TWV Podcast #050
Advancements in Water Testing with OndaVia CEO Mark Peterman
Show Notes at http://thewatervalues.com/pod50

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, the 50th session, of The Water Values Podcast! As my son Joey said, I'm Dave McGimpsey. Thanks for joining me.

It's hard to believe we've hit episode 50. Thanks to all of you who listen to the podcast because without you, there's no podcast. Thanks again for all of your support and emails. I really enjoy hearing from you. Had an especially good email exchange with several people this past week, including Josh, who's a Blue Jays fan and we commiserated about the M's and the Blue Jays. Pitchers and catchers report to the M's in less than a week, and as you know, in the spring, every team has hope, and I feel the same way about the Mariners this season. So join me in rooting on the 2016 World Series Champions, the Seattle Mariners! A guy can dream, right?

Okay, on to today's show. Mark Peterman, the CEO of OndaVia joins me today to discuss water testing and how testing technology is developed. As you'll find out by listening, Mark is terrific at making the complex simple. I met Mark during lunch at a water conference last year. He's an Ohio State Buckeyes fan that probably didn't know his favorite college football team was about to win the initial college football national championship later in the season. Ohio State had come off that loss to Virginia Tech a few weeks prior to us meeting, so his expectations probably weren't that high at the time. But during our lunch, he obviously came across as a smart guy and one that didn't let his intelligence get in the way of his message. And that comes across in our conversation today where he speaks about water testing and new technological developments in a very understandable manner.

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

Mark: Yeah. It's a pleasure to be here. Thank you for the opportunity. It's an interesting path how I ended up in water. I spent a career making small things, either manipulating photons or fluids. And as I was leaving a previous company, I had some ideas that had stewed in the background for a long time, a bit of a hammer looking for a nail, and realized that are applications in water space. And water is just so fundamentally important to everything. Clean

water allows there to be a healthy civilization. And so it's such a fundamental component that it really drew me in as an interesting place to apply these technologies.

Dave: Ok. What is your background in terms of what you're doing now? How does your background relate to the area you're in now?

Mark: Well, my education is in physics. So my graduate work was focused on micro-fabrication – making devices that can handle fluids at the micro-scale, so microfluid devices. Graduate work was actually focused on making retinal prosthesis, a replacement for the retina for certain diseases. But there were ideas from that project and knowledge from that project that applied into analytical chemistry and rapid chemical testing, which is what OndaVia has become and does.

Dave: Ok. And so what exactly is a microfluid?

Mark: It is handling fluids at sub-millimeter scale. So, typically some of the devices we make, they have channels that are etched in silicon. We use the technologies that are used in the semi-conductor industry, and we will etch a channel 100 microns across. And 100 microns is about the size of a human hair. And at that scale, the property of fluids is a bit different than it is at the macro-scale we're all used to. There are different things you can do. You can move fluids around on the chip, which allows you to do new processes that would not be possible at the large scale.

Dave: Ok. We'll get into that stuff. Now you mentioned you had the hammer, you were just looking for the nail. So where did you find the nail and what is the nail?

Mark: Well, the technology we had was a new way of doing separations, chemical separations. So, often in analytical chemistry you have a mixture of a water sample. You could have a whole set of different chemicals in that water sample. And in order to measure those chemicals what's usually first done is they're separated from each other, actually physically separated so that you can measure them individually. And what we can do with a micro-scale is make chips that can actually do that separation at the micro-scale. So single-use, consumable chips that are made of silicon that you can put a fluid in, drive it with a battery and get that separation to occur. That was the first hammer that was out looking for applications. That's a widely used concept in water analysis, and we felt that would be an interesting place to apply it.

Dave: Ok. And so that concept grew into your company, which you mentioned the name of it earlier, OndaVia. So tell us a little about the background of the company. Where did the name come from? That's kind of interesting to me and talk about how this technology has blossomed under your leadership here.

Mark: Yeah, so the name for OndaVia, "Onda" is basically Latin, romance language, for wave. And one of the structures we have microfluid device, that thing that's the silicon chip oscillates in width and so it's kind of wave-like in terms of its appearance. Really the OndaVia name becomes trying to find something that said wave and was a short domain name that was available. So OndaVia is seven letters, and I have to type it frequently, so the shorter the better.

Dave: Ok. Tell us a little about the development of the technology within OndaVia and this microchip.

Mark: So the development of the technology is really funded by the National Science Foundation. So the Federal Government has a program called the Small Business Innovative Research Program, SBIR, and we applied to the NSF, National Science Foundation, back in 2008, 2009 for funding to demonstrate that the technology would work in some of these applications. After that, we actually applied for additional grants, received additional funding from the NSF for follow-on projects and some new technologies that came along and have since received funding from both the USDA and the National Institute of Health for related projects. So those grants were really the driving components for OndaVia's early product development.

Dave: Ok. And so using the chips to separate chemicals and such from water, what are you testing for, what are you looking for when you're doing this? Are you focused in a certain direction?

Mark: We've looked at a lot of different applications. So what we've ended up with is, separation is only one piece of the puzzle. After separation, you have to be able to detect. If we can't detect, the separation wasn't a whole lot of use. So we brought in detection technologies. And we focused on compounds that are of, there's frequent high volume testing and time critical type testing. Where our technology really has a benefit is being able to do it, let's say out in the field, or being able to do very rapid turnaround testing. Right now, you typically take water samples and you ship them to a lab and you wait three weeks to get a result back. We can do that same type of test either in the field or in a remote lab and get faster results.

Our initial applications were focused on things like perchlorate. Perchlorate is the oxidizer used in missiles and rockets. It's a groundwater contaminant, especially here in California, but nationwide if there has been any aerospace activity, you're going to end up with perchlorate in the groundwater. So our initial applications were focused on those types of groundwater contaminants. Over time we began to look at more industrial process use. For example, monitoring water at an oil refinery or at a chemical plant. Those applications are very time-critical because you need to know the results to be able to optimize the process. That's our real strong suit, that's where we play best.

Dave: Why, in some of these industrial processes, is it so time critical to know whether or not perchlorate's in the water? What's driving that?

Mark: One of the things we do in a refinery application is measure chemicals that are related to corrosion control. So, if you're a refinery, you're putting through one hundred-seventy thousand barrels per day of oil through that facility and using tremendous amounts of water in the process. If you end up with a corrosion problem, if something goes wrong in the system, you have to shut the refinery down. The "not" processing one hundred seventy thousand barrels per day is a huge revenue loss. Those systems where large amounts of fluids are moved in a short period of time where there are high revenue products, you need to know quickly what the results are in various tests to really optimize and make sure everything runs efficiently. Of course, there's always the safety application. If you got corrosion problems in a refinery and something goes, you could find yourself in a serious health and safety situation.

Dave: Ok. I'm way over my head in terms of how all this stuff works but in terms of the testing, what all is involved? I mean how, do you just drop the water on the silicone chip and put it into a little machine and it does its work or how does this actually function out in the field?

Mark: Yeah, that's pretty much it. We have a portable instrument. The technology, the detection based on Raman-spectroscopy. So there's an instrument that's a Raman Spectrometer. It connects to a laptop and has some really easy-to-use software, and you have cartridges. They're consumable cartridges. You put a drop of your sample on the cartridge. You might do a little sample prep ahead of time, maybe adjust the pH, maybe filter out some compounds that might be present. Get the dirt and the sludge out of your sample. You basically put a drop of water on the cartridge, plug it into the instrument and hit "start" in the software. Typically it takes five to ten minutes.

Dave: That's amazing. Five to ten minutes to figure that out. In terms of getting the chip are you manufacturing the chip or what exactly are you doing? The chip or are you doing the software as well? I mean what, I just don't have a real good sense in terms of… I understand that the result you kicking out, but what exactly does your process look like?

Mark: Yeah, the secret sauce is really in the cartridge – pretty much the chip although there's a plastic shell that holds it in place. We design the chip ourselves. We have them manufactured here in Silicon Valley. We don't operate the fab so we let others actually make the components. But then we do the final assembly, any of the re-agents, any of the sample prep components. We prepare those and provide them in a kit for the user. The spectrometer, we work folks who are experts in Raman-spectroscopy to get an optimized system. And then we make it special to hold our cartridges and really to fit our users and customers to applications.

Dave: Ok. So what are some of the advancements that you see coming down the pike in terms of this water testing and how you can use your technology for testing purposes?

Mark: I think the real advantage is the speed. For OndaVia, we're pushing to develop more and more tests. We see a value to our customers if you're routinely measuring, let's say ten different things in a water sample, and we come in with a system that can only measure one, it's limited value. But if we can measure all ten, all of a sudden, it's very interesting. So we're working to increase, basically, the catalog of different tests we can do.

I'm seeing this across the water analysis space in general. The idea of doing rapid on-site testing, even moving to a point where it is autonomous or in the field where we'd like to eventually go, then it becomes the Holy Grail. That is, having a system that you could bolt on the well head, for example, you could do this trace level laboratory grade-type analysis for low levels of chemicals automatically in the field. That's what, not just OndaVia, but everybody in the space is pushing for.

Dave: In the Safe Drinking Water Act space there's all this talk about micro-contaminants even in the Clean Water Act space, there's all this talk about micro-contaminants, about pharmaceuticals in the water. How far away are we from actually being able to have an economically, reasonably priced test for those types of contaminants?

Mark: Not too far. The challenge there is the market's got to drive the need for the test. So there's a bit of a chicken or an egg problem. Until folks want to, really want to watch it and do something about it, there's not a whole lot of driver for the test. But we know the technology to measure those kinds of, especially those types chemicals especially pharmaceuticals, endocrine disrupters, organic compounds with fantastic fingerprints that we can detect very well. The challenge becomes having folks really interested in knowing if they're there or not. Part of the problem is, once you know they're there, you have to do something about it. And so it's a multi-stage problem, right? There's multiple technology that all have to come together at the same time, so we can focus on that.

Dave: Sure. Now I guess the question I should have asked first is do we know whether or not these are, I call them micro-contaminants or pharmaceuticals, do we know whether they're even harmful to humans to consume? Do you have any thoughts on what the state of research is on that?

Mark: It's a tough problem. You think about part per billion where some of the things we look at like perchlorate, we look at it down to four parts per billion. A part per billion is an eye dropper in a swimming pool. It is a very small amount of chemical. But on the other hand, we drink water every day. So we always consume it. So these are the types of problems that the health impact is over the course of fifty or seventy or a life span of hundred years, so it is a very

difficult question to answer. And if you look at what the EPA has to deal with in terms of regulating it, it will affect one-in-a-million people in one hundred years. And it's likely the answer is yes. Somebody is going to be impacted by it, and we have to draw the line somewhere.

Dave: That's a fascinating way to look at it. I had not thought of looking at it through that prism yet. What do see in terms of the development of tests, you say we're not too far off, what are we looking at in terms of, do you think systems are going to start testing? Obviously these are not regulated contaminants under the Safe Drinking Water Act or the Clean Water Act. Do you see communities wanting to test for this stuff just wanting to know if it's there so that they can market to their consumers and say, "Hey, we don't have this stuff because we're testing for it and removing it." I guess that's the other piece is that you may be able to test for it but how difficult is it to remove this stuff?

Mark: Yes. The thing about drinking water, on the drinking water side, it's a very challenging market because it is very regulatory driven. Government bodies are funding it, so it is a very slow moving conservative sector, and honestly if you look at our quality of life improvements since the 1900s as we've brought in these new technologies, they've done tremendous things. Increasing our life spans, we don't routinely get dysentery anymore or cholera from drinking our water.

Just like any new technology, there are early adopters and there are innovators. There are communities that will say, "We are interested, we do want to approach that. Let's take a look and get involved in some of these new technologies." I think the challenge we will face is the proverbial chasm that must be crossed from the early adopters and the innovators to get over to the larger scale use. It is a very big chasm. And likely regulation is what will be needed to really make that chasm shorten up. So, there will be communities that will look at it, but it will take time and a fair amount of effort to get widespread use.

Dave: Sure. So do you have any sense in terms of what the regulators are doing in terms of looking at regulating this type of stuff?

Mark: For the micro-contaminants? I see people studying it, and they're looking into it. I haven't really followed very closely what they've really jumped into, whether or not these chemicals will end up, where they are in the regulatory path. It's a long path toward any type of rulemaking. There are things like hex-chrome and perchlorate that are being pushed, but it takes years to bring new contaminants through the regulations for the Safe Drinking Water Act, Clean Water Act and such.

Dave: Right and so, let's talk a little about…you've mentioned that you've been the recipient of a lot of grant funding. Could you talk a little about kind of the commercialization process for the technology? You obviously have to have capital from somewhere to start, and you may not have

a huge market to start in. What's the life for these water companies? You've mentioned that it can be tough especially with slower adoption rates.

Mark: Yeah, I think what we've done, and I see this frequently as I talk to other folks, entrepreneurs in the space, you very frequently see that you start out, and you've got a great idea to do something with water. First, you can go out and find a list of all the community water sources in the country, fifty-five thousands of them. And you can practically boil it down to the name of the person to whom you would sell stuff, fifty-five thousand names, right? So in terms of market research, in terms of putting together what's your go-to-market strategy and sales process. It's very easy to quantify everything, but on the other hand it's very difficult to sell to them.

And so what I see is a transition, most entrepreneurs make a transition more to the industrial side. Where there is an economic benefit for the users. Let's say in our case, we can do rapid testing. And I think the pathway back towards the drinking water side and more of the environmental type testing is to start in industrial. That's where you really build the technology up, you build the base of understanding, the proof of concept and that allows you then to go back to other sectors and say, "Look, the technology works, start to sell those early adopters and move your way up the curves."

Dave: Got it. That all kind of lines up the story of OndaVia as you've told it. Working in this industrial sector, and you used the example of the refinery early on.

Mark: Yes. And if you look at our early business plans, they are straight up drinking water applications and municipal systems. I might be a little biased in my view of how this works because it's what we've done, but I see others doing the same, making the same type of transition.

Dave: Yeah. I mean it's a fascinating way to go about it. It's almost sort of circuitous. You start with a municipal plan, go to the industrials with the, I don't know if the end game now is to go back to the municipals but sounds like you're doing great in the industrial space. And there's a lot of opportunity there.

Mark: Agreed. Yes. When there's an economic benefit to using the system, it helps them operate more efficiently. There's interest in the system, one, and two then there's also capital available to purchase systems and use it. Those two together mean that, as a small business, cash is king. You gotta go with what folks are going to buy. And use that to leverage into larger opportunities in the future.

Dave: Right. I know this is coming out of left field, but have you thought about, is there a market for just the residential consumer so that they can do a home testing kit to find out what's in their water coming out of their tap at home?

Mark: Ok, the challenge is that the spectrometer is still a pricey piece of equipment so for a home user there's probably a fairly long road before you're buying Ramon-spectrometers at Home Depot, for example. But there's an intermediate business model where there's a service provider. The local bottled water company could have it in their vans and go out and use it as part of the sales pitch, right? Part of the challenge is, let's say you found that your water at home had nine hundred parts per trillion of perchlorate in it or fifty parts per trillion of arsenic. Well, it's well below any regulatory limit, what do you do? You install a whole bunch of treatment technology and try to knock that down. You drink bottled water or now that you know, you're always going to be worried about your water. The challenge is what to do once you have that information.

Dave: I think you're absolutely right there. Well, Mark do you have any other thoughts about the technology sector and kind of this water testing? What have I missed?

Mark: They are always pushing new testing technologies in all types of sectors, right? I think overall testing is an enabling technology for everything else because if you can't measure it, you can't fix it. So testing becomes a very fundamental component, although, it's often the piece no one pays any attention to. When you've got the neat new carbon nanotube-based treatment technology, everyone thinks that's really sexy and cool. But meanwhile, those folks need to buy systems and need to prove that it works. It's the part that's hidden, but I think that it continues to progress. I see things being done in labs now, practically single molecule detection at this point.

And all this technology is pushed to a level where it will eventually be the tricorder from Star Trek, the old pictures of Spock walking around waiving it over the ground and saying, "This or that chemical is present." We're headed that direction. We will eventually have the ability to do things like that, and so it's going to open all types of fascinating new understandings of our planet and our ecosystems over the coming, I would say, decades, plural, but you never know with how fast these things accelerate.

Dave: One question I should have asked earlier, we've talked about a lot, obviously, the use of the technology in an industrial process, the use in the drinking water process. What about testing for the effluent from a wastewater treatment plant or other industrial process? What are the applications and the market opportunities you're seeing for effluent based testing?

Mark: Yeah, similar type applications as you get into the wastewater treatment facilities it's again, very heavily regulated. So things need to be done via standard protocols. So folks tend to be very conservative in the approach they take to measurement. On the other side, you've also

got industrial folks with wastewater, and they want to be able to very quickly determine that everything is within compliance, everything is operating properly. Being able to get instead of testing once a quarter, being able to test let's say once a week so you know that everything is operating fine, and there'll be no issues is a powerful benefit on the industrial side. On the municipal wastewater treatment, it's kind of the same problem with the drinking water, the same issues as the drinking water side. It's a very conservative business. Because in general, it all works fine, and if it ain't broke don't fix it is somewhat the approach there.

Dave: Well, Mark, you've been absolutely fantastic today talking about this very complex subject in laymen's terms. You're talking about something that's way over my head, but you made it very understandable, and so I really want to thank you for taking time out of your day and really explaining how this stuff works in a way that I and probably a lot of the folks at home can understand it. So I want to applaud you for that.

For folks who want to find out more about you and OndaVia, could you please tell them where to go to find that information?

Mark: You know best starting point is our website, www.ondavia.com and Google search us for contact info and get ahold of us. We love to chat with folks if there are new up and coming contaminants problems, testing issues, that's what our expertise is. We love hearing from folks.

Dave: Terrific. Well, Mark, thanks again for your time. Really appreciate it.

Mark: And I thank you. It was a true pleasure.

Dave: You bet, Mark, bye.

Mark: Bye.

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Dave: That was my conversation with Mark Peterman – He was fantastic, and I hope you found it enlightening.

My first takeaway concerns the blissful ignorance we have with our drinking water. Mark mentioned that if you test for a substance in water and find it, then you have to do something about it. It's almost better not to know so that you don't become obsessed with pure water. The fact is, water is such a great solvent that there's all kinds of things in the water. In fact, pure water isn't safe to drink because it would leach important minerals and nutrients from your body. So perhaps that just means we need to be better educated about water and what's in it.

Second, as I mentioned during my Phil Rolchigo takeaways last week in session 49, that episode and this one with Mark really highlight how technology is brought to market. The applications start on the industrial side – the drinking water and the municipal wastewater side simply take too long to develop. The industrial sector lets the technology mature before the drinking and wastewater sectors invest in it. It's that proverbial race to be 10th.

My final takeaway is just my marveling at the levels we're able to detect substances in water. Mark mentioned that we're practically down to the molecule level. The silicon chips they're using have channels etched into them that are 100 microns wide – the width of a human hair. And I'm sure this is just the tip of the iceberg. Wait another couple years to really be blown away.

Well, you can check the Show Notes out for this session at http://thewatervalues.com/pod50. Leave a comment on the Show Notes or email me at david@thewatervalues.com. You can also tweet at me @DTM1993, and you can tweet about the podcast using #WaterValues. And don't forget to rate and please review the podcast on iTunes, Stitcher and other podcast directories. And please 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.

Dave: Thank you for tuning in to the disclaimer. I'm a lawyer licensed in Colorado and Indiana. And nothing in this podcast should be taken as providing legal advice or as establishing an attorney-client relationship with you or with anyone else. Additionally, nothing in this podcast should be considered a solicitation for professional employment. I'm just a lawyer that finds water issues interesting and that believes greater public education is needed about water issues. And that includes enhancing my own education about water issues because no one knows everything about water.