TWV Podcast #079

Water Use in Industrial Processes with Grant Newhouse

Show Notes at http://thewatervalues.com/pod79

Intro: Welcome to The Water Values Podcast. This is the podcast dedicated to water utilities, resources, treatment, reuse, and all things water. Now here's your host, Dave McGimpsey.

Dave: Hello and welcome to another session of The Water Values Podcast! As my son Joey said, I'm Dave McGimpsey, and thanks for joining me.

We've got a fantastic interview today – but first, as always, please remember to rate and review the podcast on iTunes, Stitcher or any other podcast directory you use. And please take The Water Values listener survey online at http://thewatervalues.com.

Now on to my interview with Grant Newhouse of Sustainable Water Solutions. Grant is fantastic and will explain water use in industrial processes in one of the most down-to-earth, understandable ways that I've ever encountered. The interview is long, but it flies by, so …

… with that said, let's get on with it. Open the valves, fasten your seatbelts and here we go.

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Dave: Well, Grant, thanks very much for coming on to The Water Values Podcast. Really appreciate you taking some time. To start off, Grant, could you tell us a little about your background and how you got interested in water?

Grant: Sure. I started in the State of Oregon, attending Oregon State University and really, I think, water found me. I was studying pharmacy at the time and then made a decision to switch to chemistry and business, dual major. And during the interviewing process a company interviewed me by the name of American Cyanamid and they sold something called polymers to something called water plants and wastewater plants, all of which were a mystery to me. But I was fairly good at chemistry and got along pretty well with people so it was a good fit and that's how I entered the water world.

Dave: All right. and so for a little more background, polymers, can you tell us a little about what they're used in and what they do?

Grant: Yep. That was one of the basic questions that I had as well. And so as it comes to find out, polymers are pretty similar to a railroad train. They're made up of monomers that you could think of as a boxcar. And in the boxcars, the carry either a plus charge or a minus charge so you get cationic or plus charged polymers or negatively charged anionic polymers. And then what those polymers do, is they collect the small particles in the water from BBs into ping pong balls, if you will. And then the ping pong balls float or sink depending on what it is that you'd like them to do. At the end of the day it's a liquid-solid separation and the idea of polymers is to make the particle larger.

Dave: Sure, and you mentioned that these polymers are used in wastewater and water plants. So, are there other applications where polymers are used?

Grant: Well, there are. And so we can think about polymers to either cause things to work like a magnet a north/south pole attracting one another. And in that case, if you are talking about a drinking water plant, it's all about getting the water clear prior to filtration. If we are talking about a wastewater plant, it's about removing solids that you don't want in the water anymore. Polymers also can be used as scale inhibiters. And so in that case, you would want to think of like a charge repulsion. So maybe the two north ends of the magnet pointing toward one another. And so anti-scalants polymers would be used to keep scale particles off of heat transfer surfaces. So lots of different uses.

Dave: Ok. and so how are you putting all of this knowledge that you've gained using polymers, to work in the water industry?

Grant: Well, here at Sustainable Water Solutions, we work with a wide toolbox and so in our toolbox, we have a hammers, wrenches, screwdrivers, ratchets and things of that nature. Only, in our world, we would pronounce those as polymers, reverse osmosis membrane, nano-filtration membrane, flotation cells, centrifuges, things of that nature. So, at the end of the day, we use the tools in the box to remove those things that are troublesome in water and let the water, itself, be reused or optimize that water such that it can be used most effectively in either boilers or cooling or process applications or things of that nature. So, I guess the general idea is we make water with various tools most fit for use.

Dave: Ok and it sounds to me like when you say process water, in my mind, that says manufacturing.

Grant: Well, it does. It so could be something as simple as, if we are in a peach cannery, we don't want any spots on cans or on glasses, glass material that peaches are canned in. That could be an application. It could be more exotic where we would be claiming a process re-agent stream – plating, gold mining, things of that nature. So yeah, things like that.

Dave: And, so could you give us just the broad overview, I know you gave some specific examples there of the peach cannery and but could you give us the broad overview of just water use in the manufacturing sector?

Grant: Sure. There are three or four major applications. And so the first application would be water that's entering the manufacturing facility. That might be out of a well. It might be coming from a city, etc. And so we need to make sure that there are no trouble-causing impurities in that water. And so a common example might be iron or manganese in a well water source. If that's left as is, then we end up with brown water and brown spots, which in general, is not a good thing.

We made need to remove hardness from that water prior to introduction into a boiler. And so one tool we may use would be just a common water softener that you may have in the house only it's a heck of a lot bigger in an industrial place. If we want to get more efficient, we would use reverse osmosis in place of a softener. So we would remove not only just the hardness but literally everything that is in the water. That would help us so that we could use less water in that boiler.

In terms of cooling towers, we may want to take the alkalinity out of the water using an acid so that we don't form various trouble causing scales. So that's the first big application point is treating water so that it's appropriate for use when it enters the facility. And then every application point, whether that be boilers which we talked about, cooling which we talked about. It may be process waters in the case of a tomato processing facility. Water is actually used, trucks come into the plant. The truck is actually filled with water and then the tomatoes are kind of floated out of the truck. That water is re-used so we may want might want to put some chlorine in that water, for example, in that water to keep it fresh so that that water can be used over and over.

And then finally, at the end of the plant, where we would have water that's about to be discharged, most generally to a wastewater treatment system owned by a city but sometimes to farmers' fields for irrigation, we have the option of reclaiming and reusing that water such that, again, we would take out those things that are not wanted in the water and circle that water back for reuse into the plant.

Dave: Ok. So, process water is water that's used in the manufacturing process and sounds like there's a couple chunks, right? There's the cooling, there's the used in boilers and then there's end-of-pipe or point-of-use water.

Grant: Yeah.

Dave: So those are the three big buckets that you've identified. Let's kind of take those one by one. Let's talk about cooling first. Can you give us, I know you've talked a little about water going into a cooling tower. For those who don't really know about cooling towers or how they function and all that, can you tell us how water helps in the cooling process and what an absorption cooling tower and things like that? Could you just walk us through real quickly how water's used in that process?

Grant: Sure.

Dave: Thank you.

Grant: So with regard to cooling water, the idea is always we would transfer water from a warm or hot area. So that could be a hot process stream. It could be, we mentioned canning where cans are actually cooked and then they're cooled down with water. So water is heated up. The heat goes from the process into the cooling water. The same sort of thing holds if we were talking about air conditioning, HVAC type stuff. Water, in general, is the medium that is used to transfer heat from a process item into this cooling water.

So now we have "warmer" cooling water and that warmer cooling water goes over a cooling tower. In the cooling tower you can think of water entering through maybe a six or twelve inch pipe. It goes through a distribution deck and then is broken up into small droplets of water similar to what you would see coming out of your showerhead in your home. And these small, small drops of water cascade down over many areas of what we call fill or packing. The idea is that we have air coming from the bottom of the cooling tower up, the water is coming down from the top of the cooling tower. And some portion of that water will evaporate. And so that evaporation process is the means by which energy or heat is rejected from that tower. And so again, we've taken water from an unwanted area of the process. We've put it into the cooling water, and then we've rejected that heat through evaporation out the top of the cooling tower. Water is the medium that is used to do that.

And so how efficiently we use that water matters a lot. And so to give you an example, we can take a simple cooling operation that we recently took a look at. Cooling is always rated in tons. And so in this operation, it was a fruit processor. So they cleaned oranges and lemons and whatnot. Prepared them for shipment in boxes. And we were able to show that processor using a real small cooling tower, two hundred tons, how to save three million gallons of water a year simply by getting the chemistry right in that cooling tower.

Dave: Three million gallons a year, that is absolutely huge. When you say getting the chemistry right. What's entailed in getting the chemistry right?

Grant: Well, that does seem like a lot. However, there are other industries where the number is bigger. And so, if we took a look at the data center industry, here in California, there are about eight hundred data centers in the state. And as a group they use somewhere around one hundred billion gallons of water a year. And if those towers were optimized, there would be a savings of somewhere around ten billion, billion with a b, gallons of water per year. So, the opportunities to make an impact are quite large.

And so, when we day get the chemistry right, what does that mean? Nothing can be infinitely optimized I guess, and so if we started with an inch and we cut it in half. Now we have one-half inch. Cut it in half and now we have a quarter inch and when we were in grade school we may remember the professor asking us how long till we get to zero, and of course the answer is never. So with a cooling tower optimization or boiler optimization, really what we are talking about is getting the equipment such that it uses approaching an optimum amount of water. And we do that by getting the pH right.

We do that by getting the anti-scalant level right. We do that by controlling biocides biology in the tower. And then we do that by inspecting what we expect. So, what we mean by that is that we put sufficient gaging, monitoring, etc., on the system so that we can see deviations in the process and then report those to the folks that are responsible for running those pieces of equipment. And then they have the data to make a decision, do we or do we not fix this particular thing today. Or maybe we put it on the list and get to it next week. So, that's kind of the name of the game with regard to cooling.

Dave: Ok, so pH and scaling are two of the issues that you have to get right. How do those introduce inefficiencies into how a cooling tower or a boiler or anything like that works?

Grant: Well, great question. With regard to cooling, we had mentioned that it is all about heat transfer. And so you can think of attempting to cook an egg on your stove. If you have a gas stove, you would put a pan on the stove, turn the gas on and then in short order, you would be ready to cook your egg. When there's scale on a heat transfer surface, then it's a little bit different. Then it would be like putting two bricks on your stove and then the pan on top of the bricks. What happens is that heat is retarded from getting to the pan itself because there's foreign material between the heat source and the metal of the pan.

That happens in industrial settings. Of course, the deposits are not as thick as a brick but once you start getting deposits built up, even as thin as an eggshell, you start seeing some of the heat not passing directly into the metal and then the cooling water. You see it kind of reflected back from where it came.

And so, those inefficiencies can really cause a problem. All cooling apparatus is designed for a certain amount of heat flux. In the case of air conditioning, that can be tied directly to kilowatts. And so a dirty cooling system will use far more kilowatts to produce the same amount of cooling that a clean one. And so those savings can easily exceed one hundred thousand a year and many times, significantly more than that. So the name of the game is get the chemistry right, keep the heat transfer surfaces clean or pay the penalty.

Dave: Sure. And you've really identified an issue in the water-energy nexus here – the tradeoff between water efficiency/energy efficiency. Could you talk a little about those interface with each other in a cooling system?

Grant: Well, sure. As we're talking about water and energy efficiency, in the old days, if you will, and to some great extend now, water was very plentiful and very cheap. And so, it didn't matter, to a great extent, how much you used because again, it's cheap and there's plenty of it. Now, certainly in the Southwestern part of the United States, and other portions of the world, now that is not the case. We're finding out, of course, what has been true for a long time, which is water is finite.

There are a number of people that are in the mix now, and I'm just going talk about California as an example. Population growth in California means that more people are competing for that finite resource. We can talk about the agriculture of California that is competing for the water to feed the people. And then we can talk about hydropower, which that industry, of course, by the very definition of the word, uses water to make electricity. So they compete for that water. And what we see is a lot of pressure on the same resource and increasing pressure on that resource which means, of course, the price is going to go up.

And so it's kind of interesting when you take a look at Los Angeles as an example. We've had the Governor ask everyone to save water, which, of course to a great extent, has been accomplished for the individual. But that means that the water agencies are not receiving the amount of revenue that they would have in the past. And so now the price of water, on one hand, "Congratulations, you've done a good job saving water but here is your new water rate which may be double or triple what it was in the past." And so, the short story is the price of water is going up and so it becomes more of a focal point.

With regard to energy, the same exact thing holds true. Companies now, are trying to be as efficient as possible when we are talking about kilowatts of energy. Of course, the vast majority of energy in this country is involving a carbon source and so people are paying attention to the carbon footprint and things like that. So, those things, it's not so much that the levers have changed, it's just they've become far more visible and a lot bigger.

Dave: Got it. So I think we've covered cooling. Let's move over to boilers and the heating systems. Could you explain how water is used in these boiler systems?

Grant: Well, sure. We can think of boilers as the exact inverse to cooling. And so the name of the game with the boiler it to take a source of heat, and that, in the case of the boiler, is either hot water or it's steam. And that heat is made in a location then it's transferred across the plant grounds to a different area where it's needed. And that heat is used there. So it could be for cooking food. It could be for steaming rice. It could be for melting plastics for heat injection. It could be used for all kinds of stuff, humidification in paint, the list kind of goes on and on. In general, if you're looking at an industrial manufacturing process, you're going to have both cooling and boilers. Boilers are there to transfer the heat from one place to another.

When we talk about water in a boiler, there are a list of standards that have been put out by American Society of Mechanical Engineers. Boilers were invented somewhere in the late 1800's and it was a clever way to transfer energy, but what we quickly found out is if we put just untreated water into the boiler, we start to developing the scales that we talked about earlier. The metal actually gets too hot in the boiler, and we have metal failure and boiler explosions. And so really that's how the whole water treatment industry was started. It was in response to explosions in boilers.

The first compounds were things like potato starch that was found to be a scale modifier, and we eventually worked our way up to today's technology where for the most part, we remove as many of those impurities as we can. And then use chemistry kind of as a band-aid to catch the rest of it.

Dave: So how can these boiler systems, you're treating the water before it goes in, and are there other mechanisms that we can be more water efficient with how we use our boiler systems?

Grant: Well, that a great question. And so, we here at Sustainable Water Solutions, think that answer has been around for some time now. So the traditional approach to treat a boiler has been softening of the water which means you just run it through a softener similar to your house. But what we need to remember is the use the softener adds 10% to the water usage in that application. So it's not as simple as just putting the water into the softener and magically get soft. We need to do things like brining and backwashing and things of that nature. And so, at the end of the day, softeners add about 10% to the water use, number 1. Number 2, they only remove calcium and magnesium, so the other troublesome impurities like silicone, alkalinity, things of that nature really are not altered by softeners. And then finally, we need to consider that a softener adds two pounds of salt for every one pound of hardness that they temporarily remove.

So, you may see talk in the media about EC, electrical conductivity, in the water, especially in the Central Valley of California. That did not used to be an issue, but it certainly is now. Where the individual users and cities and counties, etc., are trying to control the amount of EC, or things that are dissolved in the water, because you have negative impact on crops and water sources. And so, we think that it's time that softeners go by the wayside and other better technologies, such as reverse osmosis, are employed because reverse osmosis, again, invented in the mid-60's down at UCLA, removes all the impurities from water that can cause problems for the end-user. It makes for a much smaller boiler water footprint and gas footprint. And then it also allows the end-user to use maybe about 5% of the chemicals that they would have had to use otherwise, just by getting the pre-treatment right. If there are no problem-causing impurities in the water, no need to hog in a bunch of chemistries to combat impurities that are not there.

Dave: Sure. And so, when you say reverse osmosis, one of the things that goes through my mind is that that does require energy. Is there a significant energy difference between using a softener and using reverse osmosis?

Grant: Well, great, great question, Dave. There is. However, when we look at the progress of the reverse osmosis membrane, when it was invented, there was significant amount of pressure that was required to drive water across that membrane. So we can think in terms of three, four, five hundred pounds per square inch which translates into a ton of horsepower. That craft, the craft of manufacturing reverse osmosis membranes, has moved forward now. And in many cases, the pressure that is required to run those systems is below one hundred pounds per square inch now, which is not very much in an industrial setting. And so what used to be fairly expensive from an energy perspective in the past, is now on a net-net-net basis at no question, the correct direction to go.

Dave: That's interesting. I had a guy, Claus Helix-Nielsen from Denmark on recently and he was talking about his, he's with a company that deals with forward osmosis and he mentioned that it could be good pre-treatment for reverse osmosis. I'm curious if you've seen that or if you've had any thoughts on it?

Grant: Well, for American industry, American manufacturing, so we're talking about the processing of chickens and hogs and beef and cheese, cans of tomatoes and those sorts of things. The game that is played in terms of a water perspective in those industries, is fairly simple. So it's similar to just handing the football off to the tailback, and he just does a running play right up the middle. There are a number of different technologies that make sense when you get into more exotic applications or exacting applications, such high pressure boiler, steam turbines, manufacturing of microchips, etc., where the water quality needs to be pretty exacting and pretty high, where some of these other, newer more exotic technologies come into play and make a ton of sense.

What we try to do for our client base, which is again, American manufacturing, is to keep the play as simple as is possible and as affordable as possible. And so those technologies, while the may be a fit maybe in the future, or they may be a fit for some of those more exotic applications, we've not seen a compelling argument for it in what we do.

Dave: Sure. And that jives, I think, with what his point was, that, "Hey, this can be used in specialty applications." He was very straight up and said, "Hey, some people have touted forward osmosis as kind of a panacea for all water filtration." He said that's not really the case, but it does have specialty uses.

But, in any event, let’s move on to that third bucket that you mentioned, the point-of-use and end-of-pipe. Talk a little about how water is reused, if you would, in the manufacturing processes.

Grant: Well, that’s interesting and that, I think, is kind of the future of the industry. And the reason that we say that is, if you look now, we have water that would come out of the ground or a lake and then it’s pumped. Most of the time, a considerable distance to the water treatment plant, where it processed, cleaned, etc. Then it is pumped to various end-users and then after the end-user it’s collected and pumped to the sewer plant where it’s processed and then it’s pumped again to a river or a percolation bed or ocean discharge or whatever it may be. So there’s a bunch of energy that is involved with the treatment and more important, the transportation of water from here to there.

We think, as we become more evolved in our thinking, it makes a lot more sense to do, what we call, point-of-use recycle and reuse. So, once the water arrives at the manufacturing location, the appropriate treatment technologies would be installed such that the good water is kept and only the components of the water that are not needed such as suspended solids or BOD or any number of other things that could be in the water, those would be disposed of. And so that’s kind of what we’re talking about when we talk about point-of-use reuse.

Now, when we think about something like that, we’ll just use a beef slaughtering operation. I’ll tell you what, let’s use an automobile manufacturing operation, it’s easier to understand. So, when we would get water at the end of the automobile manufacturing process, that water would have generally some dissolved metals in it. It might have some turbidity in it, etc. And so, a person might want to put in a piece of technology that removes those things that are causing the water to be cloudy. And we might want to do some sedimentation or filtration. We might want to remove some of the dissolved ions that are in the water, again through RO or something of that nature. And then in general, about 80% of the water that used to go down the sewer pipe can now be put right back into the front of the manufacturing process and that water will be far better than city water that comes into the plant from the city. And so, we’re starting to see enough lever in the equation where that is starting to make sense in a number of different industries.

We get into talking about what water quality is appropriate for use and so some, if we stay with that automobile manufacturer, they may have an application for a certain amount of water to water shrubbery, grass, etc. Certainly that’s one water quality. A second water quality might be used in cooling towers. A third might be used in boilers, and a fourth maybe might be used a painting application. So we have the technology now, available to us, so that we can make the water clean enough but not too clean, which translates into a fairly economical solution.

Dave: And do you continue to capture and reuse even the reused water so that you're almost continuously cycling the same water the same water through the process? Is there ever kind of a place where the water gets out of that cycle?

Grant: No. And so big picture, think about our life here on the rock. The water that's here is here, and it is recycled through natural processes. And so when we talk about reusing water if we can just break it down into H_2O and then junk, if we're able to separate out H_2O from junk, that H_2O can be used over, and over, and over, and over infinitely. And so that's kind of the point. And then the obvious next question is, "Well, what do we do with the junk?" And so that's a great question.

What you'll hear about is, "What are we going to do with some of the brines that we currently produce?" So, brines from softeners, brines from reverse osmosis, etc. And then that is a big, big question that as we move further down the water efficiency line, questions like that are going to need to be answered as a group.

And so, one example of how that is currently answered is there is what is called a brine line in the L.A. Basin where if you have a property that is on this brine line, it's ok to dump pretty salty water high in EC, as we mentioned before. It's ok to do that because that water ends up in the ocean. The same sort of thing is going on up here in San Francisco with the East Bay and MUD guys. They take highly saline water and they dump it in the ocean. But the question really is for those people who are in Modesto, Fresno, places like that that are inland, and frankly a long way from a brine line or from the East Bay-MUD operation, what do those guys do? There are answers to that question, probably not appropriate for this discussion, but water is kind of a spider-webby type thing. We believe that you need to look at it in kind of a holistic way as opposed to maybe an inch or two up from the work surface.

Dave: Got it. Well, Grant, you have been absolutely fantastic walking us through how water is used in these manufacturing processes. For those folks who want to find out more you and Sustainable Water Solutions, where can they go to find that information?

Grant: Well, a good place to start would be on the web, sustainablewatersolutionsllc.com. You could look us up there on our website. There's a couple easy to understand videos. I think they're somewhere around a minute or two long, kind of fun. Probably even appropriate to share with your kids if you want to have an after dinner discussion that doesn't involve television. Or, you can reach us at 855-289-7878.

Dave: Terrific. Well, Grant, thanks very much. You've been absolutely fantastic. Really appreciate your time. and we'll talk to you soon.

Grant: Ok. Thank you, Dave.

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Dave: You betcha. Bye

Grant: Bye now.

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Dave: Well, that was my interview with Grant Newhouse. I bet you learned a lot. He was fantastic and explained industrial water use in a very understandable fashion. Really appreciated his time.

Well, the interview lasted 35 minutes, so no time for takeaways in this episode. I thought Grant's explanations were pretty straightforward and a big value-add.

Please check out the Show Notes out for this session at http://thewatervalues.com/pod79. And leave a comment or email me at david@thewatervalues.com. You can also tweet at me @DTM1993 and tweet about the podcast using the #WaterValues. Please also rate and review the podcast on iTunes, Stitcher, or other podcast directories. And don't forget to tell your friends and colleagues about the podcast and to sign up for The Water Values Newsletter, which can be done at http://thewatervalues.com.

In closing, please remember to keep the core message of The Water Values Podcast in mind as you go about your daily business. Water is our most valuable resource. So please join me by going out into the world and acting like it.

Outro: You've been listening to The Water Values Podcast. Thank you for spending some of your day with my dad and me.

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