Managing Water Quality for Successful Flocks

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Dear Dr. Watkins…..

- My birds are not performing well
- We are good managers with a good nutritional program, equipment new and works well
- But we are consistently seeing health issues leading to mortality
- I am leaning towards a water problem……

It sure can be water!!!
First identify the symptoms

- Start with determining the issues
  - What is primary problem-weight, feed conversion, health/all?
  - Birds start poorly?
  - High early mortality, uneven poults coming out of brooding?
  - Feed passage?
  - Gut health issues during grow-out?
  - Leg issues?
  - Do they fall apart late?
  - **Or** are flocks absolutely beautiful-great livability but light weights and poor feed conversion-”pullet flock syndrome”

Next: categorize the symptoms

- Do the birds have health challenges?
  - Poor start-high mortality?
  - Feed passage/enteritis?
  - Leg problems?
  - Respiratory issues?
  - Poor growth, feed conversion and livability?

Suspect contamination

- **Microbial**
- **Additives**
- **Some minerals/other**

- Do the birds have issues that do not seem to be disease related?
  - Look good
  - Livability fine, even great
  - Weights below target, feed conversion high?

Water consumption problem

- **Not enough**
- **Restriction points**
- **They don't like it**

Suspect Contamination: But Why Now? Start Asking Questions To Determine Root Cause

- Do you use anything in the water?
  - Vitamins, electrolytes, organic acids, probiotics, special recipes??
  - Are these used at placement, certain times in flock?
- Do you use water sanitizers?
  - Which ones, how much and how often and for how long?
- How often are the water lines cleaned?
  - Every flock, once a year, never?
- Is there a water analysis?
  - Minerals and pH
  - Bacteria, mold-Samples from well house and end of lines?
  - Any water line swab tests?
- Water system-Same as what everybody else has?
- Has there been any work or changes or the water system?
- Have the injectors been checked to assure they work properly?
- Always correct height of drinkers-day of age then after?
- Checked flow along lines?

Let's talk about why these questions…….

Water Supplies
Dynamic and Influenced by Many Factors

- Can change from season to season
  - Droughts and floods
  - Agriculture, industry and septic systems
  - Well depth and placement
  - Rock and soil it passes through
  - Usage level
- Surface water supplies like ponds most vulnerable
- Contaminants are both good and bad
  - Examples-calcium, iron, manganese, sodium, chloride….
  - Low levels may be fine but higher levels may be a problem
  - Combinations of certain contaminants can create problems

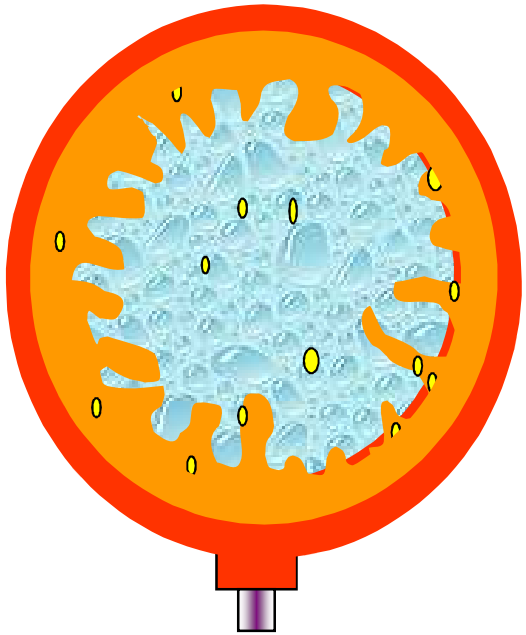
Water is Perfect Source of Health Challenges

- Water supplies can harbor many challenges
  - Bacteria
  - Viruses
  - Protozoa
  - Roundworms..

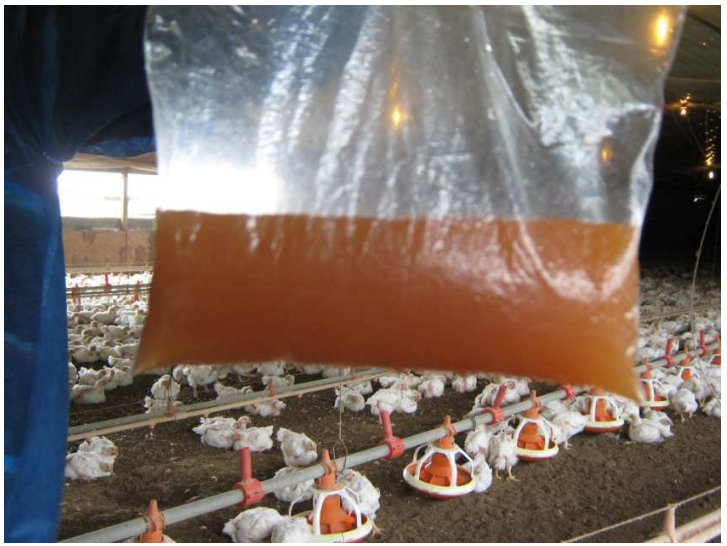
- Poultry drinking systems make it easy for microbes
  - Water is slow moving/gets warmed
  - Water systems/lines have many hiding places-pinch points
  - Water often contains food the organisms need
  - We add food

The Biofilm Slime: Source of Challenges

- Water systems contain biofilm
- Biofilm lives on very little nutrients
- Builds a protective wall
- Can cause health challenges, flock after flock
- Harbors disease agents like *E coli, strep,* and pseudomonas
- *Salmonella* can survive for weeks in biofilm
- Wideman has found birds exposed to staph in water
  And stressed had 40% increase in leg issues
- LT vaccine still viable up to three weeks
- Biofilm makes line cleaning difficult- 10-1000x
- Can return and rebuild
  - When we do a poor job of cleaning
  - When we don't keep water sanitized
  - When we add food supply
  - Just because it can



What Feeds Bio-films?



- Natural contaminants
  - Iron, manganese, sulfur
- Vitamins
- Electrolytes
- Organic acids
- Kool-aid, jello, sugar water, pancake syrup
- 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?-We screw it up!!

DON”T FORGET INJECTION SITE KEEP IT CLEAN AND SEALED

Total Bacteria
Quick Test For Quality Control
>1,000 cfu/ml-suspect

Farm	Colony forming unit/ml
A-- At well head	2,700
A-- At end of line	**26,600**
B-- At source (community)	**203,000**
B-- At end of line	**2,340,000**
C-- At source (community)	600
C-- At end of line	**282,000**
D– At well head	0
D– At end of line	**4,775,000**

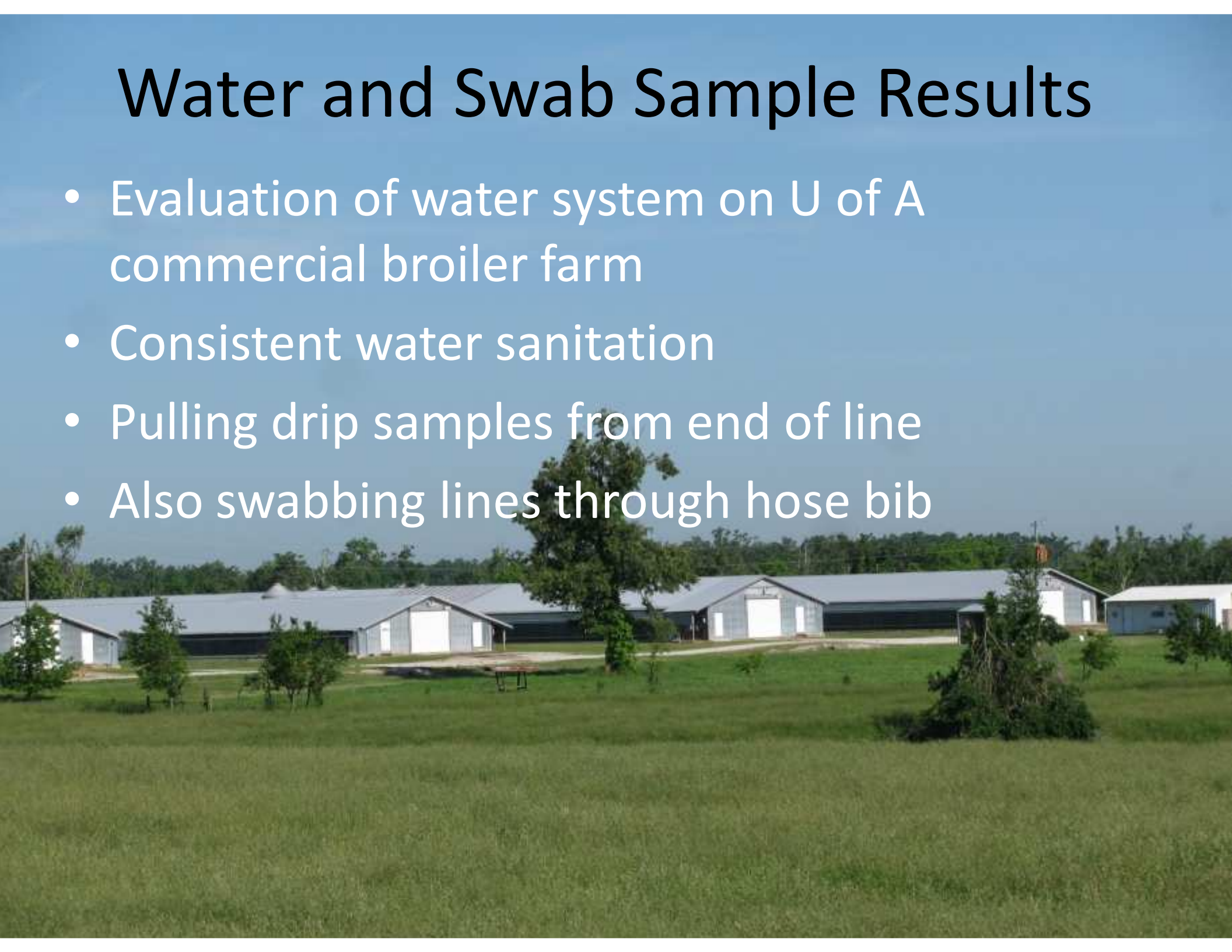
Swab Water System for More Accurate Evaluation

Swabbing water system on turkey farms revealed same challenges found in sick poults
Standpipes, drinkers, hoses, lines, etc. can all be disease hiding places

Sample location	Micro-organisms
Standpipe	Pseudomonas aeruginosa Pseudomonas sp.
Nipple drinker	Klebsiella pneumoniae
Nipple drinker	Chryseobacterium sp.

Water and Swab Sample Results

- Evaluation of water system on U of A commercial broiler farm
- Consistent water sanitation
- Pulling drip samples from end of line
- Also swabbing lines through hose bib



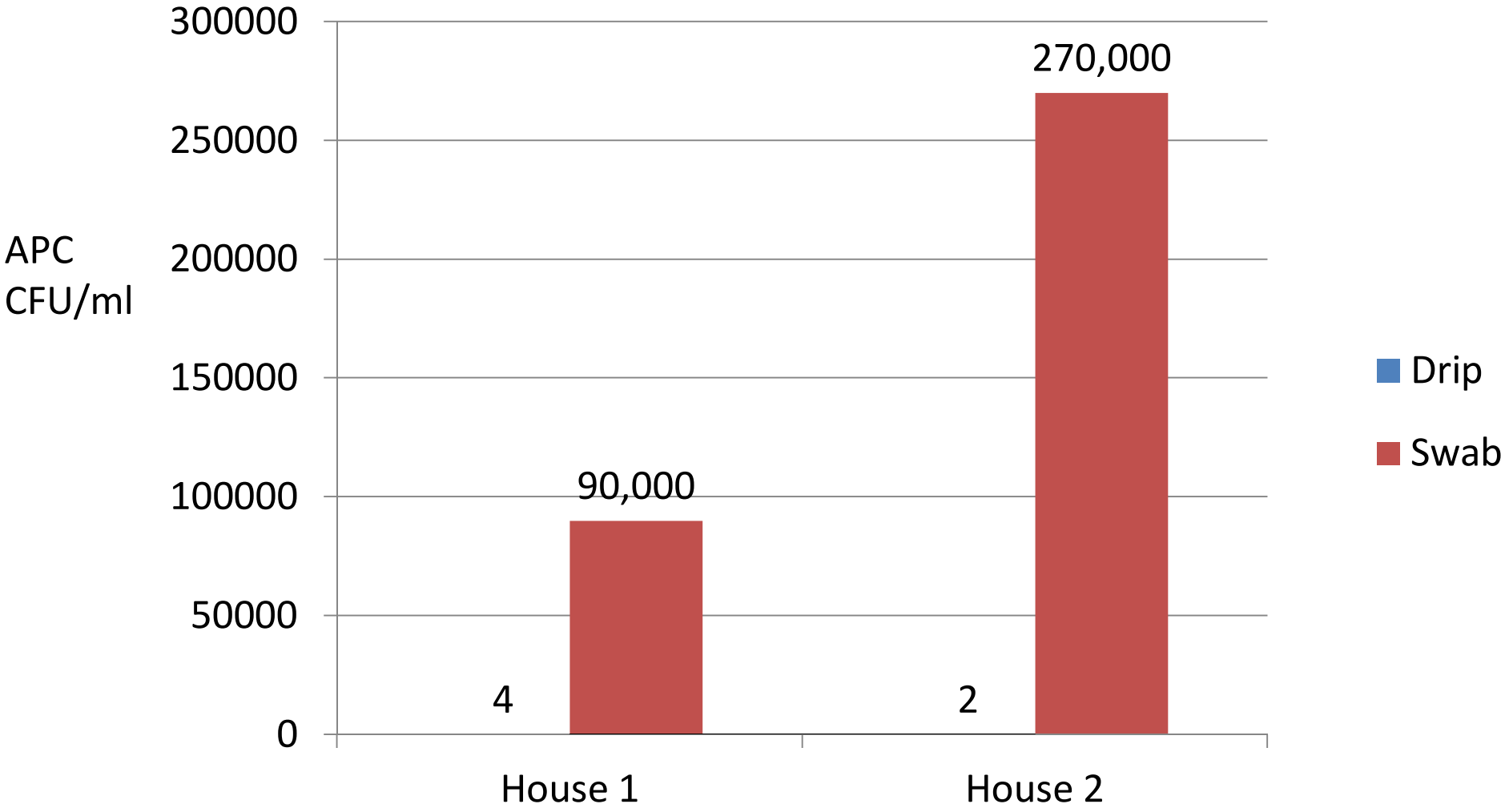
Line Swab Procedure

- Shut off water and remove hose from end of line
- Thoroughly clean opening with 91 % alcohol
- Use sterile tongs, forceps or tweezers 6-8 “ long
- Remove sponge from container

Line Swab Procedure

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

Drip Versus Swab Samples Comparison for Evaluating Water Line Sanitation

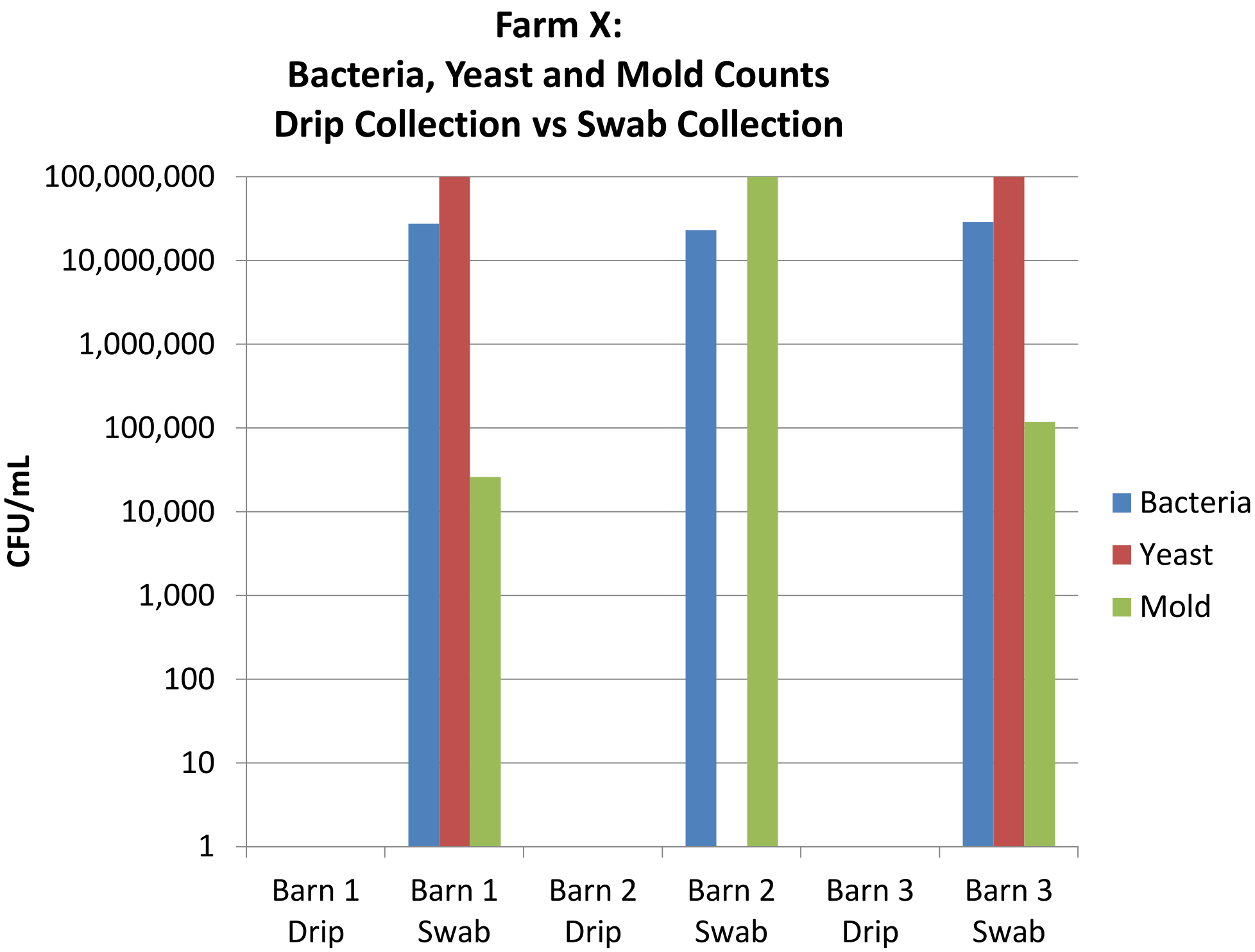


Broiler Farm Water Line Evaluation (Farm using continuous sanitation) Swab monitoring revealed line cleaning every other flock allowed biofilm to return

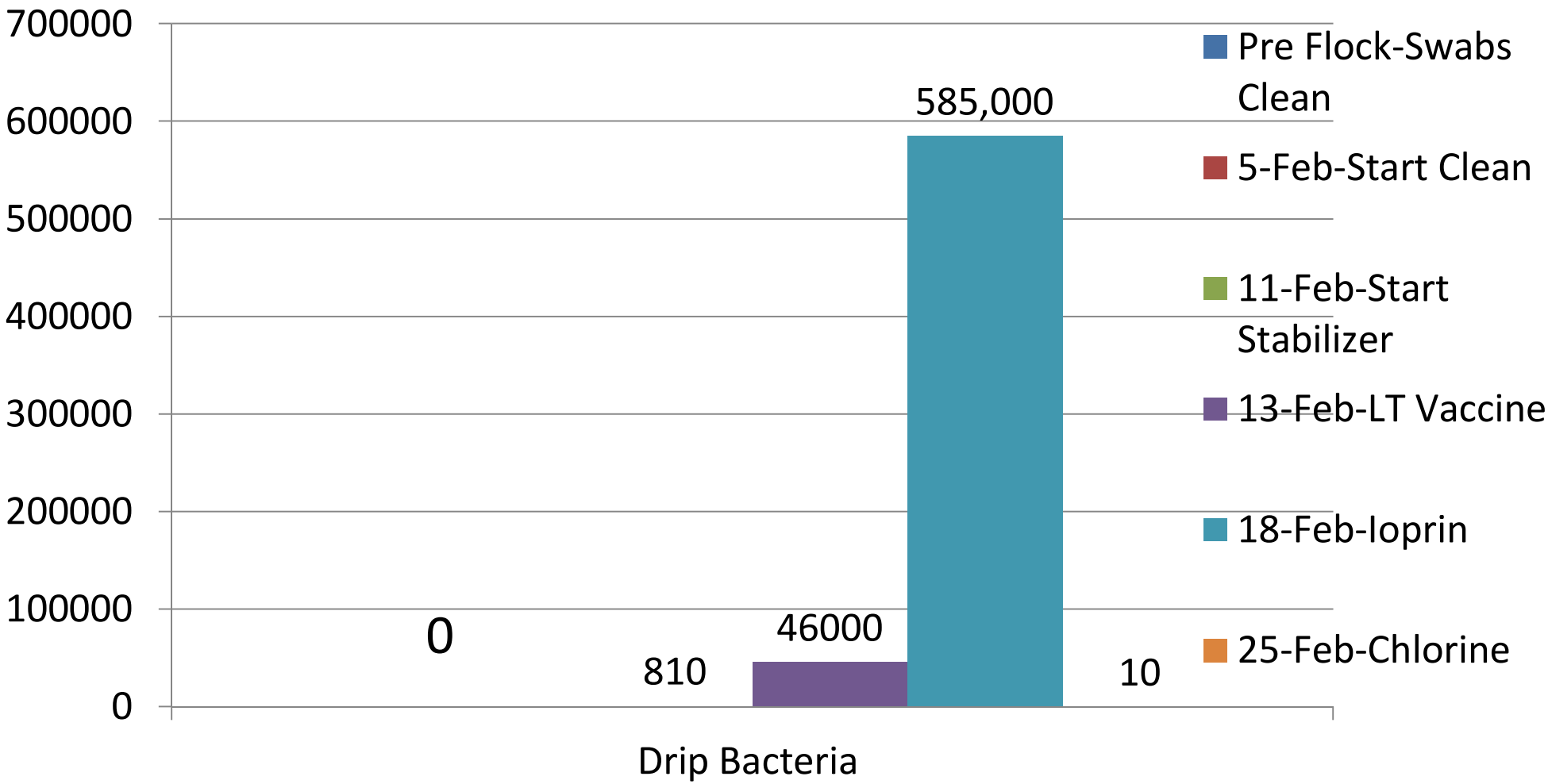
	Test 1 CFU/ml	Test 2 CFU/ml	Test 3 CFU/ml	Test 4 CFU/ml	Test 5 CFU/ml
Drip	0	0	2	4	0
Swab	170,000	5,900	121,000	20,800	191,000

All numbers are Colony Forming Units per Milliliter (CFU/mL)

Line Cleaning Between Flocks


Farm X:
Bacteria, Yeast and Mold Counts
Drip Collection vs Swab Collection
CFU/mL
100,000,000
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
Barn 1 Drip
Barn 1 Swab
Barn 2 Drip
Barn 2 Swab
Barn 3 Drip
Barn 3 Swab
Bacteria
Yeast
Mold

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



What is the Key for Success with Water Quality?

A good water sanitation program

Water Systems Must Be Cleaned Right!
But what does that involve?

Line cleaned with acid

Line cleaned with 3% ProxyClean


Thorough cleaning essential
but if harsh cleaners damage equipment
what are our best choices??

Bacteria Results

Treatment	Pre (Log 10)	Post 4 H (Log 10)	Post 24 H (Log 10)
Control	7.017	7.10	7.38
Bleach 3%	5.82	2.92	2.91
Citric Acid	7.56	7.52	7.33
Hydroline- 1%	6.03	4.13	3.57
Hydroline -3%	5.69	3.85	1>
CID 2000-2%	6.90	2.00	<1
35 H_2O_{2-} 3%	6.74	5.45	1.97
ProxyClean -3%	5.73	2.66	<1

Line Cleaning

- Proper concentration is essential
- Special pumps
  - Quick Mix
  - Easy mix
- Submersible pumps
- Holding tanks
- **Don't forget underground and distribution lines!!!!**

Water Line Cleaning

- After birds are gone, flush lines
  - Power flush is best, but any flush is good
  - Removes sediment, loosen bacteria, slime, etc.
- Make sure stand pipes are working
- Mix in trash can or 100 gal stock tank
  - 3 %- Proxy Clean- 1 gallon to 30 gal water
  - 2% CID 2000-1 gallon to 50 gallon water
- Add dye
- Fill lines
- Sweep drinkers to charge drinker wells
- Leave 3% solutions in lines for 24-72 hours
- Leave 2% CID 4-6 hours

Line Cleaning

- Flush cleaner from lines-watch for dye
- De-scale lines with acid if water supply contains minerals:
  - Calcium or magnesium (> 80 ppm)
  - Iron or manganese (>0.5 ppm)
  - Sulfur (>80 ppm)
  - pH must be 5 or less to dissolve scale
  - Leave in lines 24 hours
- Flush acid from lines
- Follow acid with sanitizer such as bleach
  - 4-6 ounces/gallon stock solution
  - 1 ounce stock/gallon water
  - Proxy Clean stock solution- 4 ounces/gallon then 1:128
  - This last step can help keep biofilm from returning
  - May even prevent drinkers from “sticking” after cleaning

Even Proxyclean has its 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 jobl!!

BOTTOM LINE: BIOFILM IS A REAL CHALLENGE THAT CAN ADAPT AND SURVIVE TOUGH CONDITIONS, DON'T GIVE IT THE OPPORTUNITY

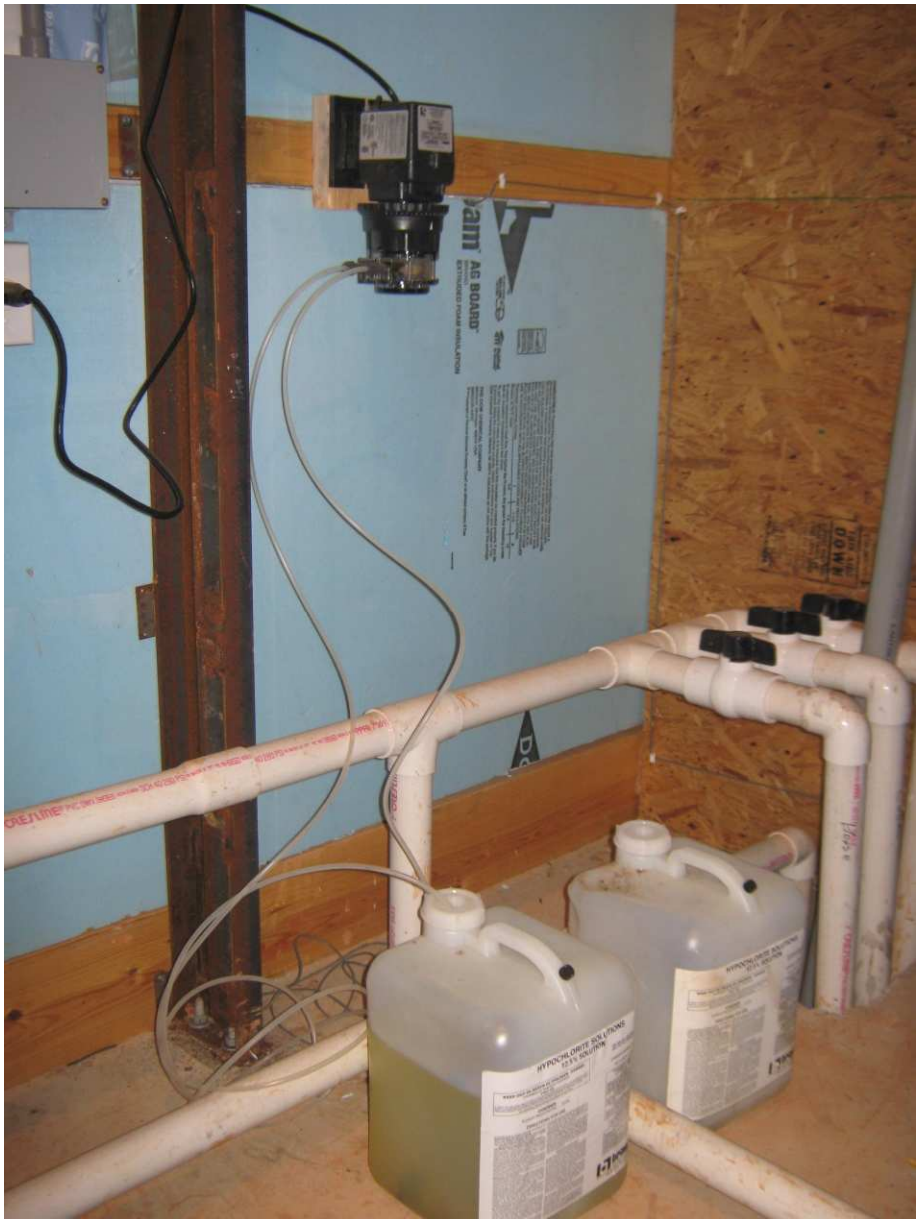
Water Sanitation

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

Abuse and misuse of chlorine results in resistant organisms

Chlorination

- **Goa**l- 2-4 ppm Free Chlorine
  - Ideal is same reading beginning/end of line
- May need more for disease control or problem farms
- Cleaner the system- less required
- Test for total and free chlorine
  - Once these two numbers are the same reading, system is clean
- Smell chlorine- smelling chloramine
  - Chlorine reacting with organic material present
- High chloride levels – chlorine may not be best sanitizer choice




mV
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ORP

Challenges with Chlorine

- Turkey company faithfully uses gas chlorination and acidification
- Overall positive results
- Except.. One area of producers
  - Concrete water holding tanks
  - Spring sources, some well, some rural water
  - Consistent E. coli outbreaks around 3 weeks of age
  - Medication became necessary- problems difficult/impossible to control
  - Flocks going to market with 80% livability

One solution

- After reviewing the situation, realized gas chlorine and acidification with the frequent medication breaks not working
- Concrete tanks had algae- biofilm build-up
- Decided water flow during brood too slow
- Chlorine residual not adequate/losing its strength
- Switched flocks to stabilized H2O2-4 oz/gallon is stock solution, then run 1:128
- Ran this during brood
- Eliminated E coli breaks
- Flocks started finishing with 90% livability
- Yes stabilized H2O2 is expensive but what is 10% livability on a turkey flock worth??

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 approved products last longer

5 Day Residual for Different H_2O_2 Products

(ppm or mg/l)

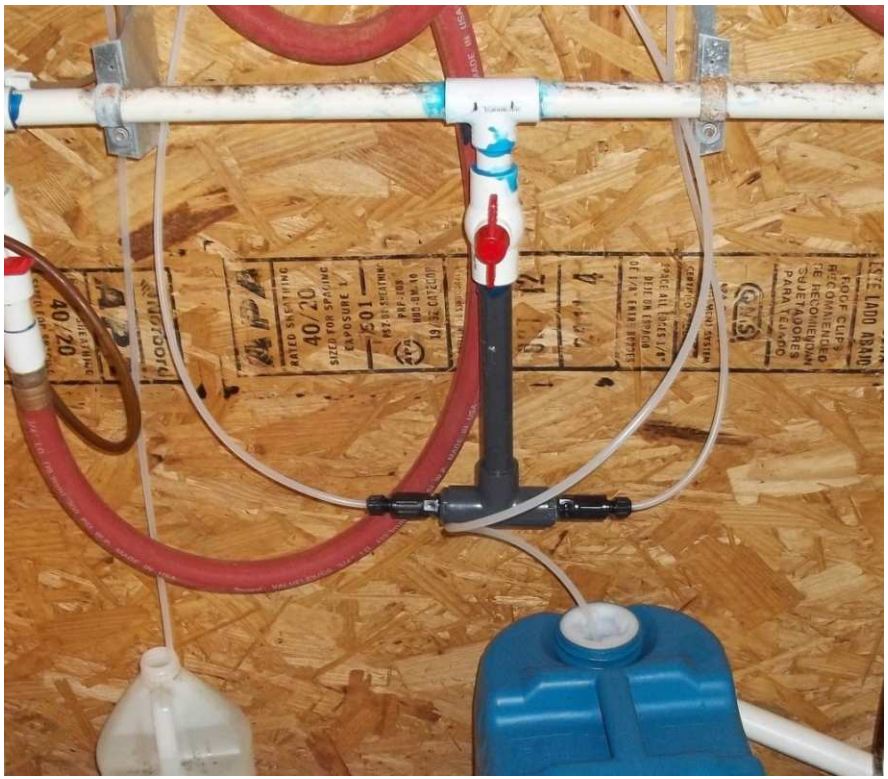
Products, stock concentration	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5
50% stabilized , 2 oz/gal	79.0 ^{e}	76.7^{e}	64.2^{gh}	58.6^{hijk}	55.5^{klm}	>50^{lmn}
20% stabilized , 2 oz/gal	44.4^{op}	37.1^{pq}	32.9^{s}	27.0^{tu}	26.3^{u}	>10^{w}
34 % stabilized , 2 oz/gal	53.5^{klm}	49.6^{mn}	41.2^{pqr}	36.5^{qrs}	32.6st	>10^{w}
28% non-stabilized, 2 oz/gall	36.3^{rs}	34.1^{s}	26.6^{tu}	22.1^{uv}	19.2^{v}	>10^{w}

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


Peroxide Te
1. Dip the Test strip into the
for one second and shake
2. After 10 seconds compare
0
1
ppm
10

Chlorine Dioxide

- Strong oxidizer
- Effective-wide pH range 6-10
- EPA-residual 0.8 ppm
- Products used at 2-8 ppm
- Two types available
  - Ready to use products-5-7% solutions-sodium chlorite
- Products which must be made on site
  - Chlorine dioxide explosive in concentrations >10%
  - Dual inject acid and sodium chlorite to form chlorine dioxide
  - Requires a two injectors
  - Know your acid!




COLOR SCALE
0.5
2
5
10
15
25
ppm

Silver Bullet

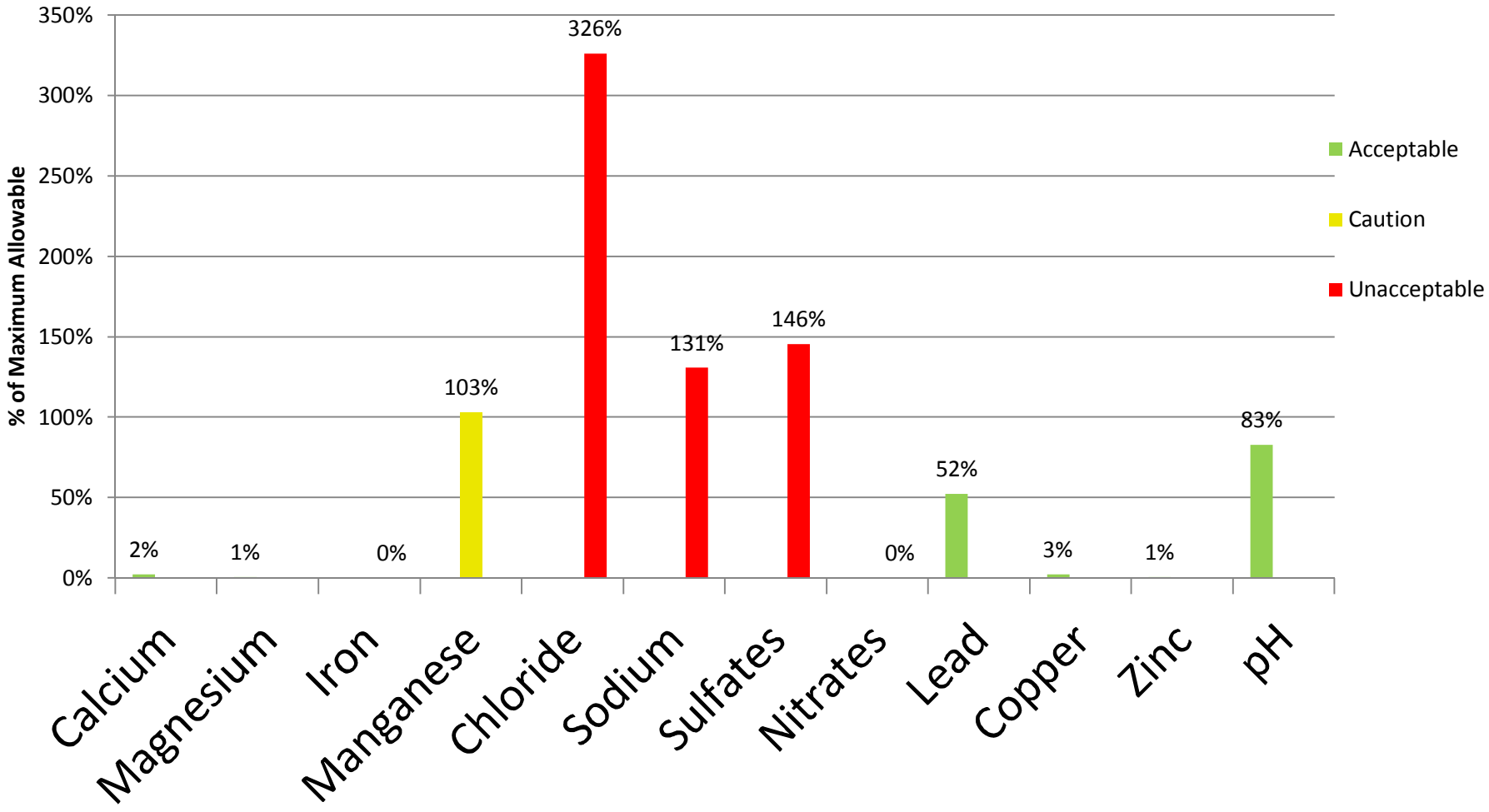
- Ultra-violet plus electrolyzing water to make oxidizers

Claims

- Reduction in Algae Formations
- Elimination of Scaling
- Elimination of Foul Odor
- Increased Flow Rates
- Misters become unclogged

Pricey

K 4 Fan End
Analyze water to know your challenges



Lessons Learned Water Basics

Water According to "Jim"

- Water is a very important NUTRIENT!!!
- Water can be complex to understand and solve issues
- Water programs must be managed 24/365, even when facilities are empty
- Keep it simple
- More is not always better with water treatments
- The birds will tell you if your water program is right
- Be the guinea pig, taste the water
- Test water supplies twice yearly (Hot and Cold seasons)
- Use swabs to check weak points in system
- Make sure birds get the volume they need

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