Well Disinfection Using Chlorine

BCGWA Regional Meeting

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Agenda

ClearTech – Who we are, what we do

Chlorine

Well disinfection

- **What are the goals**
- **What are the methods**

Questions, extra discussion

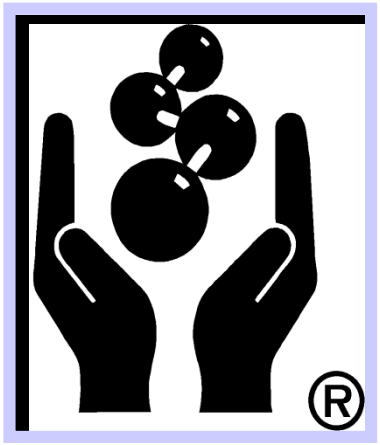
ClearTech – who are we?

ClearTech is a chemical manufacturer and distributor of chemicals, chemical feed equipment, instrumentation and laboratory products. We serve as a full solution provider to industry and municipalities across Canada.

ClearTech – who are we?

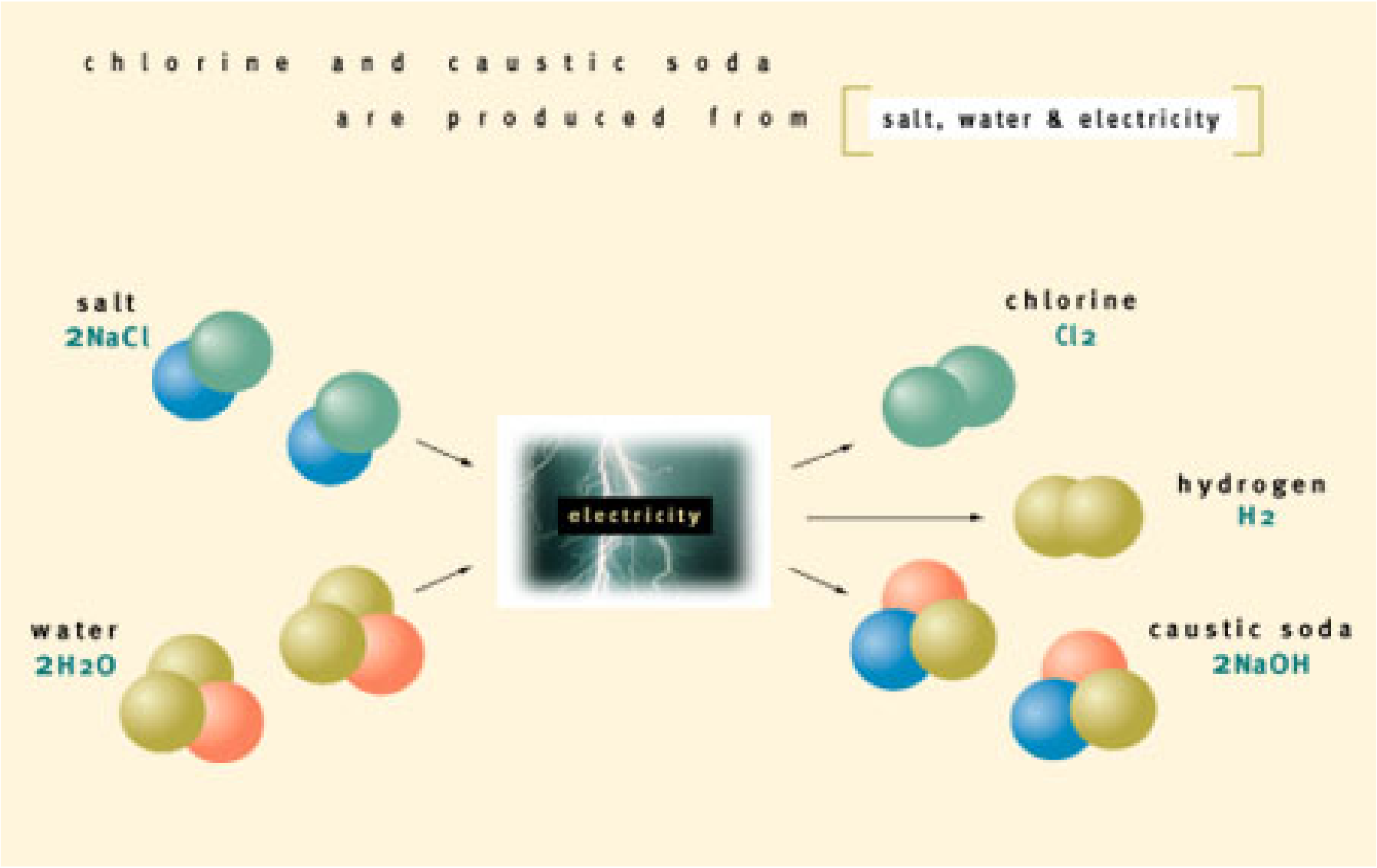
- Canadian Association of Chemical Distributors
- Responsible Distribution® & Responsible Care®
- ISO 9001:2008

CACD™
RESPONSIBILITY MATTERS



NSF®

The Chlor-Alkali Process



The Chlor-Alkali Products

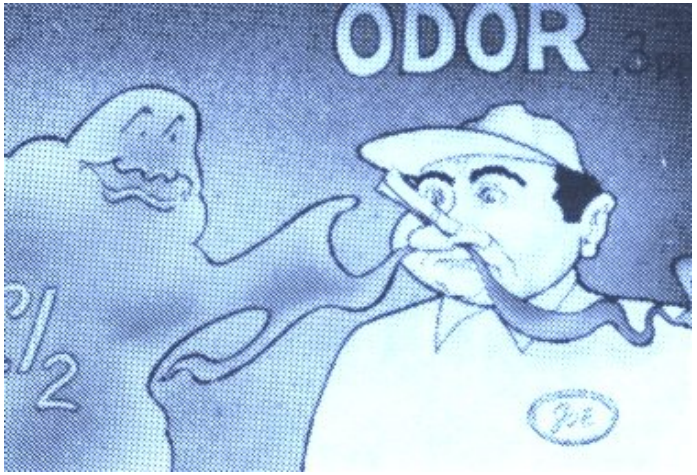
Chlorine
Cl2

Greenish colored gas, strong disinfectant

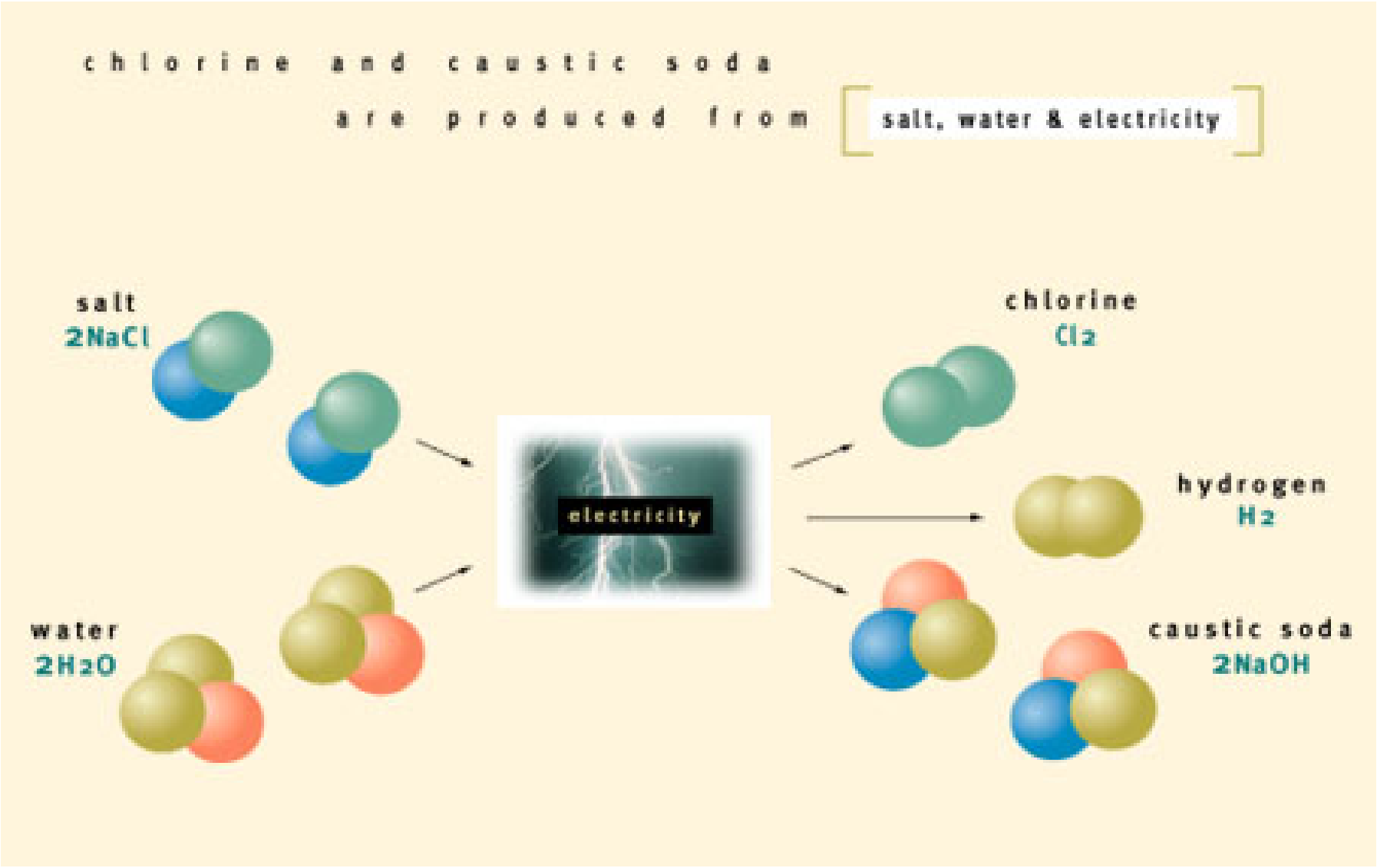
Packaged under pressure as a liquid

Boiling point is -34 degrees C

Available in cylinders, tonners, and railcar



The Chlor-Alkali Process



The Chlor-Alkali Products

Sodium Hypochlorite, NaOCl

aka bleach, Javex, hypo, “liquid chlorine”

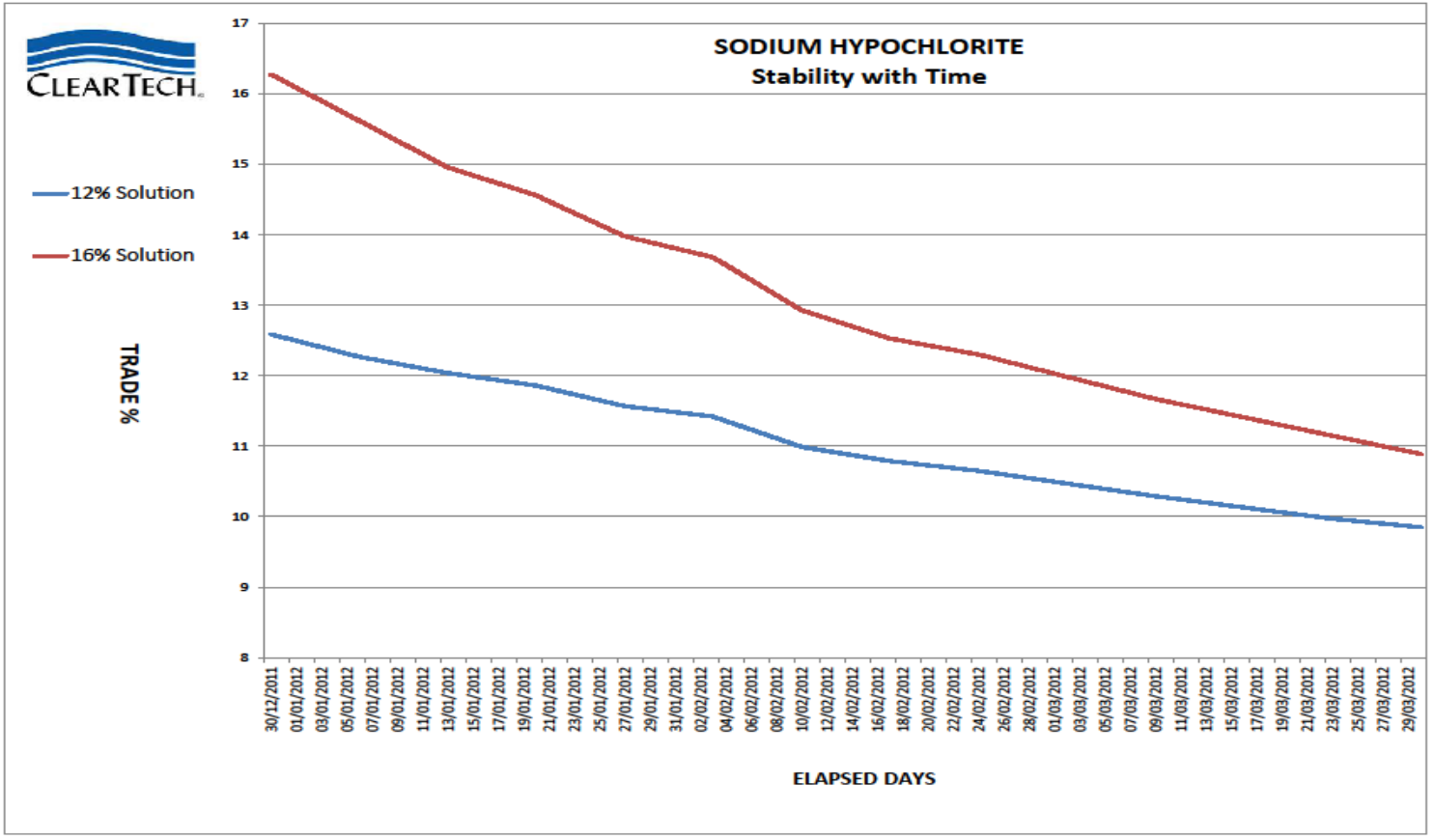
Manufactured by reaction of chlorine with caustic soda

Strong oxidizer and disinfectant; available typically as 12% solution

Dangerous reaction with acids

Sodium Hypochlorite Stability

Storage Conditions are key!! Limit contact with high temperature, water, air, sunlight, and metals!



The Chlor-Alkali Products

Calcium Hypochlorite, $Ca(OCl)_2$

aka chlorine powder, chlorine pucks

Strong oxidizer and disinfectant; available typically as 65% powder

Dangerous reaction with acids

Acids

Low pH (<7). Grouped into strong acids and weaker acids

Lowering pH can remove organics and TOCs from source water, dissolve and remove scale, or precipitate salt by neutralizing high pH solutions

Common acids in water treatment include:

Hydrochloric – typically a 31.5% solution, chlor-alkali product, pH reduction
Sulphuric – 36% to 93% solution, pH reduction, color removal
Citric – dry or 50% solution, descaling solution (CIPs)

Other Common Chemicals

Dechlorination Chemicals

Include sodium thiosulphate, sodium metabisulphite, sodium bisulphite, calcium thiosulphate, ascorbic acid, sodium sulphite

Act as reducing agents to remove hypochlorous acid

Depending on choice, different amounts needed

Depending on plant and process, some are better choices than others

Certifications, mixing, pH control play huge factors here

Chemical Containers

There are primarily 5 ways liquid chemicals come packaged:

1. 4 L jugs
2. 20L pails
3. 210L gallon drums
4. 1230 L totes
5. Bulk tanker truck

Safety and Handling

Know what you are using

Know the hazards (where do you find them?)

Use common sense

Read the SDS!!!

Courses: WHMIS, TDG, H2S Alive

Personal Protective Equipment

Read the MSDS

Use common sense – take 2 minutes to put safety clothing on prior to handling

Keep your clothing clean

Materials of Compatibility

Cole Parmer has a great database

General rule with chemicals is “use plastic”
minimum SCH 80 PVC, CPVC, PVDF

Tips:
Viton/FKM great for everything but caustic
EPDM not good for acids/bleach
Glass check balls not good for HFS acid

Read MSDS

NSF 60 Certification

The gold standard in ANSI Standard 60 certification

Product doesn't need the "dot", just needs to be listed on the official website

Also refer to spec sheets and/or MSDS for registration details.

If new products/container sizes are added, NSF needs to be added to that particular product listing

Well Disinfection

When should you disinfect a well?

1. After installing the last piece of equipment, but before comissioning

2. Any time internal components of the well are serviced

Simple Chlorination

Simple chlorination is the process of adding a small volume of chlorine solution in to the top of a water well, followed by circulating the chlorine into the distribution system,

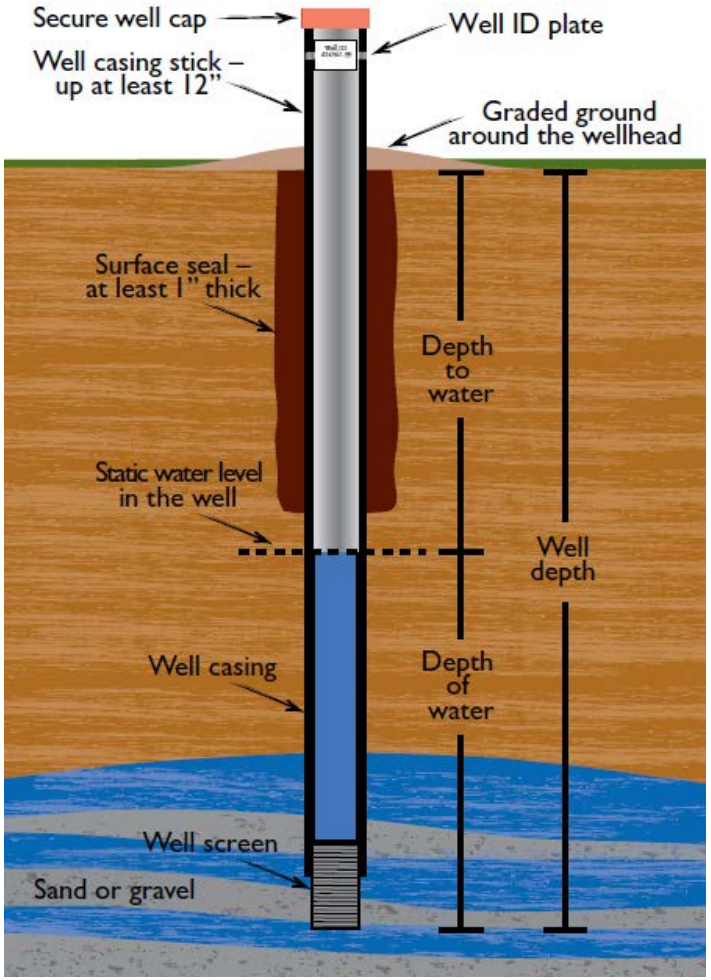
Simple chlorination is used to disinfect the upper portion of the well casing, the well pump, the drop pipe, water service line, pressure tank and building distribution system

Simple Chlorination

1) Remove turbidity (pump to waste until the water is clear before starting treatment.
2) Bypass water treatment units
3) Check the water well record – are there drawdown seals that will prevent chlorine from reaching the water?
4) Turn off pump power before removing the pump cap

Simple Chlorination

1) Make the chlorine solution



Well diameter		Domestic bleach* (5-6%) needed per 3 metres (10 feet) of water		
inches	mm	metric	US gallons	other
4	100	100 mL	0.02	5 tbsp
5	130	150 mL	0.04	10 tbsp
6	150	200 mL	0.05	13 tbsp
8	200	360 mL	0.09	1.5 cups
10	250	560 mL	0.15	2.5 cups
12	300	808 mL	0.21	3.5 cups
24	610	3.3 L	0.9	14.6 cups
36	914	7.5 L	2.0	
48	1219	13.3 L	3.5	

Well diameter		Dry weight of chlorine tablets (65-75%) per 3 metres (10 feet) of water	
inches	mm	oz	grams
4	100	0.3	9
5	130	0.5	15
6	150	0.7	20
8	200	1.3	36
10	250	2.0	57
12	300	2.9	82
24	610	11.9	337
36	914	26.7	758
48	1219	47.4	1347

Simple Chlorination

1) Add the appropriate amount of sodium hypochlorite or calcium hypochlorite to approximately 50L of water
2) Pour or syphon this solution into the well
3) Turn on the well pump and purge the water system of non-chlorinated water
4) Recirculate the water for at least 30 minutes
5) Reinstall the well cap
6) Run all the taps in the house until you smell chlorine
7) Wait 4 to 12 hours
8) Flush the system – pump to waste, not into a septic system

Simple Chlorination

1) Reactivate water treatment systems
2) Collect samples for bacteriological testing
3) The water may be turbid after chlorination due to dislodged biofilm and minerals. The cloudiness will dissapate over time

Bulk Displacement Chlorination

1) Used when simple chlorination was ineffective at solving the problem
2) Displaces the water in the well casing, forces chlorinated water in to the formation

Bulk Displacement Chlorination

1) Follow the same initial steps as simple chlorination
2) However, a solution of low pH, 200 ppm chlorine at 5 times the water volume in the casing is added.
3) The high volumes forces water back into the formation and ensures that the even water at the bottom of the well is chlorinated

Questions??