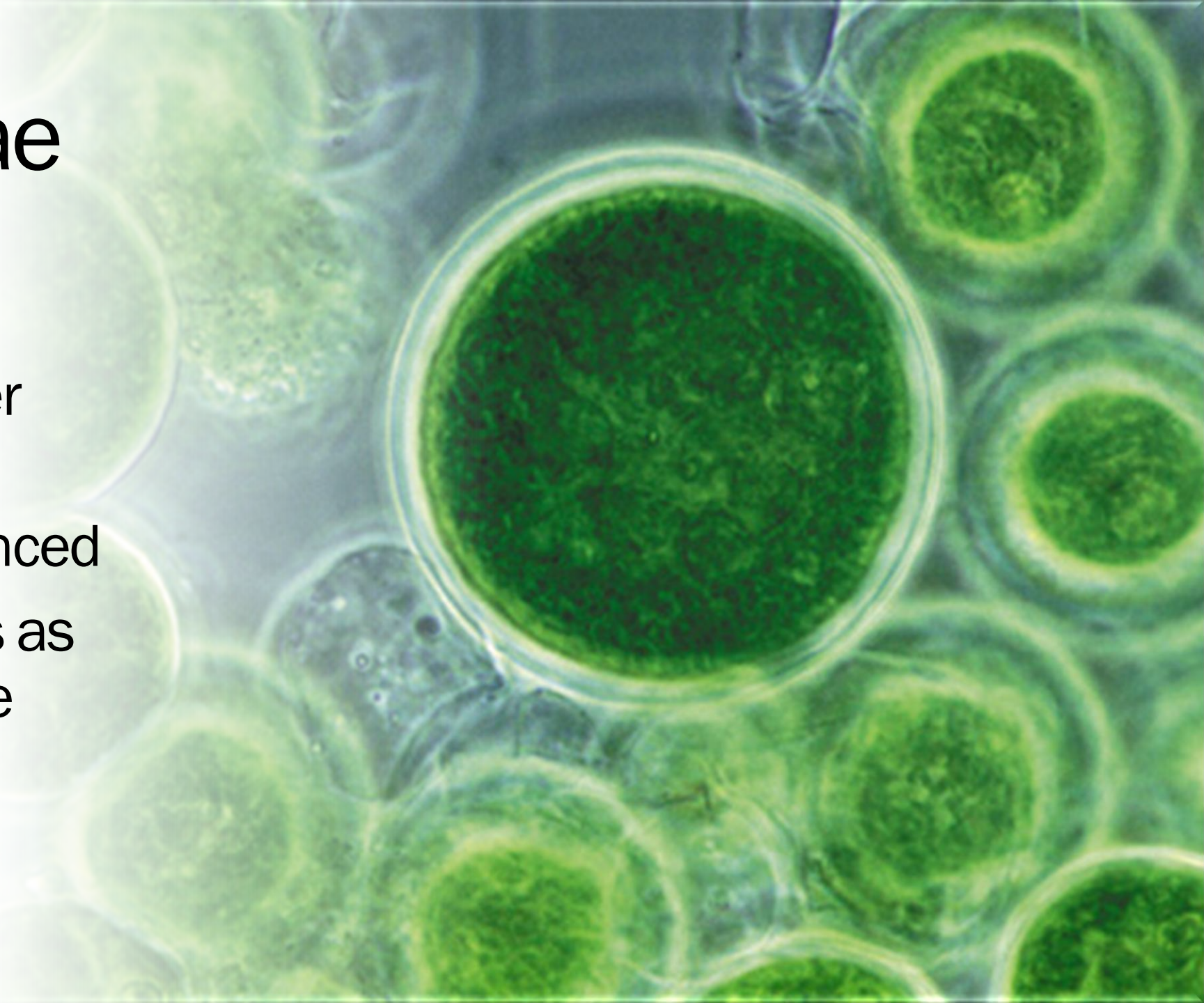


The Value of multi- functional algaecides

- Need a more effective algicide for troublesome algae
- Not all algae reacts to all algaecides
- Approach algae prevention and killing from multiple directions

Keys to Algae Prevention

- Maintain sanitizer residual
- Keep water balanced
- Reduce nutrients as much as possible
- Use Preventative algaecide



Recap

- There are 5 keys to pool care
- Every pool must be balanced
- Non-negotiable pool care
 - Sanitize
 - Oxidize
 - Prevent algae

Questions?

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