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Importance of drinking water to poultry

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Did you have a good time last night?

A. Yes

B. No

1. Is it water a nutrient?
2. Yes
3. No



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The most important nutrient



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The forgotten nutrient





Water covers 71% of earth's surface

thereof:

97% in oceans

1.5% in glaciers & ice caps

1.5% in groundwater

0.001% in the air as vapor & clouds

Just less than 1% of the total water in the Earth is fresh accessible water for humane use!

Importance of water

- Water plays an important role in the world economy
- As a solvent for a wide variety of chemical substances
- As a means of transportation and industrial functions i.g. cooling etc.
- Approximately **70%** of the fresh water used by humans goes to agriculture.

- A chemical substance **VITAL** for all known forms of life!



Standard values: Minerals

Parameter	Recommended Range for Poultry	German Human Drinking water ordinance
Calcium	60 - 75 mg/L	No limit
Copper	0.6 - 1 mg/L	2 mg/L
Iron	0.2 - 0.3 mg/L	0.2 mg/L
Magnesium	50 - 75 mg/L	-
Manganese	0.1 mg/L	0.05mg/L
Nitrate	15 mg/L	50 mg/L
pH	6 – 8	6.5 – 9.5
Phosphorus	0.1 mg/L	-
Potassium	250 - 500 mg/L	-
Sodium	50 mg/L	200 mg/L
Sulfate	100 – 200 mg/L	240 mg/L
Hardness	60 – 180 mg/L	-

Minerals

- Iron-red water
- Manganese- black solids
- Sulfur
- Small quantity- bitter metallic taste for people
 - .3 ppm Fe-Iron
 - .05 ppm Mn-Manganese
- **Birds not sensitive to mineral tastes**
- **Promote the growth of organisms**
 - Form heavy gelatinous stringy masses
 - Reduces pipe volume
 - Clogs drinkers
- **Promotes *Pseudomonas* and *E. coli* , other pathogens**
- Mineral deposits cause drinkers to stick
- Chlorinate and then filter

Possible impacts of exceedance of the standard values

(Depending on age and body size)

- **Nitrites & Nitrate:** Decrease of oxygen absorption in blood (Lazy & sluggish birds, Blue Comb & Wattle); Low Fertility; Respiratory Infections, low feed Intake, lower weight gain and performance
- **Iron:** Gastrointestinal Disorders, negative impacts on vaccines and medication efficiency; clogs the water pipes up, bad odor or taste, encourage the bacteria growth
- **Sulfate:** Laxative effect, fishy egg smell, negative impacts on nervous system, bitter taste, reduced water intake
- **Calcium & Magnesium (Water Hardness):** Lime Deposit in the water system, high magnesium levels (50 ppm) can have laxative effect esp. when the Sulfate or Chloride levels are high
- **Chloride:** Detrimental effect on Metabolism
- **Sodium:** Laxative effect
- **Lead, Zinc:** Toxic
- **Copper, Manganese:** bitter taste
- **pH:** Low values harms Vaccines and medications

Water is Perfect Carrier of Health Challenges

- Water supplies can harbor many health challenges
 - Bacteria
 - Viruses
 - Protozoa
 - Worms..
- Poultry drinking systems easily contaminated
 - Water is slow moving/ warmed during brooding
 - Water systems/lines have many hiding places-pinch points
 - Water often contains food the organisms need
 - We add food



Water quality: bacteriology

Parameter	Unit	Recommended Range	German Drinking water ordinance
Bacterial Count (20°C)	In 1 mL	< 100	1000
Bacterial Count (36°C)	In 1 mL	< 100	100
Coliform Bacteria (e.g E. Coli)	In 100 mL	< 10 (0)	0
Escherchia Coli	In 100 mL	< 10 (0)	0

Survival time in water of different pathogens

Pathogenic germ	Survival Time
Salmonella Typhi	2 - 93 Days
Shiegella Dysenteriae	15 - 27 Days
Brucella Abortus	5 - 85 Days
Clostridium Tetani (Spores)	unlimited
Bacillus Anthracis (Spores)	unlimited
Enteroviruses	200 Days

Total Bacteria

Inexpensive Test for Quality Assurance >1,000 cfu/ml-potential problem

Farm	Source	End of line un poultry barn
	Colony forming units of bacteria/mal	
A	2.700	26.600
B	203.000	2.340.000
C	0	4.775.000
D	0	0

Do you sample wáter lines?

1.YES

2.NO

**Water analysis must be performed frequently (every month).
Especially if the source is well water**



Same Farm, different well waters!



Take samples from all parts of the house!

How to sample?

- Take the samples from **different parts of the water system** e.g. dead ends
- **Clean and disinfect the openings and nipples thoroughly before** taking samples
- Water should be **first run for some minutes** to get a representative sample



How to sample?

- For bacteria count tests the sample should arrive the laboratory **within 24 hours** otherwise the water sample should be frozen!
- **Glass bottles** are more preferred than plastic ones
- As Biofilm may not be releasing pathogens when you take a water sample, It is recommended to **use swab** samples from inside the water system (Biofilm swabbing)

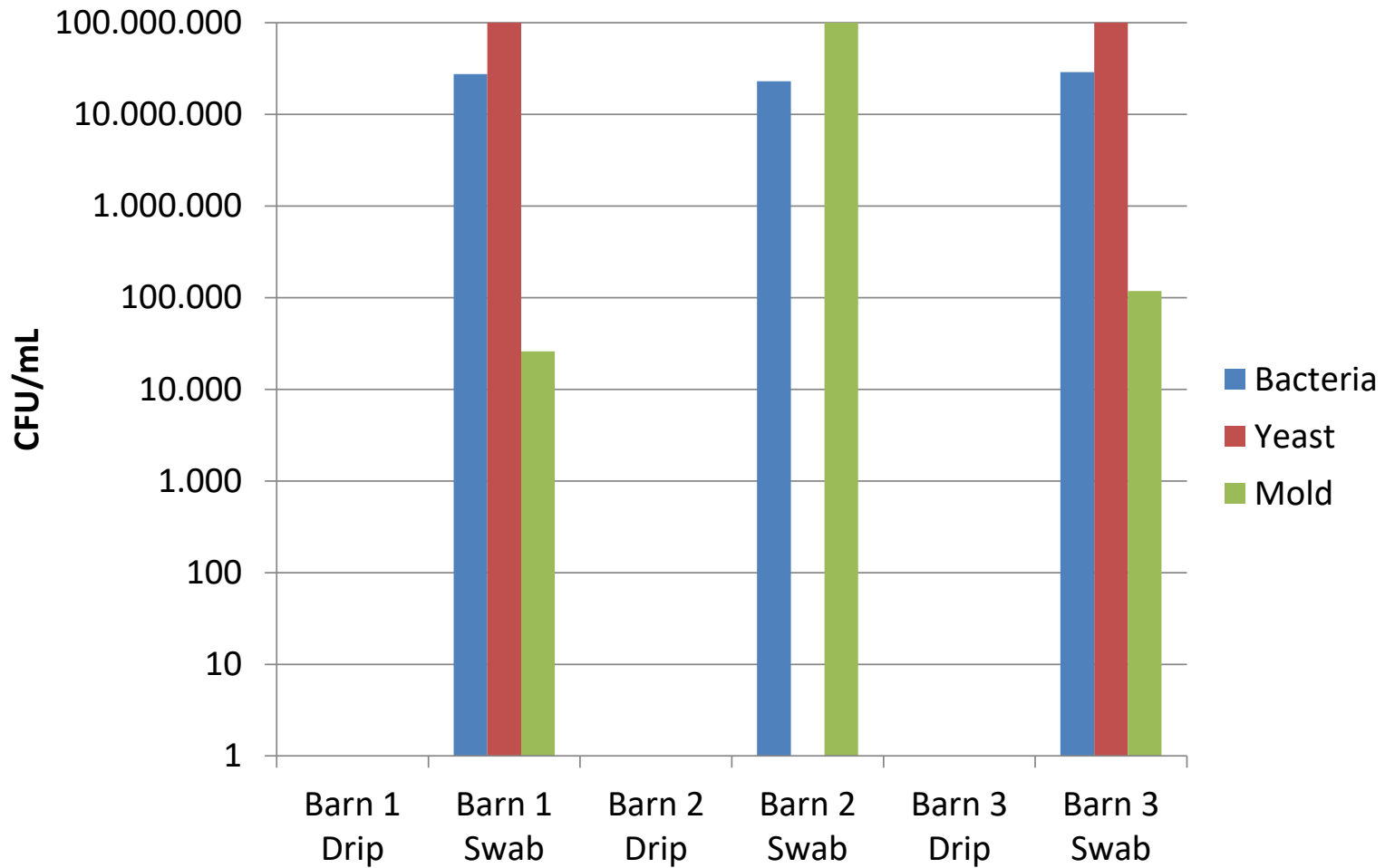


Look For the Source of Problems: **Line Swab** Procedure

- Insert sponge into line approximately 8-10 cm
- Return sponge to 25 ml BPD or sterile water



Farm X: Bacteria, Yeast and Mold Counts Drip Collection vs Swab Collection







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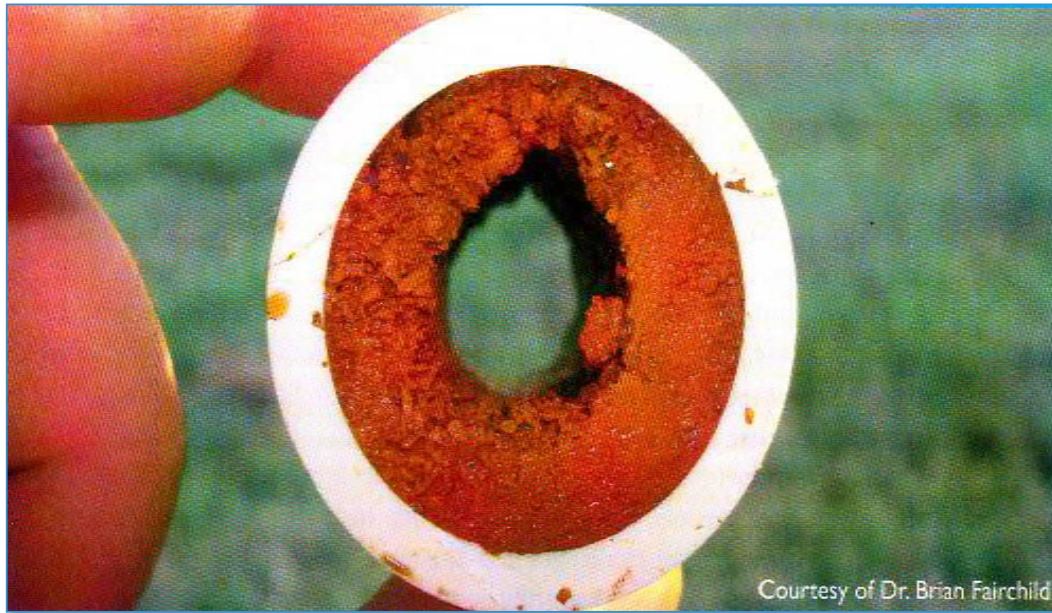
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Biofilm



Biofilm is a mixture of Fungi, Algae and Bacteria and organic contaminants e.g. sugar bound together stuck on the inner surface of the pipelines and water system!



What promotes Bio-film?

1. **Natural contaminants**
2. Vitamins
3. Electrolytes
4. Organic acids
5. Vaccines and vaccine stabilizers
6. Probiotics and Antibiotics
7. None of above
8. All of above

What Promotes Bio-film?

- Natural contaminants
 - Iron, manganese, sulfur
- Vitamins
- Electrolytes
- Organic acids
- Products with nutrients like carbohydrates
- Vaccines and vaccine stabilizers
- Probiotics and Antibiotics
- **Are lines cleaned lines after product use?**
- **Is water sanitation sacrificed so water can be delivery route for products?**



Biofilm

Causes:

- Dirty water source, low water flow rate, standing water, medications, vaccinations and high water temperature.
- Be sure, although you don't see it, **Biofilm & Mineral Deposits** are inside your waterlines!



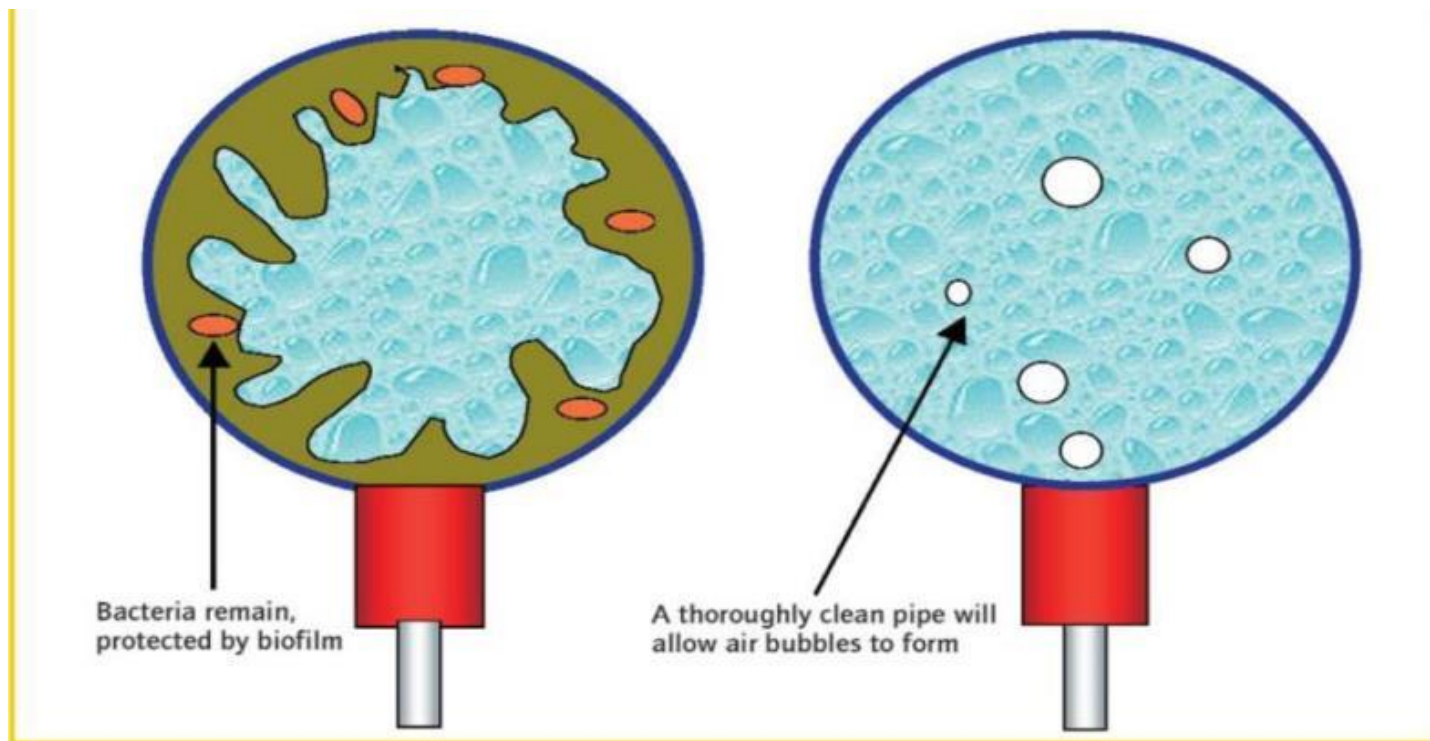
Picture: Selko feed additives

Negative impacts caused because of Biofilm

- Reduce flow
- Increase pressure
- Negative impacts on Medications & Vaccines applied through drinking water
- An optimum medium for pathogenic germs (Salmonella + Campylobacter ...)
- Negative impact on feed conversion
- Drop in Egg production
- Increased mortality
- Negative impact on drinking system specially nipple drinkers

A single Bacteria can increase to over 2 Mio. within just 7 hours under ideal conditions inside Biofilm*

*World Poultry, Volume 18, No 5. 02



**WE HAVE TO DISINFECT THE WATER
AND REMOVE BIOFILM**

What treatment do you have in place?

1. Chlorination
2. Hydrogen Peroxide
3. Polyphosphate Compounds
4. Organic Acids
5. Physical treatment
6. None

Treatments to eliminate or reduce impurities, scale and lime build-ups, biofilm and bacteria count.

Chemical Treatments

- a) Chlorination (unsafe, bad smell, not completely effective)
- b) Hydrogen Peroxide
- c) Polyphosphate Compounds
- d) Organic Acids (not completely effective)

Treatments to eliminate or reduce impurities, scale and lime build-ups, biofilm and bacteria count.

Physical Treatments

- a) Electromagnetic Methods
 - b) Ultraviolet light, Ozone Treatment (Limited effect on bio-film)
 - c) Laser (Only effective at point of use)
 - d) Softener Equipment
 - e) Pressure impulse methods
-
- *Only a very few treatments can be used during the production cycle. **LABEL**
 - Other effective treatments must be applied during service period!

Water Treatment

	Disinfection	Desinfection under hard conditions*	Lime sclae Elimination	Biofilm Elimination	Acidification	Stability	Toxicological Properties
Peracetic Acid	Excellent	Good	Good	Good	Good	Good	Excellent
Hydrogen Peroxide	Acceptable	Poor	Acceptable	Acceptable	Poor	Good	Acceptable
Organic Acids	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Good
Chlorine Compound	Acceptable	Poor	Poor	Acceptable	Poor	Acceptable	Poor
Chlorine Dioxide	Good	Acceptable	Poor	Good	Poor	Poor	Good
Chloramine T	Good	Good	Acceptable	Acceptable	Good	Good	Excellent

Lohmann Animal Health 2010

Excellent

Good

Satisfactory

Acceptable

Poor



*PH, Water Hardness, Temperature



Product Evaluation: Bacteria Results total bacteria/cc of water

Treatment	Pre Clean	Post Clean 4 Hours	Post Clean 24 Hours
Control	1,202,000	977,200	2,691,500
Bleach 3%	660,700	832	813
Citric Acid	36,307,800	33,113,100	21,379,600
CID 2000-2%	7,943,200	100	<1
ProxyClean 1%	1,659,500	12,300	316
ProxyClean 3%	537,000	457	<1

Water Line Cleaning Essentials

- Right concentration of an effective cleaner left the proper amount of time is the key to success
 - Improper cleaner concentration or not leaving long enough are both failures
- Cleaning the whole system is essential
 - Water lines
 - Standpipes
 - Regulator
 - Distribution pipes
- There are lots of great products, DOCUMENT which one is best for your operation(s)
 - Collect swabs pre and post cleaning
- **Flush system after cleaning with sanitizer**
 - Stabilized products ideal since they keep working for days
 - This helps kill any bugs that survived line cleaning

Regulators can harbor challenges

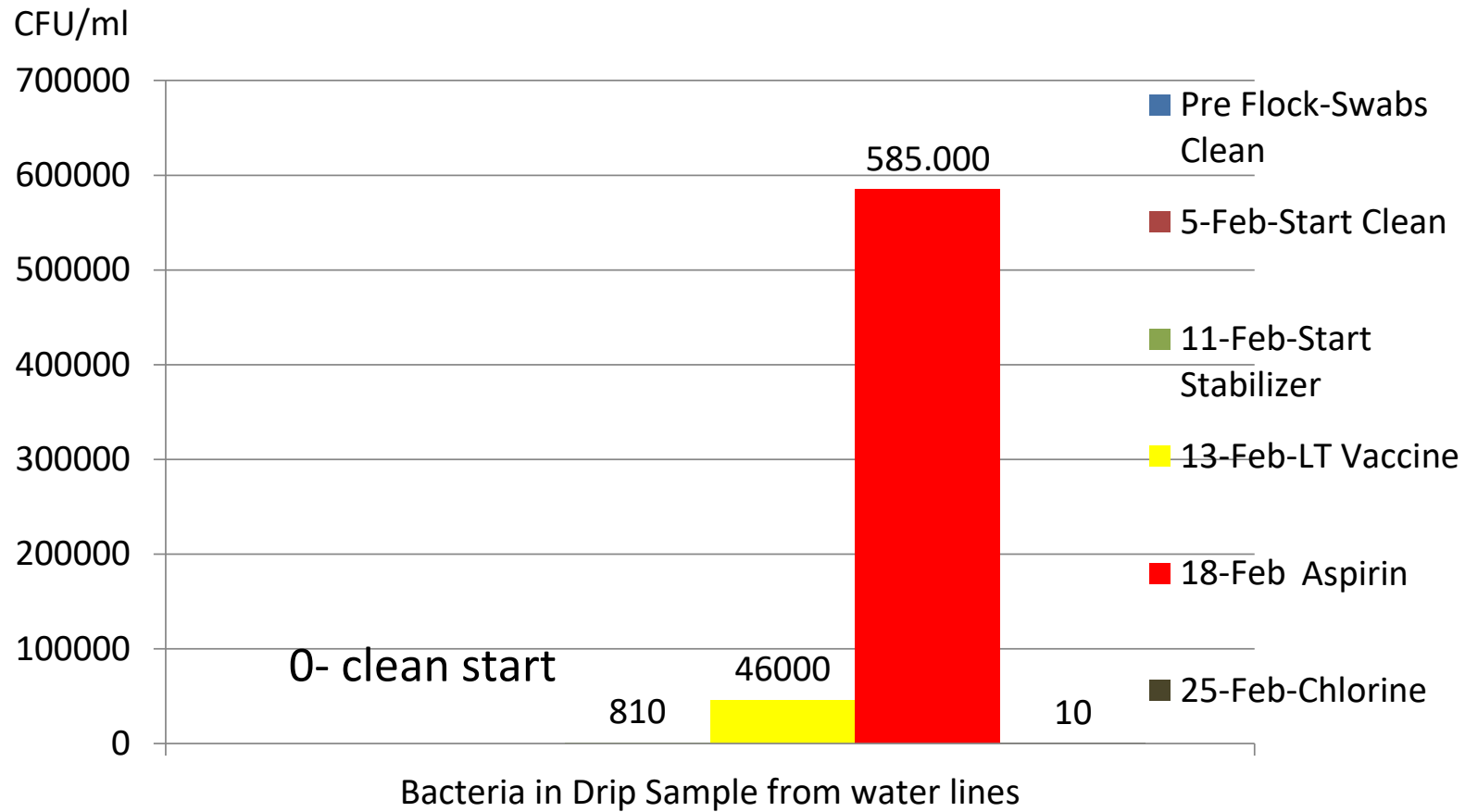
Before cleaning regulators



After cleaning regulators



What happens to water quality when the sanitizer is shut off or barn is empty?

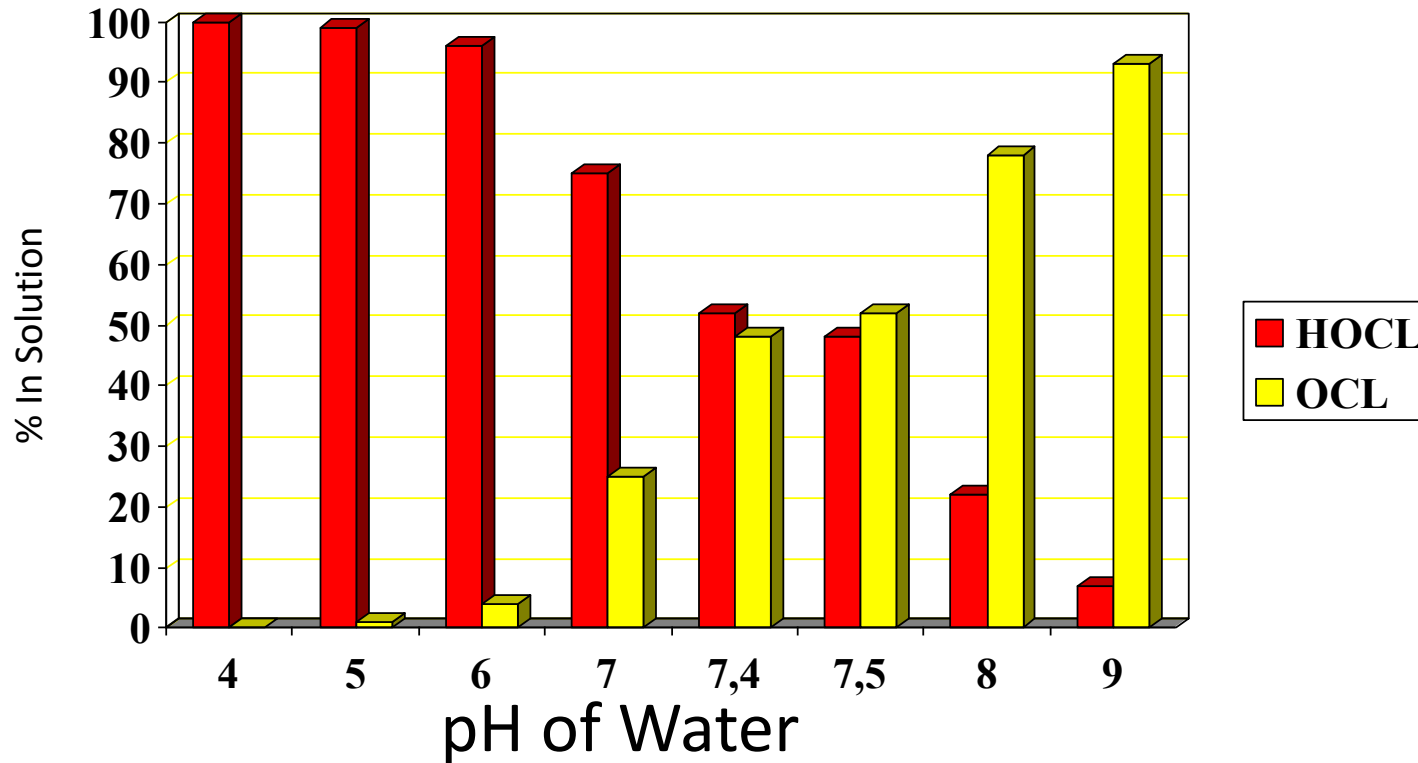


Chlorine

- Chlorine great sanitizer but not perfect
- Affected by:
 - pH, best pH is 4.0 to 7.0
 - Low concentration bacteria will live
 - Water temperature, >18.9 C loses effectiveness
 - Turbidity (dirty water)
 - Short exposure time, will not work
 - Growth stage and type of bacteria present
 - Age/ storage conditions of bleach



How pH Affects Chlorine Ratio of Hypochlorous Acid to Chloric Ion



What Form is Your Chlorine?

- Hypochlorous acid is 80-300 times more effective as a sanitizer than chloric ion
- **Free chlorine** not considered effective unless it is 85 % Hypochlorous acid (<7 pH)

Dual Injection of chlorine and acid



Dual Injection with Stenner Pumps



Chlorination

- **Goal- 2-4 ppm Free Chlorine**
 - Target- same reading beginning/end of line
- May need more for disease control or problem farms
- Cleaner the system- less required
- Check- total and **free chlorine**
 - Once these two numbers are the same reading, system is clean
- Chlorine smell- smelling chloramine
 - Chlorine reacting with organic material present



Green Klean Bleach Crystals



- Active ingredient-Sodium Dichloro-s-triazinetrione dihydrate 99 %
- Provides 55% available chlorine
- Acid-neutral pH
- EPA approved drinking water sanitizer



Rectangular Smart Hinge™ Bucket

Features a hinged lid that remains attached to the container and permits easy opening and resealing. Lid opens completely and has an enhanced, tamper evident tear tab that allows right or left handed opening. Molded-in bottom grips assist in pouring contents. Max. content weight is 34 lbs. 4.5 gallon capacity. Bucket is made of Polypropylene and cover is made of HDPE. Cover is sold separately. Material meets FDA standards. Bucket measures 11-7/8" L x 9-5/8" W x 12-3/4" H.

Additional Resources

[Related Products](#)
[Have a question?](#)

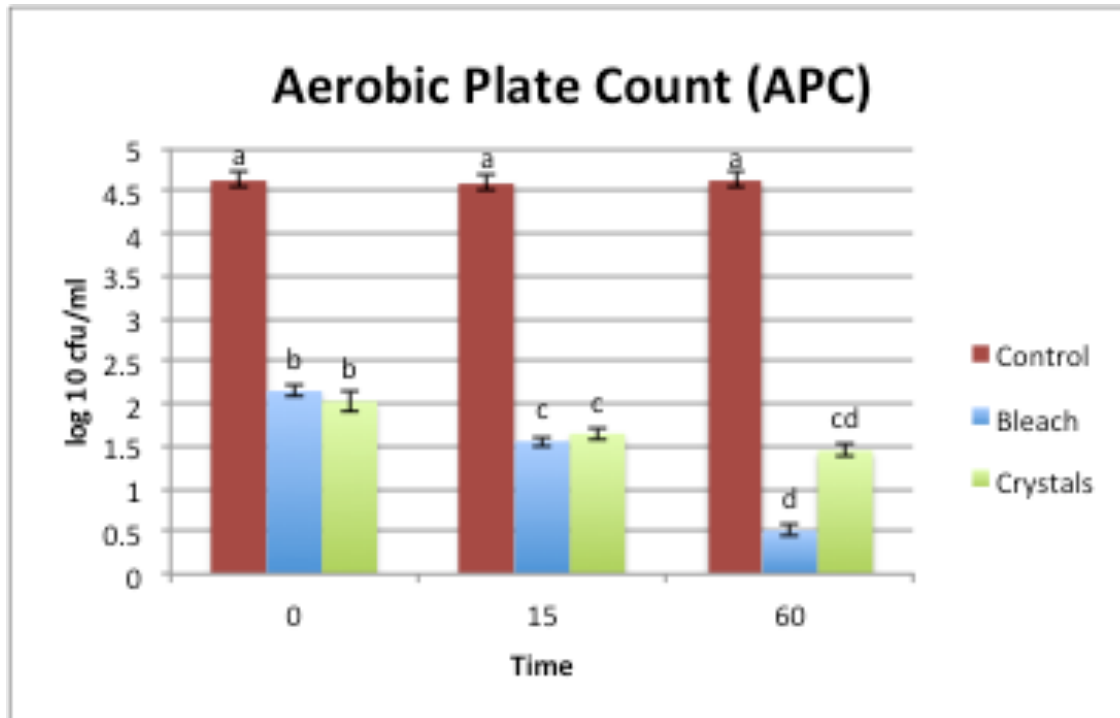
Free Chlorine Residuals



a-b Values with no common superscript differ significantly

- Monitoring Cl residuals over time, liquid bleach **significantly declined by 60 minutes** (from 1.2 ppm to .6 ppm) while the **bleach crystals remained steady** from 0 to 60 minutes (~1ppm).
- Control had 0 ppm chlorine

Aerobic Plate Count (APC)



- As compared to the control, liquid bleach and bleach crystals both resulted in significantly lower APC levels (2-3 log reduction) with similar final APC for both products.

a-d Values with no common superscript differ significantly

■

Protect Chlorine

- Seal chlorine container
- If chlorine concentrate is not used within 4-6 weeks, consider using smaller volumes to reduce loss of chlorine efficacy

Hydrogen Peroxide

- Target- **25-50 ppm** residual in drinking water
- Good for sanitizing pond or river water-controls taste issues/no chlorine by-products
- Not as good at oxidizing iron and manganese
- **Can be dangerous to store and handle**, flammable
- Effectiveness deteriorates with **storage**
- **Stabilized products** like Proxy Clean/CID last longer



5 Day Residual for Different H₂O₂ Products (ppm or mg/l)

Products, stock concentration	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5
50% stabilized , 2 oz/gal	79.0	76.7	64.2	58.6	55.5	>50
20% stabilized , 2 oz/gal	44.4	37.1	32.9	27.0	26.3	>10
34 % stabilized , 2 oz/gal	53.5	49.6	41.2	36.5	32.6	>10
28% non-stabilized, 2 oz/gal	36.3	34.1	26.6	22.1	19.2	>10

Each product was mixed at the concentration shown then added at a rate of 1 ml to 128 ml of drinking water

Stabilized hydrogen peroxide can be a good sanitizer during low water flow

Even good cleaner products used at right concentration have limits in tough situations

Product	Pre Bacteria	48 Hours later
ProxyClean 3%	155,000	530
ProxyClean 3%	579,000	43,000
ProxyClean 3%	603,000	10,200
ProxyClean 3%	164,000	23,3000

Flush with sanitized water to finish the job!!

Chlorine Dioxide ClO_2

- Strong oxidizer
- **Effective-wide pH range 6-10**
- Make ClO_2 -Blend
 - 5-7% sodium chlorite
 - Liquid Acid
- Monitor free and total ClO_2
 - Target residual
 - 0.2-1.0 ppm free
 - 2-4 ppm total



AANE mixing and injection system

Mixes the sodium chlorite with acid

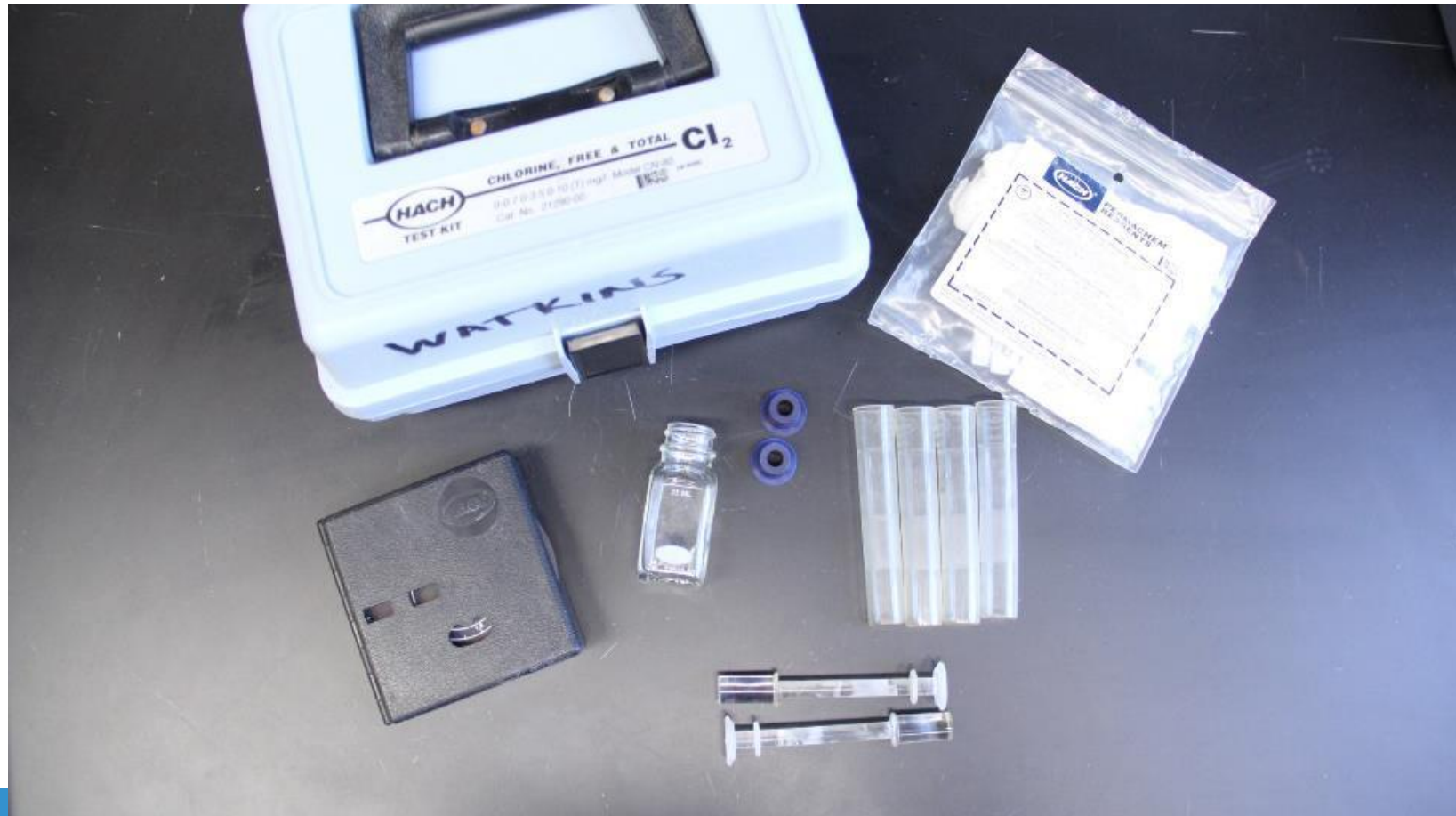


Turkey Farm Test with Pro-Oxine

- Grow-out farm with chronic respiratory challenges- did not respond to bleach, city water
- Pro-Oxine/acid-flock 1
- No respiratory challenge
- Continuous use (6 weeks) steadily reduced bacteria/biofilm in water lines

Sample from turkey barn	Initial bacteria cfu/ml	Final bacteria Cfu/ml
Swab EOL	670,000	8
Drip EOL	15,500	0

Hach Testing Kits- Good Monitoring Tool



Physical Treatments:

APIRE[®] (Lohmann Animal Health GmbH)

- The APIRE drinking line cleaning equipment
- **A new method based on pulsed Water & Air pressure produced in specific intervals in pipelines**
- A chemical-free method
- Suitable for empty houses (in the service period) and occupied houses
- Complete elimination of Biofilm
- Easy and fast application
- Does not cause any corrosion in the system. It can be used in the long term and at any frequency.
- Works under lower pressure, thus does not overload the water mains network.



APIRE[®] (LAH GmbH)





Simple Pipeline Flushing without APIRE®



First Flushing with APIRE®



Third Flushing with APIRE®



Fifth Flushing

**VS
with APIRE®**

Third Flushing



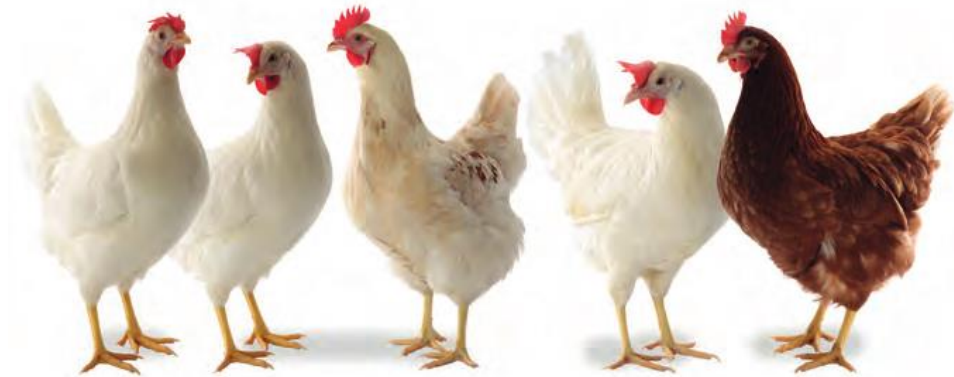
Can we calculate the economic impact?

- According to the Dutch Poultry Health Service (GD) over a third (**36%**) of the drinking water used in commercial poultry farms has **a poor quality!**
- According to calculations done by GD the contaminated water with mold and yeast causes damage of **12.000 €** (for a flock of 30.000 laying hens).
- Bacterial contamination of the drinking water of 30.000 broilers can lead to financial losses up to **2000 €** per cycle!



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Conclusion

Would I drink the water?

Keep in mind

- More than **one in 6 people in the world don't have access to clean drinking water!**
- About 1.8 Mio. People die yearly of diarrheal diseases like cholera as a result of drinking polluted water



- 785 million people lack even a basic drinking-water service, including 144 million people who are dependent on surface water.
- At least 2 billion people use a drinking water source contaminated with feces.
- In least developed countries, 22% of health care facilities have no water service, 21% no sanitation service, and 22% no waste management service.
- By 2025, half of the world's population will be living in water-stressed areas.



650^M

650 million people live without safe water.

2.3^B

2.3 billion people don't have access to adequate sanitation, one in three of the world's population.

315K

Over 315,000 children die every year from diarrhoeal diseases caused by unsafe water and poor sanitation. That's almost 900 children a day.





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Susan Watkins

