



# Chlorine Chemistry

David DeLong

## Primary Disinfectants (CHLORINE)

Product	% Available Chlorine	pH in 1% solution	pH Effect	Appearance
Gas Chlorine	100%	0	Lowers pH	Gas
Sodium Hypochlorite	10-12.5% Household bleach 3-5%	9-14	Raises pH	Liquid
Calcium Hypochlorite	47-78%	8.5-11	Raises pH	Granular, tabs, briquet
Lithium Hypochlorite	35%	10.8	Raises pH	Granular
Trichlor*	90%	2.8-3.5	Lowers pH	Granular & Tabs
Dichlor*	56-63%	6.5-6.8	Neutral	Granular
Bromine (BCDMH)	27%	4.8	Lowers pH	Granular, Tabs

\*These chlorine products are sun stabilized – they contain cyanuric acid

## Section 1

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# THE CHEMISTRY OF DISINFECTION

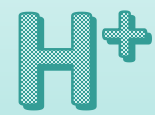
## HYPOCHLOROUS ACID/HYPOBROMOUS ACID

# Free Chlorine

97%

50%

91%



Hypochlorous Acid is a powerful germ killer

Hypochlorite ion is a weak germ killer



6.0

7.5

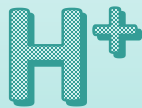
8.5

Bromine

100%

94%

17%



Hypochlorous Acid is a powerful germ killer

Hypochlorite ion is a weak germ killer



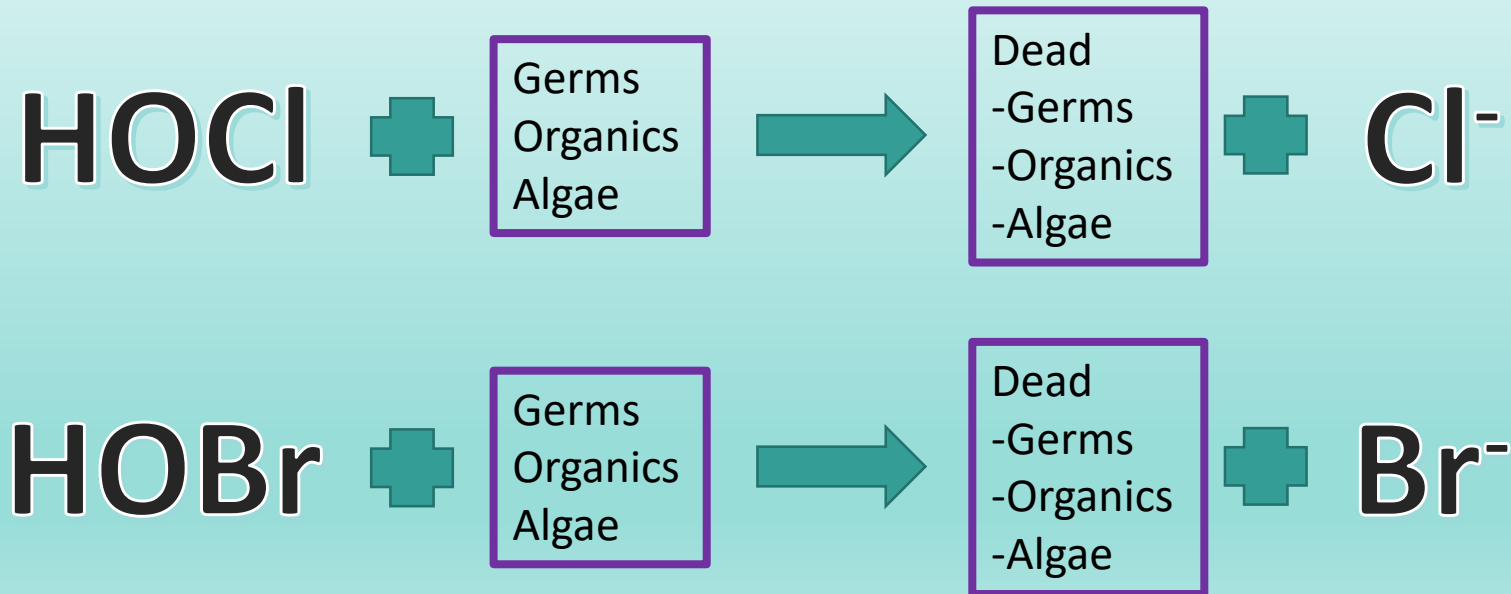
6.0

7.5

8.0

# Killing Germs

- Chlorine attacks the cell membrane and dissolves it
- But chlorine also attacks all organic materials



## Chloramines

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- There are lots of things that end up in pool water that are not pathogens
  - Sweat, urine, dead skin cells, leaves, hair, etc.
  - Your sanitizer works to break this down

## Breaking down Ammonia





## Section 2

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# SANITIZER LEVELS

## How much Chlorine should you use?

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- Are you using sun stabilizer (Cyanuric Acid)?
- What kind of pool (spa, swimming pool)
- What are your patterns of use?

# Sanitizer Chart

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Swimming Pool	Minimum
Chlorine	1.5 ppm FAC
Chlorine w/ Cyanuric Acid	2.0 ppm FAC
Bromine	2.5 ppm TB

Spas & Wading & Spray Pools	Minimum
Chlorine	3.0 ppm FAC
Chlorine w/ Cyanuric Acid	3.5 ppm FAC
Bromine	4.0 ppm TB

Maximum levels should conform to manufacturers' recommendations and shall not exceed 10 ppm. Check your product's label for manufactures' maximum level.

# Cyanuric Acid

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- Cyanuric Acid protects Chlorine from being destroyed by the sun. You can lose half of your chlorine every hour on a bright sunny day.
- The CPO manual recommends 30 to 50 ppm to provide sun protection.
- Too much reduces the activity of chlorine.
- Legal Maximum in Washington State is 90 ppm.



Questions?

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