The Fowl Frontier: Poultry Science Unplucked, Episode 2 Transcript

[00:01] Zac Willams
Welcome to the Fowl Frontier: Poultry Science Unplucked. On this show, we will discuss all things related to poultry science and poultry production. The Fowl Frontier is brought to you by the University of Arkansas System Division of Agriculture, Cooperative Extension Service and the Center of Excellence for Poultry Science. I am Dr. Zac Williams and I will be your host. All right. Welcome to the show. I'm Dr. Zac Williams, of course, your host. My guest with me today is Dr. Susan Watkins. And we're going to be talking about water quality. So I will let Dr. Watkins introduce herself and tell all about her background and anything else she wants to tell us about herself.

[00:42] Susan Watkins
Well, thank you very much, Zac, for inviting me to be here today. It was almost 30 years ago I was sitting exactly where you are in this office, and I'd started as a new extension specialist and my background was a nutritionist. And the next thing I know, I was getting all these calls asking about water. And I would say, well, I don't know, but I'll find out. So here I am almost 30 years later. I've learned a few things about water. So I'm retired from the University of Arkansas Cooperative Extension Service as the poultry specialist, still doing some consulting with the industry in water. So would love to share today my experience and some of the things we've learned and hopefully they can help some production people out there to solve some challenges or maybe to prevent some challenges.

[01:40] Zac Willams
All right. Good things. Yeah, I just. Yeah. This is your old office.

[01:45] Susan Watkins
Yeah, my old office. Yeah. Glad to see you in it. It was making me sad seeing it empty for all those years.

[01:52] Zac Willams
I know. They cleaned it up for me and here I am. So let's get started. And my first question for you is, how do we define or how do you define water quality. Like what are your characteristics that you look for when you're defining the quality that you're looking for in water.

[02:10] Susan Watkins
So we're going to focus on poultry water and what I would consider acceptable quality of water is there's no E.coli coliforms in that water that's just unacceptable to even have one because of the risk of them multiplying. We want water that has a minimal amount of bacteria. My target is less than 10,000 colony forming units of aerobic plate count bacteria or total plate count bacteria. 1,000 or less is even better. And then when it comes to minerals, we want enough minerals dissolved in that water to keep that water from being aggressive. What's dissolved in water, are what we call the clothes of water. So we don't want pure water or it's going to be dissolving your pipes, your metal nipples, whatever, in that system. And after that, we want to try to have water that's going to not be promoting bacterial growth. We want to minimize iron, manganese, sulfur in the water. And then we don't want minerals that are going to be causing our pipes to seal up over time, like calcium, magnesium, hardness. We want to minimize heavy metals, particularly for birds that are on the farm for a long time. Pullets, breeders turkey. So things like lead, cadmium, those types of metals. We don't want to see very much of that. We

don't want to see very much salt in the water or we're literally salting the birds. So those are kind of my starting points for defining quality. What's there? Can we live with it in the amounts or can we fix it so that we can live with it or it's going to promote good performance in an economical manner?

[04:02] Zac Willams
Very good. All right, so I've got a picture here. Um, for the people who can't see, this is pretty. I mean, it looks like one step away from mud, right?

[04:12] Susan Watkins
Correct. Yep.

[04:14] Zac Willams
Acceptable or not.

[04:15] Susan Watkins
That that would not be acceptable. And for the most part, poultry are fairly tolerant of poor quality water. If you look at the old guidelines. But in this modern day of age, we've got birds that or we're expecting to give us their best performance, high efficiency, high yields. Every input has to be perfect and that includes water. So when we have water that looks murky like this, then it's probably full of iron, which means it's probably at high risk for E.coli, Pseudomonas growth. Both of those are bacteria that can definitely cause an impact on our birds. If they if they're it's any type of stress situation then and then we have this slow moving water. It's warm during brooding. It just becomes a mecca for microbial growth. So if this is the water that you're giving your birds, then you clearly aren't expecting those birds to give you their best performance.

[05:27] Zac Willams
Yeah, I think a lot of this, you know, they're drinking this day in and day out. And this is what they have for their entire lives. So let's look at how we get this water, we'll take a look at how we get this water and how we can do some things about it. So let's talk about water quality at the source versus the drinker's.

[05:48] Susan Watkins
Good question. So at the source, we're going to just get a baseline. What is the water parameters? And there's a great list of acceptable and acceptable parameters that's out there that we can make available to your audience. But at the source, we're going to define what we've got and then we're going to go and see what are the birds actually drinking. And really the two key things that we like to compare source to what the birds are drinking is the microbial levels. Usually the minerals are settling out in the water or they don't change much from source to the drinker, but the bacteria levels can have huge changes. I've seen everything from zero at the source to hundreds of millions in the drinker and if you expect a new pult or a new chick to drink water that is just loaded with bacteria and give you its best performance, then your expectations are a little high.

[06:53] Zac Willams
Okay. So question along those lines, when people are planning for like mitigation strategies, should they look at both or should they just look at more of what they want at the end?

[07:06] Susan Watkins
Well, what we found is the closer to the source, we can identify contaminants like iron, manganese, sulfur, calcium, magnesium, if those are challenges also and address them, then the less we're going to

have sediment build up, scale minerals throughout the system. So we deal with those there. We might even need to want to sanitize to start the sanitation process early in your water handling system and then you're going to minimize how much potential challenges you're building up in the distribution system. And then sometimes what we may need to do is actually boost our sanitation right before it goes to the birds.

[07:54] Zac Willams
Okay. So question if we're talking about the bird from their perspective, like we've talked about what Susan's perspective is on good water quality, what about from the bird? Like, are there things that are off putting to the bird or are there qualities of water that they prefer?

[08:12] Susan Watkins
Well, birds are pretty indifferent to taste. They really only taste two things salt and bitter. They taste salt because they're not going to last long if they do not have salt in their diet. Fortunately, we feed a nutritious food, so they're getting this salt. They taste bitter because the majority of the poisons in nature typically are bitter. And so that's kind of nature's way of telling the birds, hey, if this is bitter, it's probably not a good idea to consume it. So when we do things to our water to make it better, adding copper sulfate, while it has great anti-microbial value, it makes the water bitter. So we kind of got a balance using products like that to not back the birds off, but get the value that we need for that anti-microbial. Hydrogen sulfide bacteria. It can make that water smell like rotten eggs, bitter. I've seen birds, not miss a beat drinking it, but it can airlock the lines and cause them to not have enough water. But overall they tend to be fairly forgiving on what's in water. I've seen birds drink water that look like orange Kool-Aid there was so much iron in it, it was their best flocks. That was great as long as it held up, as long as the bad bacteria didn't move in, wonderful. Or as long as the pipes weren't getting sealed over by mineral sediment. So they are forgiving. But we do want to add things to the water sometimes it can create challenges. We start adding cocktails of products and if you aren't comfortable tasting that water, then why are you asking your cash crop to do it? So if you're adding stuff to that water, just taste it. You don't have to drink it, but taste it. It's starting to really taste a little weird or even bitter than you know. You may be doing something that's going to cause your birds to not consume what they need to to get the best performance.

[10:15] Zac Willams
All right. Very good. Um, so we got, what about, um, bacteria? You talked some about the different types of bacteria we see. Let's talk about where they come from. Where are we, if it's, you know, does it come from the well? Is it coming into the drinker system once it gets in the house? Where what are it causing bacteria to get into our water?

[10:40] Susan Watkins
Well, sometimes it is from the well, but a lot of times it's actually from the birds themselves. When they drink, if they're sick, they can deposit bacteria on that nipple drinker and it can wick back up into the water system and create and feed the biofilm. Our filters, any time we see a sediment building up on a filter, then now we're creating an opportunity for bacteria to really be growing and thriving. Other sources. Our injector site. How clean do we keep it? I'll never forget there was a wonderful, fantastic grower who years ago called us, said, you got to get out here. There's something in my water system that is clogging my drinker. So we went out there and we took a sample, we held it up and literally there were these tiny little free living nematode roundworms had filled her water lines and she was on city water

supply and it turned out that somebody talked her into using this new Vitamin E product in her water lines. She kind of had an old school house where her medicator bucket was out in the barn. The lid of the medicated bucket got knocked off. Air contaminants got into the bucket where this vitamin E product was, and it got into the water lines and boom, they were filled with free living nematodes. That day I realized all bets are off when it comes to what can be in your water life. We had another grower who fought Pseudomonas challenges for years on her farm. They had nine service techs out there one day with two air compressors trying to blow the sludge, the goo that built up in her lines, literally within 2 to 3 days of starting a flock, started doing some work there and came to find out that the people before them were brush hogging near the wellhead, hit the wellhead, cracked it, started getting surface pseudomonas down into the well, contaminated the well and then it was just the gift that kept giving. So it's just incredible. All of the things that we found over the years tracing back to just one misstep managing your water supply and then now you've got contamination in it.

[13:13] Zac Willams
Yeah, that's pretty incredible. I mean, it just it's in the environment.

[13:16] Susan Watkins
It’s in the environment. It just gets in the wrong place at the right time and away it goes. And the challenge is so many people say, oh, well, I'm drinking the same water as my birds are and I say, oh really? Well I tell you what, I'm going to pour a cup up out of this water line over here and you're going to drink it? Oh, no, I'm not drinking that. Well, that right there says, no, you're not drinking the same water that your house is versus what the birds are drinking because things are different in a poultry barn versus in our homes.

[13:47] Zac Willams
Yeah, well, I mean, it's a totally different environment.

[13:49] Susan Watkins
Absolutely.

[13:50] Zac Willams
And it's a lot warmer. It's dustier. You've got feed.

[13:53] Susan Watkins
Slow moving.

[13:55] Zac Willams
Slow moving water.

[13:56] Susan Watkins
And and we add things to it. I've heard everything from pancake syrup to probiotics on and on and on. We just feel compelled to put things in our water.

[14:09] Zac Willams
Yeah. So. So you talked about a couple of different groups of bacteria. You talked about E coli, coliforms, aerobic. Why are those three groups, why do we use those for indicators?

[14:22] Susan Watkins
Well, we use E. coli coliforms as indicator. That's kind of been adapted from the human water supply monitoring. We know if there's any E. coli coliforms and that's not a good thing. There's some type of breach in our water supply that's causing fecal contamination. Most, most of the time, if we have coliforms or E. coli in the water, I tend to use total bacteria is my determining factor of what might be going on in the system. Because when we look for just E.coli Coliform, that's like me just looking in the room and saying, It's Zacc here and ignore and if there's anybody else in the building, you're missing the big picture. I want the whole picture because E Coli Coliforms doesn't tell us if their staph are strep or pseudomonas or even fungus if, if systems have been exposed to a lot of antibiotic use, which is not common anymore. But back in the day it was then we would have yeast and mold blooms in water systems and they brought their own challenges to the performance of the birds. So if we can look at the big picture and say, hey, do we have a realistic amount of bacteria in here? Or is this number in the hundreds of thousands colony forming units per milliliter? We need to take action. That's just not healthy for young, fast growing, high efficient birds.

[15:58] Zac Willams
Yeah. Can we do tests? Like, what would you do for test for that?

[16:00] Susan Watkins
Absolutely, easy. And the very fortunate is the poultry science department has a water quality lab that can provide you with the tools and a training little video on how to take the water samples and information on how to sample. But the key thing on our sampling is, is we want to take a sample that is representative of that source, whether it's the well or out in the barn. And if we're taking a sample in the barn, we want to make sure we're not standing in front of a fan where there's a lot of matter blowing and we're not waving around our sampling tools. We want to quickly get that sample, get it sealed up, get it out. And I like to stand in front of the fan if we have to take a sample from the fan. So I'm blocking that airflow. We want that sample to truly reflect what is in that water.

[16:55] Zac Willams
Yeah. And well, I'm going to put a link in for the Water Quality Lab.

[16:58] Susan Watkins
Right, right. Give those guys a spill there. They're wonderful resource and very economical resource.

[17:06] Zac Willams
Yeah. So we talked about the different microbes. Are there limits? You talked about E.coli was zero, coliforms were zero. What about for aerobic? Is there a limit you like to place on that one?

[17:18] Susan Watkins
You know we when we see anaerobic number it doesn't tell us exactly what's there. So we don't know is it good, bad, whatever. So our rule of thumb is about 10,000 colony forming years per mil. That number starts getting higher than that. It's like, okay, what's going on here? Why do we have this bacteria thriving in our water system? We need to do some cleaning to get those numbers back down.

[17:45] Zac Willams
Okay. Um, so the next picture I've got is something we see very common in water lines and it's can you tell us what this is and kind of describe it to the people who are just listening?

[17:58] Susan Watkins
Well, this is the regulator and this started me on the journey of actually looking inside of water systems, because we can take that drip sample from the well from a water line and hopefully that's going to be representative of what's going on. But what if I'm standing out in front of a building and I'm counting who's coming out of the building? Well, if everybody's in class or they're busy in their office and I'm counting who's coming out, then my numbers are going to be very low and I'm going to go, well, there's nobody in the building when in reality there's a lot of people in the building. They're just busy. Same with BioFilm. And in this picture it's a regulator and it was on a farm. They had city water supply, they chlorinated their water. It was a almost brand new turkey operation. Yet flock after flock the poults broke with Bordetella and they were they clean this barn after every flock we could have had a picnic in this barn it was so clean. Yet here came the Bordetella next flock. So I, as always extension specialists always get called out when we are scratching our heads and we can't figure out what's going on. Well, let's ask them. Maybe they can have some ideas. So we're out there. And I said, Well, what does it look like in the water waterline? And this gentleman kindly took it apart and we swabbed it. And guess what? Was living in this biofilm inside the regulator?

[19:33] Zac Willams
Was it Bordetella.

[19:34] Susan Watkins
Bordetella. So here was they were did all of this work to get that barn ready? And they had been overlooking a very key component to controlling the Bordetella: a stagnant water regulator.

[19:52] Zac Willams
And I think what a lot of people don't understand about biofilms, this is not just like one bacteria, it's a whole community. And they do things like they can protect themselves, can't they?

[20:05] Susan Watkins
They communicate. They work together. They're they're like a city. They can transport food. They can store food. And a key thing that we know about biofilms is very much like cities is once they become too crowded, once it becomes a little difficult to get rid of their waste or get enough food, they're going to mushroom up part of that population and it's going to release into the water stream. And so I think that's why on some operations we see challenges show up very consistently, flock after flock at certain times in the flock. That's kind of when the biofilm goes through its maturation and process, releases, and those pathogens travel right down to the birds.

[20:50] Zac Willams
So we've got our biofilm. We talked about it. What about sampling? Because this looks like you would not I'm assuming you're or for our guest you're not going to just take a drip sample and it's not going to tell you…

[21:02] Susan Watkins
Not very many people enjoy taking apart regulators and getting them completely sealed back together where they don't leak. So a simpler way to determine, do we have a bio film challenge in a system is to use the little sponge swabs and go into the end of the line. The end of the lines are kind of a weak point or a dead end spot. Most of our flushing systems are up and out, and that really doesn't flush everything out of that end of that line like you would hope it could. So here is a place where you can actually go into

that line. And some of our regulators actually have a place where you can unscrew and go inside of that regulator and and swab inside of there. So by swabbing in these weak points in the water system, we can find out, do we have a biofilm that's thriving, that needs to be controlled and we can address that if we understand that it's present through very thorough cleaning when no birds are present in the barns.

[22:10] Zac Willams
Okay. Um, so, yeah. So that's what these pictures kind of just describe or depict. They're just taking some sterile forceps, it looks like in a sponge going in there and swabbing around.

[22:21] Susan Watkins
Swabbing, yeah just getting a nice and and one thing we've learned is you really need a hydrated sponge that's going to cover that surface area inside that pipe, wipe it well. Was working with the vet a few years ago and we were on a turkey farm and they were doing some work on the water storage unit and they had cut the line as it left that water storage tank. And so I said, hey, this would be a great thing to swab in this line and see what's going on. So the vet took her little Q-Tip, curett and wiped in there. And then I came behind with the sponge, took them back to the lab. 5:30 that evening. We plated it by 7:30 the next morning. The plate that came from my sponge was just covered in Bordetella. The one where she had used her little curette Q-Tip wiping in the line, there was hardly any growth, so the sponge gave us a better visual of what was living in that system. And that's what we want. We want to use tools that are going to give us the most accurate information so we can make the best decisions.

[23:38] Zac Willams
Do you think the sponge is a little better at breaking apart the biofilm? And getting it off the pipes and drinkers?

[23:43] Susan Watkins
I certainly think it's going to do a better job of wiping. I was in Argentina a few years ago and they were using almost a Brillo pad sponge. I thought, well, that ought to break off that biofilm if you're wiping inside that line. They were very proud of that technique that they had developed. Yeah.

[24:01] Zac Willams
Good deal. Okay, so we got bacteria. Are there other microbes that we see in the lines that are of concern?

[24:12] Susan Watkins
Fungal. That's the other challenge that we see sometimes, and you may show a picture of it in a minute, but we'll get these slime blooms and that can be the pseudomonas, the coryneform family of bacteria or it can be fungal. And yeast. I think we can see some challenges with yeast. There's some good yeast out there and there's some very harmful yeast populations out there. Those are two other families of organisms that we have seen over the years that can be challenges.

[24:47] Zac Willams
So we know use, you know, sanitizers for bacteria. What should, what about against like yeast and molds?

[24:54] Susan Watkins
Well, what we found is the yeast and mold tend to like more, lower pH So those organic acids can actually enhance yeast and mold. In those cases, we found good old bleach raising the pH, adding that

chlorine residual can have a very effective action against yeast and mold as well as the Pseudomonas. Sometimes when we see that slime bloom coming on early in flocks, we've been running some organic acids. I encourage people shut that organic acid off, get them going all bleach good rule of thumb four ounces of household bleach, gallon of water, that's your stock solution and then run it 1 to 128 and that can, that will raise the pH that kind of shocks the environment out of that comfort zone for those organisms as well as adds that chlorine residual.

[25:53] Zac Willams
Right. Yeah. I've got a picture here.

[25:54] Susan Watkins
Yeah. That's, that's a classic example there.

[25:57] Zac Willams
It looks like a nipple drinker there on the left and then the filter on the right. Correct?

[26:03] Susan Watkins
Correct. Yep. So pretty sure that was a pseudomonas organism on the filters and almost certain that on the nipple that was kind of a fungal bloom that was occurring due to organic acids in the water and the systems just weren't clean, started adding these therapeutic products and next thing we know we've got a mess on our hands. They had to literally pull out every single nipple and clean that off. It could not be cleansed out with using the concentrated hydrogen peroxide or anything like that. And you got a flock of birds in a house and they can't get water. You're in a critical situation.

[26:44] Zac Willams
How, so you know, we know they clog our water lines and drinkers. So what about these filters? What happens to the effectiveness of your filter once you get a slime that looks like this or even like, less degree than this?

[26:56] Susan Watkins
Great question. You don’t have a filter, you have a block. You have just essentially shut off your water flow to your birds. There's a producer that for years had a lot of sulfur in his water and it was creating this gray paste on his filters. And we identified that it was a sulfur and we said, you know, you really need a chlorination, oxidizer, filtration to get rid of it because every time that filters being blocked in that barn, you reduce some water flow. And this is a producer that was a good, did everything right except his performance was never there. Finally, finally he took our advice, put in oxidation, filtration, went from below average consistent performance to in the top 10% of the company. So probably within two flocks the system more than paid for itself. So those filters are vulnerable to sediment buildup, creating blockages that prevent optimal water flow. And if you're not giving those birds the water they need to hydrate that feed and get the value out of it. Then you're throwing away money.

[28:11] Zac Willams
How often should a grower check those filters.

[28:14] Susan Watkins
Well, they should be just looking at that filter every time they walk in the barn. And if you're starting to see that sediment building up and the more water they use, you've got one part per million iron, you use a million gallons of water, you're probably talking 100 pounds of iron at the end of the day is going

through your water system and that's a lot of mineral build up over time. So if you're seeing those challenges and your filters are getting clogged and you're having to change more than once or twice a week, then you need to back up, get to the source, and put in a system that's going to filter and then flush in the middle of the night when there's no water usage. So that the next morning those filters in those barns are staying clean, that should just be a minimal clean up. Those barn filters, not the key water clean up for your operation.

[29:16] Zac Willams
I like to go back to something you just said for a second, because I think a lot of people don't think about how much material is actually going through the system. You said about one part per million of odorless iron, for example, would be 100 pounds a day or something?

[29:33] Zac Willams
Or depending on how much water is going through your house.

[29:35] Susan Watkins
You've got an eight house farm, you use million gallons of water between your cool cells, the birds drinking. You've got one part per million iron, over time that's a 100 pounds of iron and then you multiply that by six blocks. I've seen storage tanks on farms that probably had two feet of sludge in the bottom of them because there was no filtration system and the water outlet was up off the bottom. So this sludge was just allowed to build up over time. It's just, it's mind boggling to think about. Yeah, we're we're looking at a very small amount in the water, but the volumes of water we use on these large farms, it adds up.

[30:17] Zac Willams
Yeah. And like I said, I think that's something that a lot of people don't think about is how much water goes through there. And even just a small, tiny amount of anything, it will just snowball over time and then you've got a huge number. All right, good. So we covered bacteria, biofilms, what about pH? You know, you got neutral, basic, acidic – what's typical for Arkansas?

[30:44] Susan Watkins
What's typical for Arkansas? I would say in the poultry producing areas, we tend to be around neutral to slightly above, slightly in the basic range. So 7 to 7 and a half, there are a few areas that are fortunate in that they've got in the six range. That's just fantastic when you've got that because you can run bleach and life's great, tend to be the places where they have more iron in the water on those types of operations. But for the most part, we're around, you know, slightly above neutral. A few operations the further south you go, we may get up into higher patches almost to 9.

[31:26] Zac Willams
Is there a upper and lower limit for what's acceptable?

[31:32] Susan Watkins
So as far as the birds are concerned, they they tend to adapt again. If the water's not bitter and they've got plenty of it, they tend to adapt to these minerals in the water. There's really, my friend, Dr. David McCreary, he's a nutritionist for Pilgrim's Pride, and he has been correlating water quality parameters to performance. And at the end of the day and he says, you know, they're very tolerant of about any level of minerals in the water, pH, what have you. But what we we want to think about is, okay, we've got

calcium, magnesium, we've got alkalinity in the water. Are we using cool cells? What's the damage being done to those cool cells over time that we could prevent by keeping that recirculation tank neutral or maybe slightly on the acidic range? Or what's it doing to our pipes?

[32:31] Zac Willams
Yeah, that was my question is like what kind of effect will pH have on our pipes or our drinker systems?

[32:38] Susan Watkins
So I, we don't really want to see the too much below six because then the equipment people start to get antsy that we're potentially damaging seals in the nipple drinkers of things like. Getting the pH above eight now we're we're risking that build up of alkalinity or that that scale mineral buildup and that just is devastating for cool cells because what happens is, is as water evaporates we're concentrating those minerals, we're pushing that pH up even higher. And it's just becoming the perfect recipe for stalactites on your cool cells, if you will. Yep. So this was a cool cell pad that was from the middle of the state and it weighed 26 pounds. There was so much mineral buildup on it. Do you think you got any airflow through that? Absolutely not. So we not only are probably compromising water quantity for the flock, but we're compromising cooling air quality coming through those cool cells. And it's very expensive to replace cool cells. So a little bit of preventative maintenance, monitoring, that recirculation tank watching if it's starting to get up much above eight, we need to either flush that recirculation tank out or maybe we need to add a little acid to it, keep it down. A few years ago, I was visiting a lot of farms in the Delmarva area on the shore and they tend to have lower pH up there. Their cool cells were 14, 15, 16 years old. They look brand new and it's just because that's the cool cells were more tolerant of the lower pH water than they are of the higher water. And some people say, oh my goodness, you don't want to run any chlorine on your cool cells. It's not the chlorine. It's all of those high pH additives that come along with chlorine. That's the challenge. So again, not letting those additives concentrate, build up in those recirculation tanks, then your cool cells should last you for years.

[35:04] Zac Willams
How hard is it to test water pH?

[35:07] Susan Watkins
You can get test strips. Just make sure they're good, fresh test strips. I have never had great luck with keeping a pH meter functioning properly. I would encourage you, if you want to know what your pH is, pull a sample, get it to the lab, let those guys where they are, they are standardizing their meters. They're going to be able to give you a more accurate number as to what that pH is.

[35:34] Zac Willams
Yeah, I feel like the strips are kind of going to get you in the ballpark.

[35:37] Susan Watkins
It's going to get you in the ballpark.

[35:38] Zac Willams
Yeah. Hey, we might have a problem. We might be good. Let's go. Send it off to the lab.

[35:41] Susan Watkins
Correct.

[35:43] Zac Willams
Yeah. Most of those handheld meters just don't last.

[35:45] Susan Watkins
Just do not last. We did a lot of work with handheld meters back in the day when we were looking at what was the best pH for the drinking water. And it was just murder to try to keep those meters functioning properly.

[36:01] Zac Willams
So a producer has pH out of whack, what are their options?

[36:06] Susan Watkins
Well, if the water is too acidic, like if you're from your part of the world, Zack down in south Mississippi, don't know if you're south Mississippi boy or not. But Mississippi.

[36:17] Zac Willams
Mississippi. Yeah.

[36:17] Susan Watkins
Okay. South Mississippi, where the rate is, would be in the three, three and a half, four range. They needed to add baking soda. They needed to neutralize that water for those birds. If my pH is high and I've got a lot of alkalinity associated with it, when I say a lot, we start getting over 150 parts per million alkalinity in the water. Then I'm going to pick an inorganic acid to try to bring that pH down. And if I want to use an organic acid, I'm going to use, but I'm not going to try to rely on that organic acid to lower the pH to four or what not it's just going to be not cost effective. And we're probably going to back the birds off on the water because the amount we're trying to add.

[37:02] Zac Willams
Okay, good. So let's talk about water hardness. Not typically a problem, not typically a health concern for birds, but definitely can have some effects on the drain equipment.

[37:13] Susan Watkins
Yep.

[37:14] Zac Willams
What do we see from, like, water hardness?

[37:18] Susan Watkins
So water hardness, if we start getting over 80 parts per million calcium, more than 40 to 60 parts for me and magnesium and we have that 150 plus alkalinity in the form of bicarbonates, carbonate sulfate. Then we're, we're seeing those potential hardness, mineral issues and what you want to do in that case, if we can just kind of keep that pH in the 6 to 6.5 range, that's going to help keep those minerals dissolved. We're going to be monitoring those recirculation tanks when they're being heavily used in the summer. We're going to make sure that pH isn't getting up above nine because we're going to neutralize it with some inorganic acid. And you might want to possibly use a good mineral cleaner, sequestering agents, what they call it. They're usually phosphoric acid based acids to cleanse that scale mineral out of those systems between flocks.

[38:22] Zac Willams
Is there what can you do about scale if you get it on like the cool pads.

[38:30] Susan Watkins
You're better off preventing it. That would be my advice once you have rocked over that cool cell pad, it's almost impossible to get all of that dissolved back out. So stay ahead of it. Use your. Yeah. Keep that pH managed in those tanks in the six ish range if you can to prevent that scale mineral there are some great products out there for descaling your cool sells but that's a lot of work that could have been prevented and money.

[39:06] Zac Willams
Yeah, we're kind of an ounce of prevention, pound of cure.

[39:09] Susan Watkins
Pound of cure, correct.

[39:12] Zac Willams
Right. Total dissolved solids. So you hear about this all the time. Can you explain to our listeners what this is and then what kind of effects they can have on poultry production or drinker systems?

[39:26] Susan Watkins
You know, total dissolved solids is just adding up everything that's in the water and coming out with a number. And I equate it to saying, well, Zac, I have a diet that I want you to feed to this flock and it has 30% nutrients. What does that mean to you? What are the next questions you're going to ask me if I told you? Well, this diet has 32% nutrients. What does that mean to you?

[39:51] Zac Willams
Doesn’t mean anything.

[39:52] Susan Watkins
It doesn't mean anything. That's kind of how I feel about total dissolved solids. It's just a total number. When, if we're going to make good decisions, we got to know the specifics, how much sodium and chloride are in the water, how much calcium, magnesium, iron, manganese, sulfur, lead, bicarbonates. We need to know what the specific values are, not just this conglomerate number. Now, with that said, there's a veterinarian by the name of Jean-Pierre Vaillancourt, who realized that we got to have about 250 parts per million alkalinity total in water. That is kind of why we can drink Coca Cola with a pH of 3.2 because that alkalinity acts as a buffer. So when we get into these water supplies that have no buffering capacity, low pH the birds physiologically start saying something is not right here. I've got to back off. And that's how we add that alkalinity, that buffering capacity with baking soda or soda ash. So we we need to know specifics what exactly is in the water in order to understand? Are we okay? Do we need to fix something or is there going to be a challenge coming down the pike that I'm unaware of right now?

[41:22] Zac Willams
And again, that goes back to getting your water tested.

[41:24] Susan Watkins
Absolutely. Yeah. Go to a reputable lab. Get a total mineral profile as well as your back bicarbonate alkalinity number and pH. Then you have facts that you can make sound decisions with.

[41:42] Zac Willams
Okay. What about seasonal? Do we have seasonal changes being like either hot, cold, spring, fall or not so much of effect on our water because our houses are maintained, at least from environmental standpoint?

[41:58] Susan Watkins
Well, if we're using surface water supplies, we can get seasonal effects, what we call the fall turn over as water, that warm water cools in the cooling, you know, environment. Then that heavy cold water is going to fall and it's going to get that, it's going to start bringing solids up off the water. We call it the fall turnover. It's kind of why in our area in the fall, the water starts tasting a little funny. I don't know if you noticed that when you moved here, it didn't taste as lovely. It's safe. It's just the organics just become a little more of a challenge to clean up because of that fall turn over surface water supplies. Now, when we have good deep wells, we typically don't see as much challenge unless we start getting a lot of droughts in the areas and a lot of usage on water supplies. Then I'll start to see where we get that dirty look to water and that's just we're starting to concentrate those minerals in that water supply is a challenge. Just depends what bacteria might move in is that water supply change is quality.

[43:11] Zac Willams
Uh, what can a grower do?

[43:14] Susan Watkins
Well, a grower can't…

[43:15] Zac Willams
Other than change the weather, which, you know.

[43:17] Susan Watkins
Can't do that. No, we have react to the weather. So I would be monitoring those in-house filters if I didn't already have a water filtration system place at the source. I would be monitoring those barn filters and if I started to notice a little off color or something going on, then I would go, hey, I might need to have my water tested. And just 20 bucks, I think, is about the cost of the water analysis. Just a tremendous bargain for finding out. Is my water supply vulnerable to change?

[43:57] Zac Willams
Yeah, we always tell people get stuff tested before we do anything.

[44:00] Susan Watkins
Absolutely.

[44:01] Zac Willams
Otherwise you just kind of go in blind.

[44:03] Susan Watkins
That's right. We're back to that, well, you got a 32% nutrient diet – okay!

[44:07] Zac Willams
So we talked about intervention strategies. Let's talk about how that gets into the water system. What like you talk about injectors or dozers. Can you give us kind of a rundown of how those work or what they're.. just to give us a rundown on those?

[44:29] Susan Watkins
So the traditional dozers, medicators, what we used to call them, although that's not what we call them anymore, this is kind of would be one here as a gallon of water passes through, it sucks an ounce of product or whatever volume it's programed to into that that water passing through and is blended with it and then passes through. There's also the new peristaltic injectors, the stenner pumps, if you will, as one type of brand and that is attached to a flow meter. The flow meter detects a gallon of water has passed. So that tells that that peristaltic pump to run and then it will drop product into the water stream. Now what we found with the peristaltic pumps is they tend to just drop product on top of the water stream. It's not blended into it at the point of injection. And you would think, well, I've got bins in the pipe. It's got to go up and around and down to the water lines. You think that would be adequate to blend the product into the water. And it's not necessarily so. A good friend of mine was doing some work with a acidifiers and they're trying to monitor to see, Hey, when did we get the right pH that we were targeting in the water? And they were using a stenner pump in a in one barn and a tradition medicator or dozer type in another, with the traditional dozer, it was very uniform . With the stenner, it might be four, it might be seven, might be six. It was all over the board because there was nothing forcing that product to blend uniformly into the water. So I think that's a challenge for us. I have people sometimes tell me, hey, I tried to run hydrogen peroxide in the water and it made the birds back off. My next question would be, are you or are you injecting it with the stenner pump? Because you may have been slugging that product into the water and the birds were hitting it and they were going, whoa, you know, this is a little stout. I don't know if I want to drink this or not. Where as having it nice an uniform at a more correct dosage level to where the birds wouldn't even know it's in the water.

[46:49] Zac Willaims
Producers or growers using those types of pumps, what can they do to help evenly distribute whatever they're using through the water lines?

[47:00] Susan Watkins
They can create many mixing chambers. One way to do it is just to increase the pipe volume, where it kind of dumps into a section of pipes. Say maybe you have a, you know, four- or six-inch section of pipe that's a couple of feet long to where it kind of creates a mixing then it kind of squeezes back down. I've seen people make multiple bends in the pipe. And again, if we put a bend in a pipe we reduce water volume or flow, so we got to be careful there. I've seen people put their products into holding tanks, kind of splashing it in, that will help mix it. I've seen pipes with baffles built in, so as water flushed past these baffles broke up that fow and forced it to mix. There's lots of ways we can create mixing. Growers are some of the most – what's the word I'm looking for? They're just creative in solving problems. So, let them know there's a potential challenge here. It's amazing how they can come up with ways to fix that challenge. Sometimes we just need to let them know, hey this is a problem for you.

[48:15] Zac Williams
Yeah, they can be pretty innovative and creative.

[48:18] Susan Watkins
Innovative! That's the word I was looking for. Thank you, Zac.

[48:20] Zac Williams
You're welcome. Alright, so we kind of talked about all these things, let's wrap up with our interventions for our different problems we might have. So microbes, bacteria: what's going to be our most common intervention strategy?

[48:36] Susan Watkins
Most common intervention strategy is a good through cleaning of the system with a product that's designed to remove biofilm. The best products that I know of right now are the concentrated hydrogen peroxides. Then, that water, as we're flushing out that concentrated product, again, we're using that with no birds present. We're going to be flushing in water that has a drinking water level of sanitizer in it. We don't want to give any microbes that may have been left behind a chance to repopulate the system. So we're going to have maybe four to six parts per million chlorine, maybe two to four parts per million chlorine dioxide, 50 to 75 ppm hydrogen peroxide in that drinking water coming in for those birds to drink. Then right when that new flock comes in, we're going to flush, bring in clean sanitized water, start those birds off on the right foot.

[49:38] Zac Williams
Alright, what about pH? What can they do, what are the ones you mentioned before? Can you just mention them again.

[49:48] Susan Watkins
Well, if we've got to descale we might want to use one of the phosphoric acid-based line cleaners. It does an excellent job of descaling that mineral build up out of there. If we have high pH and we want to bring that down to neutral or maybe we want to give those birds – years ago we found that if you lowered the pH to the three to four range just during feed transitions, that would improve feed efficiency and it just helps to preserve that feed as the textures change, as the feed types change, they gorge. It just kind of helps preserve it as a transition through those feed changes. So we can use an inorganic-based mineral, or, excuse me, inorganic-based acid to lower that pH for that type of therapeutic treatment.

[50:41] Zac Williams
Okay. What about sediments or minerals?

[50:45] Susan Watkins
Sediments or minerals, if it's a challenge, then we might want to do a big bubba, farm guard filter. These are just large canister filters that have the capacity of about 180 string filters. You can put a pressure gauge on either side of it, so you know when your pressure's building up. So you can just shut your water off, pull it out, clean it off, put it back in and keep going. Or if I want something that will manage itself, I would invest in the IronX technology. It's a resin-based filtration system that, as long as there's an oxidizer in front of it it stays charged so they never have to change out the medium like they would a green sand filter. And you can program it to backflush in the night. I've yet to hear of anyone who's installed this filtration system who said this was not the best idea or the best solution for my iron, manganese, sulfur challenges.

[51:47] Zac Williams
Okay. What about, so when growers are putting a plan together, where should they start? Or should just they just throw everything up there and see what sticks? Because I know we've all been in grower

houses where they've bought everything under the sun and then they just have a wall of water treatment and they have no idea what's doing what or if any of it's doing anything.

[52:11] Susan Watkins
Oh that's a great question and I've seen that where they thought their investment was working for them. So again, back to square one, we're going to test that water at the source to see what do we have? Then we're going to seek out good advice on what to do about it. I strongly encourage you to come to Zac. I hope he's going to be the next water expert, because I'm retired now. But just get an unbiased opinion on, here's what my challenges are, here's what you need to do about it. Because you can get sold a lot of unusual treatments out there if you're not careful. And you want to be sure, if you're investing your money, that you're doing it wisely. Just seen many things that just didn't pay off for producers over the years and they were in good faith purchasing these things because somebody made it sound like it would work for them. So invest properly and then start using it and then pull a sample after you're doing to treat your water for whatever it is. And another thing we didn't talk about calcium, magnesium, we use water softeners but we're going to be adding salt to that water and we want to be sure we're not over salting that water. So pull a sample, send it to the lab and see did the treatment fix my problem?

[53:44] Zac Williams
Good. Are there some products that growers should mix, or should not be used together?

[53:47] Susan Watkins
Well you never want to add chlorine and acid in the same bucket. I had a grower tell me one time she accidentally did that and the green cloud chased her out of her medicator room. She was lucky, it could have killed her. So if we're going to do chlorination, acidification, we need to do those with separate injectors, separate buckets, and we need to have one mixed before we add another one, otherwise you get a slug of acid, it hits the chlorine, gasses the chlorine off in the line. We don't want to add ammonia and acid, that can be a challenge. We don't want to add ammonia and chlorine products together. So those are kind of the key things there.

[54:32] Zac Williams
This was something that I had seen or read about, and I don't know a whole lot about water so I'm going to ask: what about oxidation reduction potential of water as far as that relates to their treatment or intervention options?

[54:48] Susan Watkins
That's a great question. So ORP, oxidation reduction potential, measures the millivolt energy that chlorine has in the water so when we have free chlorine in the water and the pH is right, in the below 7 range, that chlorine is looking for a way to get into the bacteria and disrupt it, kill it. And the ORP measures that energy of the chlorine. So that's how strong it is. And what we've found over the years is if we have a 750 to 800 milivolt energy, and that's by adjusting pH, having some chlorine residual there, not over-chlorinating that water, we could make baby bottles with that water. There's not going to be any bacteria in it.

[55:40] Zac Williams
Is that something that's just a pretty simple test that a grower can send off for?

[55:43] Susan Watkins
Absolutely. You can just get a little ORP meter. They tend to be a little more reliable than pH meters. But don't get the ORP, pH or dual meter because then you can't clean the ORP meter. What we found over time is if you get a little bit of film on that ORP probe, you can clean it with a little bit of white vinegar, just soak it for a few hours then you can clean that and it will be well again. So, there's a lot of folks in the industry who use that number and I was just visiting with someone the other day who has an in-line ORP meter in his water system. He said it wasn't very expensive. And he can dial in a number, say I want ORP to be 750 – and also there's a pH probe too, so he says I want my pH to be 6. So, the water's going past his probes, if the pH creeps down, it adds a little bit of chlorine. If the pH starts to creep up, it adds a little bit more acid. He said he's had very good luck with it and it wasn't very expensive to install. So that's a thought and that's a technology that I hope will become more consistent in the industry. We've just got to also be checking it. We saw on occasion where these probes went a little bit haywire and you got too much acid or too much chloring so we've got to have our backup checks to make sure our equipment is working well. But that is a great tool, particularly if you've got a big operation, you don't have a lot of time to be messing with your water, but you want to be sure you're giving the birds good water.

[57:31] Zac Willaims
That's a good suggestion. Last question: where can a grower go for help? Like this is a huge, complex issue and a lot of it sounds like it's down to the grower with help from their integrator. Where can they go for reliable sources of information?

[57:50] Susan Watkins
Well, the Poultry Science Department had a lot of publications at one time providing assistance with water. The lab, Water Quality Lab, has good factsheets on how to take samples and how to interpret your water analysis. And I got to give a pitch for the folks at the University of Alberta, they've actually developed a water app that you can, kind of a decision tree. You can start plugging in your information about your water and it will help you make decisions based on your specific water challenges.

[58:28] Zac Williams
Yeah, that's the good thing about the Water Quality Lab here is they give you your limits. They'll tell you whether you're good, they'll tell you whether you're in that, oh something might be going on, or they'll tell you you're unacceptable. So it also makes recommendations but they tell you where you're at.

[58:46] Susan Watkins
It gives you a starting points. You're not just staring at some numbers going, you know am I flying a spaceship here? What does this mean?

[58:53] Zac Williams
Alright, good. Any parting words of wisdom for our listeners?

[58:59] Susan Watkins
I just have that water will continue to be more and more at the forefront of importance on poultry operations. We've got the air right, we've got the environment right. We spend mega money on research and R&D on making sure the feed is good. We've got to give credit to the water, too. Birds drink twice as much water as feed. If they're not getting the right quality and quantity, we're not getting our money's worth.

[59:35] Zac Williams
Alright, thanks for that. And thanks Susan, and thanks for listening, and we'll see everybody next time. On behalf of myself and my guest, I'd like to thank everyone for listening to the show. If you have any questions please feel free to reach out to me via email at zwilliams@uada.edu. That's zwilliams@uada.edu. And thank you again for listening, we'll see you next time.