

Comprehensive water quality control using stabilised chlorine: CREDENCE

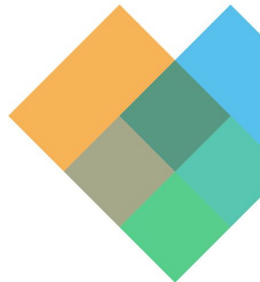
Dr Lucy Waldron



Controlling water borne pathogens

Dangers of copper and zinc overload

Clean water without harmful minerals



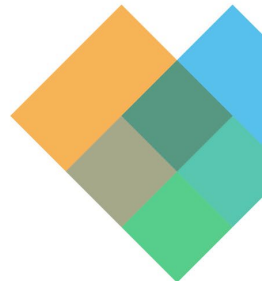
Importance of Water

- No 1 nutrient for all animals
- Major source of pathogenic organisms, including protozoa, viruses and toxic blue-green algae
- Major problem in NZ due to mild winters (no seasonal kill-off) and warm climate
- Bore holes and roof water collection
 - major contamination issue



Controlling water quality - badly

- Copper and zinc trough blocks (blue crystals)
- Dangerous overload of inorganic minerals into animals
- Copper XS is toxic in sheep and young cattle
- Higher copper and zinc intakes prevent uptake of other minerals in the gut, including calcium and magnesium for bone formation and minerals involved in immunity and reproduction



Trough blocks – the problems

- Inorganic copper and zinc are banned antimicrobials
- High levels of use in feed is legislated against as they promote bacterial resistance and interfere with uptake of other essential minerals
- Trough blocks have been ‘under the radar’ for many years
- Cu and Zn legally limited in feed, but not water
- Inorganic minerals must be carefully balanced for intakes to prevent toxicity and deficiencies
- Water overload is overlooked – but related to imbalances leading to animal health problems, organ damage, poor reproduction and reduced growth and milk yield



Trough blocks – mode of action

- Inorganic minerals compete for uptake based on electrical charge.
- All those carrying 2+ charge compete directly for uptake (calcium, magnesium, manganese, cobalt, copper, zinc)
- Highest intake will have highest absorption, at expense of other essential minerals
- Overloading water with Cu and Zn inhibits uptake of other essential minerals



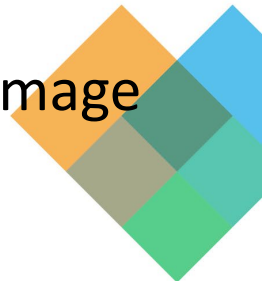
Copper overload research

- High inorganic copper intake causes liver and kidney damage, and can lead to sudden death
- Copper overload in cattle causes haemolysis and methemoglobinemia, still births, increased susceptibility to infections and poor milk yield (Perric *et al.*, 1990)
- 12 mg Cu from copper sulphate causes liver damage in cattle (Gummow, 1996)
- Copper toxicity especially prevalent in young cattle and sheep of all ages
- PKE is supplied to animals as a fibre source, but is high in copper, exacerbating the risk of toxicity from trough blocks



Zinc overload research

- Zinc toxicity is manifested as gastric disorders and diarrhoea, colic, fever and fatigue.
- In cattle, it causes poor growth and FCR, anaemia, necrohaemorrhagic abomasitis, gut wall lesions and pancreatic damage and acute tubular necrosis (Ott *et al.*, 1966)
- In sheep, inorganic zinc is used to prevent facial eczema, but excess causes gut lesions and reduced pancreatic function, reducing growth
- Excess Cu and Zn act together to increased pancreatic damage in mammals



Credence water quality control

- Credence is a **stabilised form of chlorine**; rapid pathogen kill (<15 min)
- **Does not compete** with any other minerals in the gut
- Small amounts (0.3 ppm active Cl in water) control pathogens
- Maintains neutral pH (pH 6.8-7) relative to other chlorine disinfectants
- Alkaline (pH 8.2) chlorine dioxide prevents gut Ca uptake
- Unique in its ability to **penetrate biofilms** (*Mycoplasma* spp.)
- Effective against avian influenza, rotavirus, foot and mouth



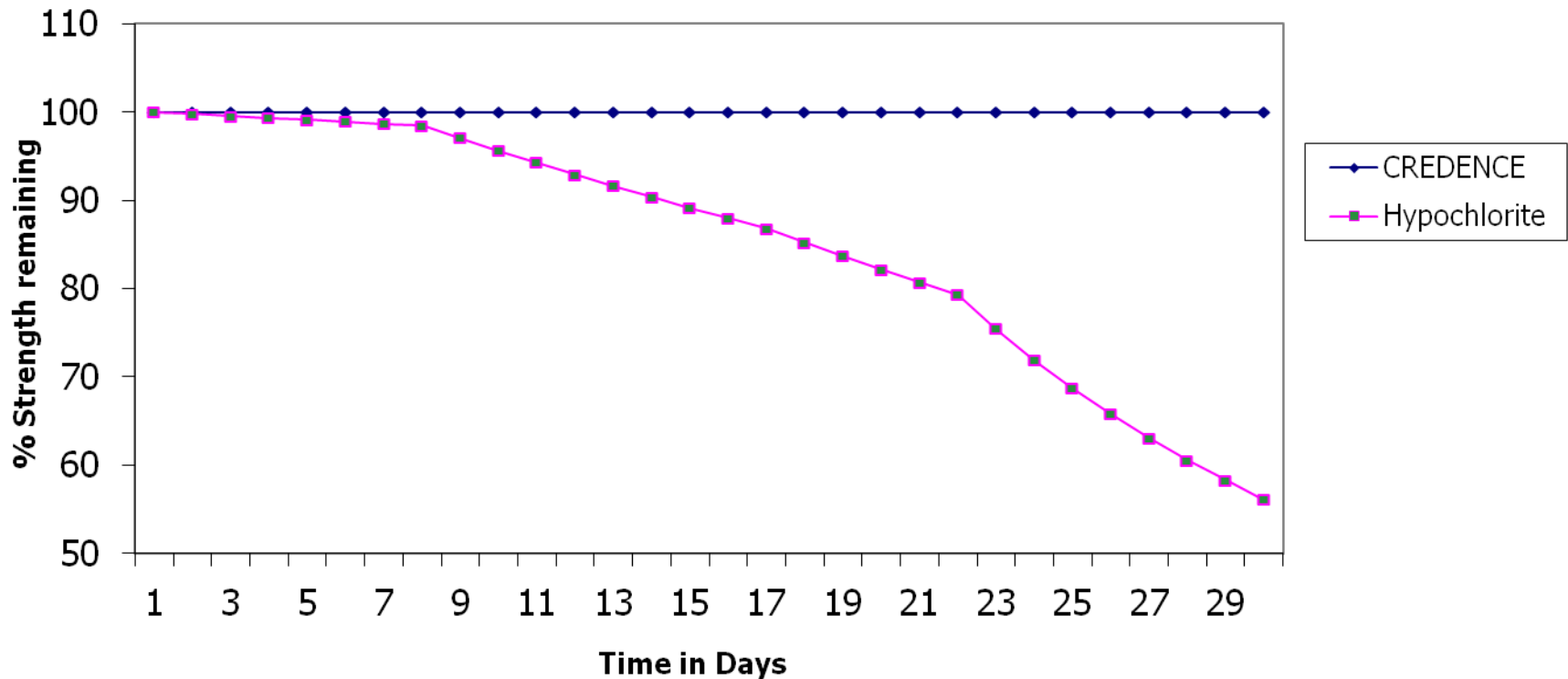
Mode of Action

- Release of long acting, stable chloride ions
- Neutral pH (pH 6.8-7)
- Long lasting in open and closed (tank) systems (3 – 9 months)
- Rapid kill rate (<15 min)
- Fast dissolving tablets with unique fizzing action to penetrate all areas, including biofilms
- Less corrosive in pipework, clothing, footwear, metal compared to other disinfectants
- Proven and easy to use in water and for biosecurity
- Unique in its ability to penetrate biofilms
- Broad spectrum kill (bacteria, viruses, algae, protozoa)



Credence is long lasting

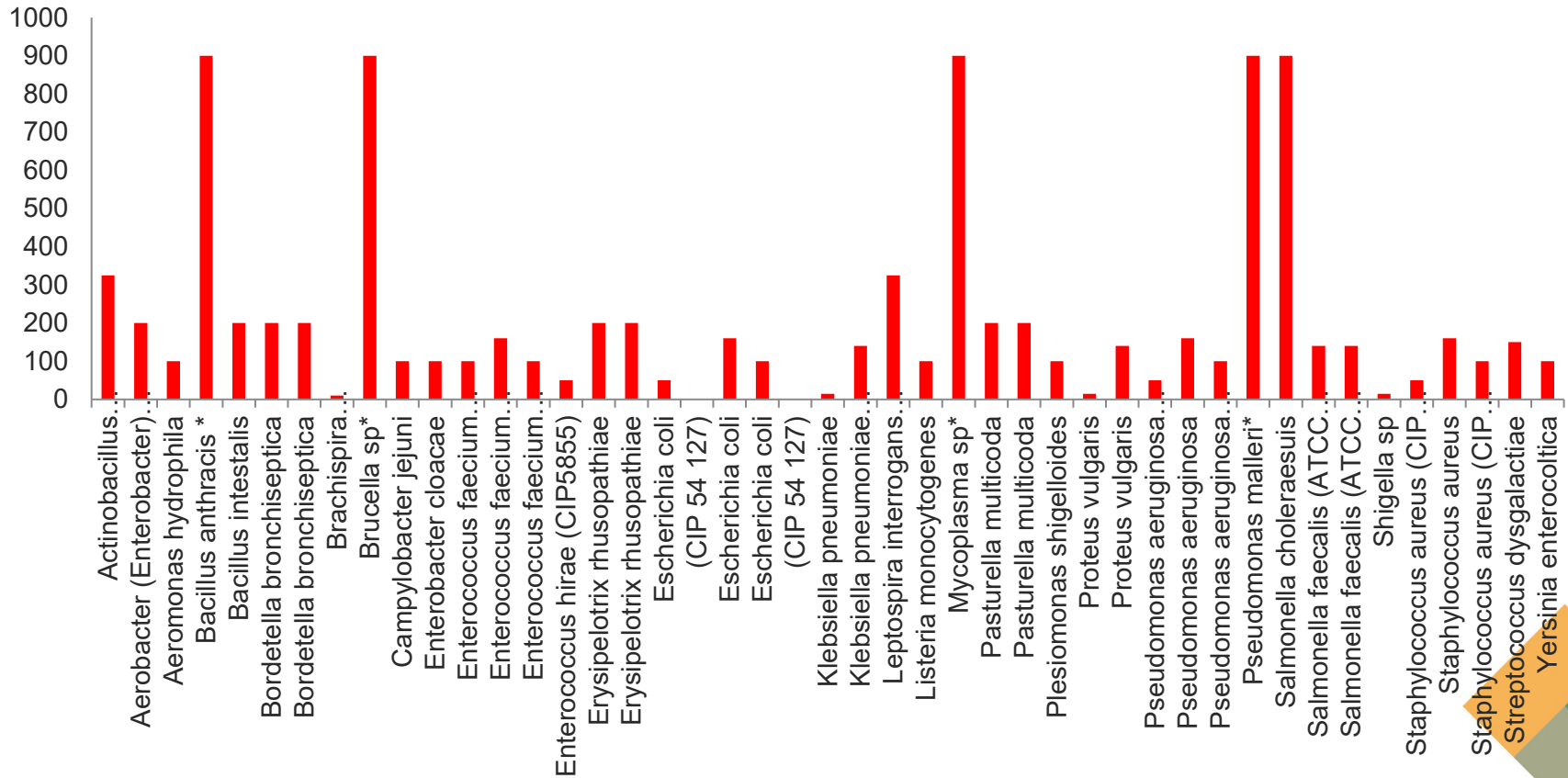
Sodium Hypochlorite Decomposition vs. CREDENCE Stability in Drinking Water



10% Hypochlorite (at manufacture), stored at 15C, half life = 460.7, CREDENCE tablets (stable >3 years)

Effective against:

MIC (ppm) Credence against common pathogenic bacteria



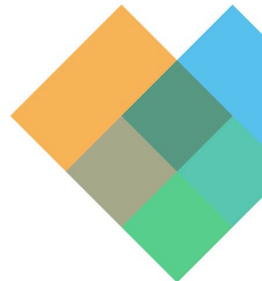
Proven effectiveness and safety

- Effective against major and emerging diseases:
 - Avian flu
 - Foot and mouth disease
 - African swine fever
 - Rotavirus
 - Mycoplasma
 - Encapsulated viruses
- Toxic algae (causing reduced growth, milk yield, neurotoxicity)
- Environmentally tested – low impact in soil and water courses (EU and South America tested)



Can be used for:

- Treating drinking water
- Higher concentrations: cleaning sheds/facilities
- Cleaning complex equipment e.g. calfeterias requiring minimal rinsing
- Biosecurity hands/boots/vehicles
- Humans and animal safe – can be used as stock and hand wash (see effective concentrations)
- Easy clean down – no major rinsing required, so less water required



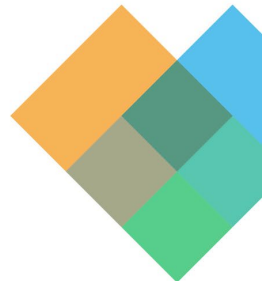
Dosing for application

Use	1 tablet in
Biosecurity/footbaths	5 litres
Equipment washing	10 litres
Non-porous surfaces	15 litres
Hand/udder washing	10 or 100 litres
Water systems clean out	200 litres
Drinking water/troughs	1000 litres



Water pipe trials

Pathogen	Pre-treatment CFU/litre	Post-treatment (35 min) CFU/litre
Aerobic mesophilic bacteria	378,500	0
Coliforms (e.g. E.coli)	149	0
Aeromonas hydrophila	Present	No
Citrobacter freundii	Present	No



Carcass trials – water contamination

Contaminating source	Pre-treatment	Credence 5 mg/l chlorine
Total bacterial counts(CFU/ml)	11,000	500
Coliforms (e.g. E. coli) (CFU/100ml)	20	0



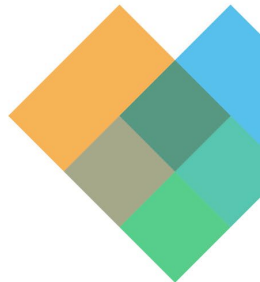
Carcass *Salmonella* contamination

Pig growing phase	Pre-treatment	Credence
Weaner	20%	NM
Grower/early finishers	47%	16%
Slaughter weight	97%	25%



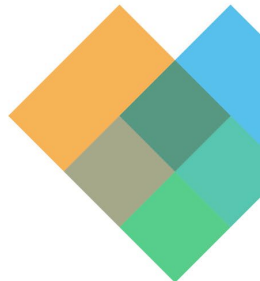
Udder cleaning trials

- Louisiana State University, USA
- Washing udders on entry to dairy shed with Credence
- Monitoring common udder contaminating organisms



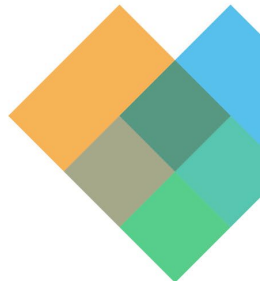
Dairy trials

Microorganism	Reduction in colonising bacteria
<i>Staphylococcus aureus</i>	75%
<i>Streptococcus agalactiae</i>	65%



Calf trials – bottle teats

- Cleaning teats with Credence spray
- Swabbed 30 seconds after spraying
- Compared against unwashed teats and water rinsing
- Bacterial CFU's measured



Calf bottle teats trials

Treatment	No. Colonies		
	Tip of teat	Base of teat	Average
None (control)	34.8	68.0	51.4
Water rinsing only	66.0	32.0	49.0
CREDENCE	0.4	0.4	0.4



Buildings

- Swabs taken over 15 days from milking parlours and calf rearing sheds
- Swabs taken before and 30 min after washing down with Credence



Percentage positive swabs

Bacterial contamination	Milking Room Floor		Calf Pen	
	Control	Credence	Control	Credence
High contamination	75%	8%	62%	11%
Zero contamination (<100 CFU)	0%	42%	0%	53%

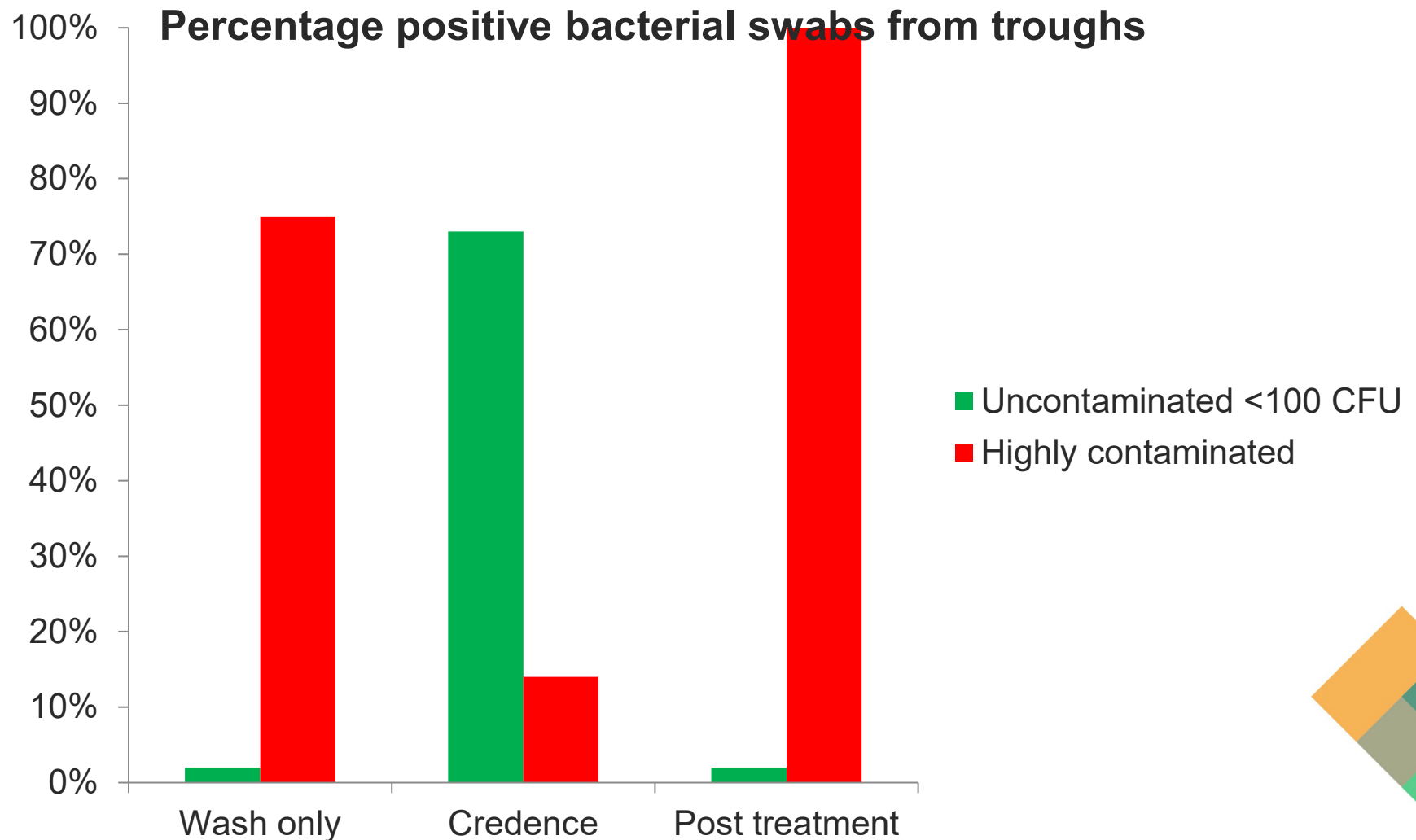


Equipment trials

- Feed bowls and water troughs swabbed over two week period (stables/equine)
- Swabs taken 30 min after washing with Credence
- Compared against water rinsing only
- Swabs taken for 20 days after Credence and washing ceased – to assess levels of recontamination

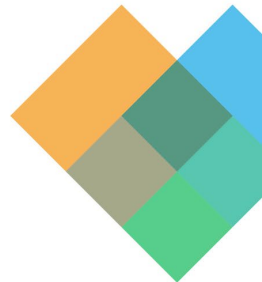


Feed and water troughs



Efficacy against viruses

- Virology report on efficacy against rotavirus
- Replicated with different water sources
- Monitoring infection of host cells with viruses
- Credence dilution 2.2 ppm (8.5 mg in 4.4 litres of water)
- Effective against FMD at dose levels of 1 tablet per 1000 litres of water (DEFRA report)



Efficacy against rotavirus

Viral dilution	Contamination of cells in control	Viral contamination in cells with Credence
10^{-2}	100%	0%
10^{-3}	96%	0%
10^{-4}	71%	0%
10^{-5}	33%	0%
10^{-6}	4%	0%
10^{-7}	4%	0%



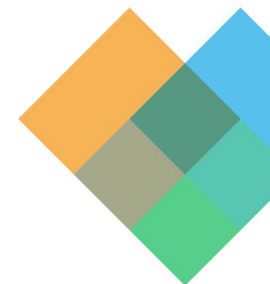
Campylobacter

- Main pathogen associated with poultry meat
- Increasing in colonisation of drinking water due to N and other nutrients from soil pollution
- Cause of major gastroenteritis outbreaks in humans from contaminated water (2016)
- Present in river and ground water, bores, and roof tanks



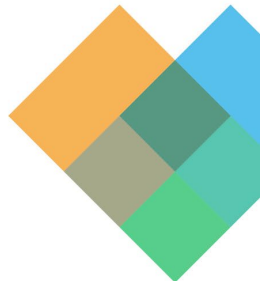
Preventing cross contamination

- Poultry clean out routines
- Are we recontaminating after clean out with contaminated water?
- Ensure all water sources used in clean out are disinfected
- Bores/tanks – Credence 1 tab/1000 l
- Water lines – need non- corrosive and long persistency disinfectant with good biofilm penetration
- Equipment – sanitise before and after use



Summary

- Less corrosive and hazardous to handle compared to peroxide-based products
- Safe to animals after basic rinsing
- No mineral overloading/imbbalances, unlike copper-based products
- No overproduction of toxins from blue-green algae during kill-off, unlike copper based products



Credence can be used to:

- Ensure uninfected water from rural water sources and in tanks and troughs
- Effective cleaning of building and equipment on farm
- Biosecurity – for personnel and vehicles

