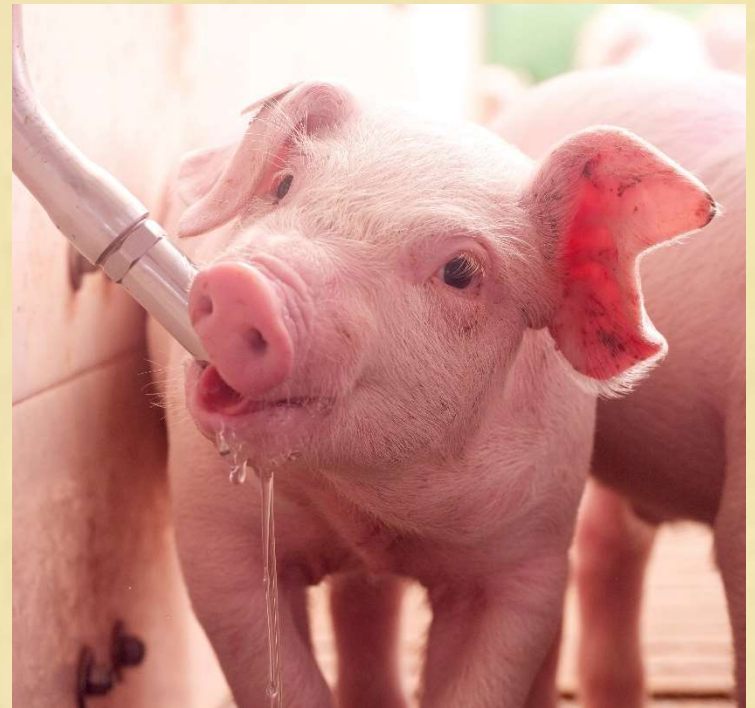


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# 4 THINGS YOU SHOULD KNOW ABOUT WATER – AND WHY IT MATTERS

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1. What do I measure to assess water quality?  
What do the results mean?
2. How water quality affects health and performance. What can I do about it?
3. What is biofilm. Should I care? What can I do about it?
4. Using drinking water to deliver medication or nutrients to my pigs. Good idea or bad?

# Measures of water quality for swine

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## Level 1 (Sentinels)

- Total coliforms
- Fecal coliforms
- Total Dissolved Solids (TDS)
- Hardness

## Level 2

- Sulfates
- Iron and manganese
- Nitrates + nitrites
- pH
- Calcium and magnesium
- Sodium and chloride

# Water hardness

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- Does not impact pig health or performance directly
- Scale accumulation may plug drinkers, other water equip't, reduce water flow rate
- Increases need for soap in laundry
- Is determined as the sum of calcium and magnesium
  - ✓ Soft water < 17 ppm
  - ✓ Hard water >120 ppm
- Can remove with water softener
  - Only need in the office/staff areas
  - Be aware that ion exchange water softeners replace calcium and magnesium with sodium



# Sulfates leading to diarrhea

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## High sulfates

- (>500 ppm) can lead to diarrhea; worse in weanling pigs, less so in older pigs
- Does not impact pig performance unless sulfates are very high perhaps over 2,000 ppm
- Do not know if this makes pigs more susceptible to pathogens
- Sulfates can also lead to rotten egg odor ( $H_2S$ )
  - Not the only source of odor
- Only way to remove sulfates from water is reverse osmosis
  - Very expensive, complex



# Effect of high sulfates in the drinking water on weanling pig performance

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<b>Sulfate, ppm</b>	<b>Expt. #1</b>	
	<b>29</b>	<b>1,650</b>
Init. wt., lb	13.1	13.0
Final wt., lb	47.0	46.3
A.D.G., lb/d	0.97	0.95
A.D.F., lb/d	1.48	1.43
Feed:gain	1.52	1.57
Water, gal/d	0.62	0.57

Experiment conducted in a 1,200 sow farrow-to-finish commercial barn, using either untreated (raw) water from a well, or treated by reverse osmosis (RO). Experiment ran from weaning at 3 weeks of age, for 5 weeks.



# Effect of high sulfates in the drinking water on weanling pig performance

<b>Sulfate, ppm</b>	<b>Expt. #1</b>		<b>Expt. #2</b>	
	<b>29</b>	<b>1,650</b>	<b>29</b>	<b>1,650</b>
Init. wt., lb	13.1	13.0	12.9	12.9
Final wt., lb	47.0	46.3	41.8	41.8
A.D.G., lb/d	0.97	0.95	0.88	0.90
A.D.F., lb/d	1.48	1.43	1.41	1.42
Feed:gain	1.52	1.57	1.61	1.58
Water, gal/d	0.62	0.57	-	-

Experiment conducted in a 1,200 sow farrow-to-finish commercial barn, using either untreated (raw) water from a well, or treated by reverse osmosis (RO). Experiment ran from weaning at 3 weeks of age, for 5 weeks.

# Iron stain – manganese too!

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- Looks a lot like rust (reddish-brown)
- This sediment can plug water heaters, showers and nipple drinkers; cause leaky nipples
- No direct affect on pigs
- **Treatment:** Iron can be removed from water through in-line filtration, cistern.
- Manganese can cause the same problem (black stain) but at 0.05 ppm



Iron bacteria are bad news!



# Nitrate and nitrite

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- A very serious problem in human health, especially infants < 6 months of age: blue baby syndrome
  - Maximum 10 ppm nitrate or 1 ppm nitrite
- The level which causes problems in pigs is not well known
  - Current standard is 100 ppm nitrates/10 ppm nitrites
  - One old study found no problem with 300 ppm nitrate in the water
- May reflect organic contamination of a well

# pH

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- Much is made about the pH of water
  - Is an aesthetic characteristic of water; rarely a health or performance concern
  - Most water is well within an acceptable range of 6.5 and 8.5
  - Water is sometimes acidified to help control pathogens; efficacy is inconsistent
- Some antibiotics are pH sensitive
  - Consult with supplier to determine if pH adjustment required
- Interestingly, Coke has a pH of 2.5 and Mountain Dew a pH of 3.22

# Biofilms

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- Collection of bacteria and/or fungi
  - Multicellular communities encased on a matrix
  - 1,500X more resistant to antibiotics than other bacteria
- Reduce water flow, plug drinkers, etcv.
- Impair effectiveness of antibiotics & vaccines
- Common examples:
  - Dental plaque
  - Pond scum



# Control of biofilms

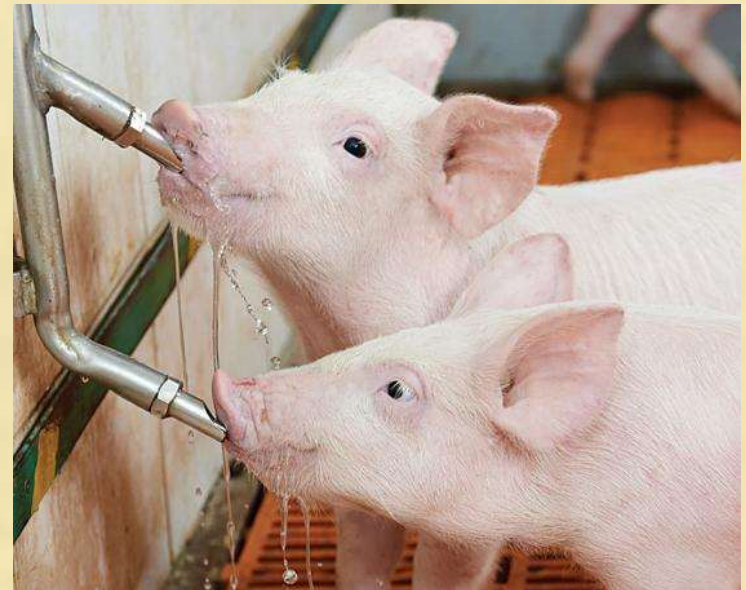
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1. Hydrogen peroxide is a simple and effective disinfectant when rooms are empty
  - 1 to 3% hydrogen peroxide solution is recommended; hold in water line for 24 to 48 hr
2. Chlorination can be used while animals in the rooms
  - NB. Excess chlorine in the water can be lethal
  - 15% sodium hypochlorite solution, or
  - 0.2 to 0.4 mg chlorine dioxide/L
  - Want 3 to 5 ppm residual free chlorine in the treated water
3. Disinfectants known to be effective against biofilms, such as Virkon S.

# Problems using water to deliver medication

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1. Nipple drinkers waste a lot of water, and therefore medication. Dish drinkers are preferred – but require more management
2. Water intake among pigs is highly variable, so medication delivery will be highly variable
2. Difficult to know if medicator is accurately meting out the correct dose of medication





# Issues using water to deliver medication

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- To properly administer medication, normal water intake patterns is important but rarely measured.
- Water intake will change with the weather, requiring adjustment of medication concentration
- pH of the water may need to be adjusted to fully dissolve the medication
- A portion of the antibiotic may become entrapped in the biofilm, adversely affecting medication delivery



# Take home messages

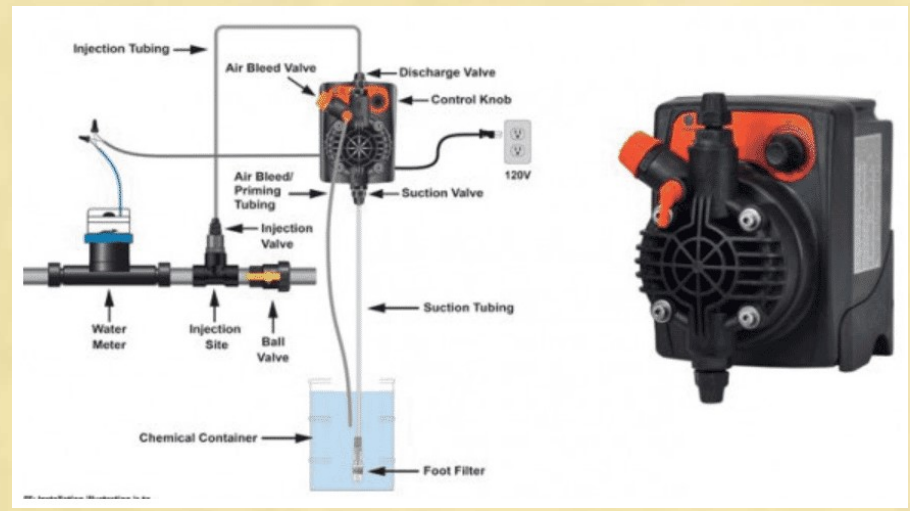
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1. The pig has a high tolerance for a wide range in water quality
2. Sulfates cause diarrhea but rarely impact performance
3. Iron in the water can be a major pain
4. Biofilms are becoming an issue of much greater concern – and for good reason
5. Delivery of medication via the water is not as simple as it seems

# Final thoughts

I really wish that routine chlorination of water lines was more common in our industry

I am pretty sure it will be one day



# Final thoughts

Water is increasingly a more scarce resource

Start conserving water now so you are ready when water becomes in short supply

# Swimming with pigs, Pig Beach, Major Cay



IOWA STATE UNIVERSITY

APPLIED SWINE NUTRITION