Sewer Signals Podcast
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Season 1 Episode 2: Kyle Curtis with Hampton Roads Sanitation District, Virginia

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Transcript

Anna Mehrotra: Okay, hello and welcome to Sewer Signals, a podcast on utility experiences with wastewater surveillance. I'm Anna Mehrotra, Director of the Wastewater Surveillance Program at the Water Environment Federation, and I'm pleased to be talking to Kyle Curtis today, who is joining from southeastern Virginia. Hey, Kyle, how are you?

Kyle Curtis: Good morning, Anna. I'm doing great. Happy to be here.

Anna: Awesome. So, Kyle is an environmental scientist with the Hampton Roads Sanitation District. His background is in environmental microbiology with a particular interest in coastal systems. As a scientist for HRSD, he helps develop and manage a variety of water quality projects ranging from long term chlorophyll monitoring of the lower Chesapeake Bay to studies focusing on pathogen concentrations in wastewater. And since 2020, his group at HRSD has largely been focused on wastewater surveillance, uh, for SARS-CoV-2. So you're probably wondering what HRSD is all about. HRSD is a wastewater utility that provides service to 20 cities and counties in Southeast Virginia and the eastern shore, an area of nearly 5, 000 square miles with a population of more than 1.9 million people. They operate eight major treatment plants and eight smaller plants with a combined treatment capacity of 225 million gallons per day so we're talking. Large scale. And Kyle, I have to say, at some point, I want to talk to you about chlorophyll monitoring in the lower Chesapeake Bay. But as you know, we're going to talk about, um, quantifying SARS-CoV-2 in wastewater today. So let's dive in. All right, we're talking about testing untreated wastewater to collect information on the health of a community. And as you know, there are many different terms for this. Wastewater surveillance, sewage surveillance, wastewater-based epidemiology. Do you have a preference for the term you like to use? And if so, why?

Kyle: Yeah, I think I don't have any strong sort of convictions about this, but I think we settled into saying wastewater surveillance. We originally were saying wastewater epidemiology. And I think there's been some discussion in the community about if that's the appropriate use of that word and I don't have an epidemiology background. So the easy thing for me to do is just not have an opinion on that and say wastewater surveillance. Um, and you know, I heard at this, uh, at the conference recently, somebody say, and I think this is a valid point that the word surveillance could have a connotation that's kind of negative or maybe even big brother like, um, to some folks in the community, which is probably real. If you already had that mindset of, you know, I'm worried about my privacy, the word surveillance makes me kind of pay extra attention. And I, and this may be an oversight on my part, but I never even thought of that, but I think it's a valid point. Um, but, yeah, so, right now, we're saying wastewater surveillance or, you know, COVID 19 surveillance, I think, is what is on the front of HRSD’s website where you could go see, you know, what the latest data looks like.

Anna: Okay. Oh, cool. Okay. Well, yeah, we'll get to talking about how the public can see your data in a bit. That's great to know that it's there. All right, so we'll go ahead and use wastewater

surveillance for our conversation then. So yeah, tell me a little bit about HRSD's program. How did you all get started in wastewater surveillance for COVID?

Kyle: Yeah, it was like can we do it technically side of it. And then there was the, is this, you know, should we pursue this and can we be useful sort of side of it. And so, uh, the first part I think was pretty straightforward. HRSD is lucky to have a set of researchers that are already, we're already doing very similar things, so have, um, you know, quantified viruses and, and then pathogens in general in wastewater. We have really good molecular biologists who understand the difficulties of quantifying maybe, you know, low concentrations of something like a viral pathogen in wastewater, which is a tricky matrix to deal with. Um, particularly when you're talking about using PCR, but, uh, you know, fortunately they, you know, our group had already gone through a lot of those growing pains and was pretty good at it. And so once we saw that folks were using the, uh, the N gene assays that CDC put out for clinical use. In wastewater, you know, we thought, okay, you know, this is probably feasible. Um, and then the other side of the question, at least from my perspective is like, should we be doing this? We're not the health department. We are the wastewater utility in the region, but we do view ourself as a public health entity, right? Treating wastewater is a huge responsibility for public health. And so we see ourself as that and we did before the pandemic. Absolutely. I mean, that's how not just my water quality group that I'm in, but the whole organization views ourself that way. And, um, you know, the decision was certainly made, uh, all the way at the top really to do this, our general management and our directors decided, yeah, we can do this if if we can do this, we should because you know, this was early days in the pandemic when we were having these conversations talking about late February, 2020, um, and, you know, there's so many unknowns at that point, but it was starting to feel like, Hey, this is going to be an all hands, really, you know, large magnitude situation and whatever we can help we should do that. I think that's what it boiled down to. Yeah. So it's sort of like, this is part of your public health mission. You have the capability to do it. Let's do it.

Anna: You mentioned that you already had sort of this, these capabilities up and running for looking at other pathogen targets. So once you started focusing on COVID, does that mean you had to put everything else kind of on hold? Is that really what you've been focusing on exclusively for the past couple of years?

Kyle: Yeah, definitely some. A subset of the folks that we typically have working on all those projects that existed and still do exist prior to COVID. Um, not everyone had to just say, all right, pause. We're doing COVID, but certainly some projects had to get put on hold. Yeah, and then that got amplified when we, when really did get a lot of the first wave through here and enough cases to be concerned and start to say, you know, how much should we even be interacting with one another? How close can we be? Because, you know, more broadly outside of the research sort of group that I'm in, we have like regulatory limits that we, we have to meet and that includes analyses. Um, so our larger laboratory who does a lot of that work. Had to figure out, you know, what is the safe way to do this? And, and of course that trickled down to us because as much as we want to help, we also needed to be safe. And this was, you know, like I mentioned, this was early on and lots of things are still being figured out. So yeah, a lot got paused.

Anna: Okay. And you mentioned that, you know, yeah, you, you had this recognition that you're not a health department, but you are a public health entity, but who, who have you been partnering with in this effort so far? And I'm sure that's evolved over the last couple of years, you

know, but are you working with local health departments, your state health department? Who are your partners?

Kyle: Yeah, absolutely. All of those and others. Our first priority was, you know, we'll generate the data and we'll, we'll QC it and we'll do all of our normal vetting so that when, once we get results that are showing like, yeah, we have detections that, you know, more than half of our plants or all the plants are showing increasing concentrations or last few weeks. If we're going to say something like that, of course, we'll vet it. But once we got past that part, um, you know, yeah, we were giving it to the state to the health department. And I mean, I just can't imagine what it would have been like to work there during those months or even the 1st year. I mean, I have no idea. Um, I'm sure they were swamped. And so we couldn't partner right away. I don't think. Um, but we gave, we continue to give them the information, both the data, you know, our analysis of it and any sort of supporting information that could let them understand like this science and how it would be useful during a pandemic. And, you know, again, this is my perspective from the outside. But once I got their head above water a little bit, um, we were able to interact with them more and they actually hired folks geared specifically for wastewater surveillance. Like, there were new three positions created to, um, manage that part of all of this. So now we speak to them every week. They've gotten our data since the beginning. Um, yeah, so we have a lot of partners, but that, you know, that's certainly our priority is because that's who's making right public health recommendations.

Anna: Yeah, that makes sense. Okay. And your program is very much ongoing. Um, so how, talk to me about, you know, how many places are you sampling from all your water resource recovery facilities, other locations, how frequently are you sampling and how has that kind of changed over time?

Kyle: Sure. Yeah. Yeah. Our, our, I would say our main program that has been the same more or less, um, since early March, 2020 is sampling those nine, what we'll call major facilities in Southeast Virginia that serve most of that population that, you know, almost 2 million people, um, that I should say just to make sure everything's correct. That's gone down to eight facilities, but that was a planned closure of a plant that's has been, you know, has been in the works way before all of this and that's just something that happened to occur during this time. But anyway. That is a, you know, weekly sampling of the raw inflow of those facilities. And the idea there is, you know, for 8 samples, which does take some work to go out, collect process and analyze, we get a pretty big snapshot of the community. And what's going on with infection trends for this whole region. So that I want to actually highlight that the like unbelievable work the technicians and the analysts have done, because we've never missed a week. Still, we started doing that in March. I think March 11th, we collected our first sample, which is right around the date WHO declared this a global pandemic. And, um, yeah, I noticed that because I do some of the data analysis and I saw that, uh, you know, we have about two years straight data pop up in March. Well, I, I just, it just occurred to me in March and I was like, you know, send everybody an email. I was like, Hey, by the way, you guys know you haven't missed a week yet through all the waves and everything we have this, yeah, this unbroken sort of chain of data since then.

Anna: That is incredible. So it is your, the technicians at each of the facilities who are collecting the samples. Is it part of sort of like their, um, permit sampling kind of program? Or is there, you know, like, how does the sampling work exactly? And then it's your lab that's actually analyzing

the samples, right? So, you know, what are the logistics like in terms of getting the samples to your lab? And how does, what does that all look like?

Kyle: Yeah, so actually it is not, um, folks at the at the plant that typically collect. We have a group that same group here, um, in our technical services division that that would have already been doing other sort of pathogen related projects. They are the ones that will go out and do the collection and they'll also do the front-end processing. So, you know, a couple of folks will go out usually and probably two teams just because of the geographic spread, go do those grabs at the eight facilities, bring them back and do the initial processing stuff, which is, you know, the concentration stuff that kind of gets you from a liquid sample to, um, to a filter that can then be, you know, analyzed by the, by the molecular biologists.

Anna: Okay. And that's all happening on one day for all plants or is it kind of spread out through the week?

Kyle: So the sample will be collected early in the week and the processing, um, through the middle of the week. It's typically the end of the week we'll get data for that same week.

Anna: Okay. That's great. And then you said they'll go take grabs. Are they actually taking grab samples? How are the samples actually collected?

Kyle: Yeah, that's a good question. I mean, that was one of our questions early on. So, when we had 9 facilities, what we did was, um, we set up flow weighted 24-hour composites at 3 of them and did true grabs at the other 6. And even for a little while we did pair grab and composite of those three, just to see I mean, you know, we have experience with wastewater and we know that they're diurnal peaks and there's, there's ways to flow way to sample to make it more representative of a day rather than that instant that you do the grab.

Anna: Right, for sure.

Kyle: But we did, you know, early on, we did an analysis of this where we, we actually at a facility, we took, um, using an auto sampler. We took grabs every hour and we compared for 3 days. So, you know, 72 hours of that, um, compared against 3. Concurrent flow way to composites. So the idea was how would any one of these grabs match up to its respective flow way to composite and then we can do that over three days. We have a preprint of that out. But what we noticed was, yeah, of course, you have increasing load, you know, associated with your, your diurnal peak, but, fortunately for us occurs around the time we would be sampling just for the sort of logistic ease of getting out there in the morning anyway. And so we realized that because we don't need to be, you know, so precise, we will simplify things and do grabs and we're likely not missing by much is what that analysis showed us. So, so we were able to just go to just true grabs rather than dealing with the, um, the auto samplers.

Anna: Okay. That's interesting. Yeah. And so we can, we'll share a link to that preprint in the, in the notes for the show. Um, I'm sure folks would be interested in reading that. So it's quite the program to collect the samples, analyze the samples and get the results turned around within the same week, which is fantastic and share them with the state health department. And then

you mentioned that you also post the data on, um, your website, um, for the, for the public to use it. Is that right?

Kyle: Yeah, we, you know, along the way, we've, we've worked a lot with, like, uh, thinking through what's the best way to display these data. And, you know, we came up with a couple, a couple of things that we think boiled down the weekly sort of trend, whether it's over time or spatially. And, um, we have a website where when those get done, I'll send them over to our, uh, you know, someone who manages the website and they'll put up the, the newest data, which, um, is usually in the form of one is like a heat map showing all showing the region and kind of like different colors based on the collection system for all the plants we sample showing, you know, which one's hotter versus one that has, you know, lower concentration to be a cooler color. Uh, and then the other figure is, uh, just the time series really going back from the beginning to look at just what's the regional load. So not one facility, but all of them kind of aggregated together. And how does that compare with, um, previously we were using daily new cases. So what's the rate of new clinical cases, but we've kind of seen that might not be the greatest metric just due to how testing is going. So we've switched over to hospitalizations. But in any case, yeah, that's available right now. And it's, it's always as up to date as it can be, which is usually about a week, you know, it might be a week off or half, you know, 5 or 6 days off.

Anna: And how are the data looking now?

Kyle: Yeah, I was just looking at it yesterday and talking to Raul Gonzalez, who I know, you know, and probably anybody in this space does at this point. There's just no way around it. I think we're seeing the beginning of an upward trend. Yeah. Um, I mean, who knows what will happen? Of course, I don't, I'm definitely not in the business of predicting waves, but we've had like a, a noisy sort of an upward trend for the past, like, I would say month or five, maybe six weeks where it's bounced around, but overall, yeah, it's seen a little bit of a rise coming off the backside of a long BA1 Omicron kind of wave that happened at the beginning of the year.

Anna: Yeah, well, I don't think you're alone in that sort of uptick. What sort of, do you get questions from the public about your data and, and, um, interest in, in, you know, what the trends are and do you get feedback on that or?

Kyle: Yeah, we do. It's, um, in a really funny way to me because, so I'll, I'll be the one that sends over the, the latest figures and if we've had some hang up, whether it's a supply chain issue, getting us reagents for the analysis or me being out with, you know, whatever, and it is not updated, we will hear about it.

Anna: Oh, interesting.

Kyle: We don't do like, uh, we don't pick up trash, you know, we just do wastewater, but it really feels like. Hey, you forgot my trash can this week, and they'll put me right away and uh, and I'm like, good. I'm glad people are actually looking at this. That's that.

Anna: That's got to feel good. Um, yeah, they're keeping you honest. Keeping you on track. That's great. So it sounds like at this point, all of this has been funded by HRSD. Is that how the program's funded?

Kyle: Yeah, a lot of it has been, um, for that. What I would call like our regional wastewater surveillance. Um, now, we haven't talked about and I don't want to take us off track but we do have a number of other studies, you know, either out in the collection system within a locality or for the Virginia Department of Corrections or in a dorm level like we've done all these things, and, and a lot of those are not funded by us they would be funded by a locality that maybe got money from the health department who got money from the federal cares sort of grant or HRSD for years well before this pandemic has had this what we call our municipal assistance program where any locality in Virginia can, um, you know, kind of hire us to do a study and, you know, they have to pay, but we do it at like I don't want to misquote it, but we will help out, you know, localities and that kind of came around with us wanting to just help out other Virginia, um, utilities that were smaller and didn't have the resources we do to do their permit sampling. So that came about like that. But once the mechanism was in place for us to get paid by say. A city in a different part of the state to do a study, then it can be used for anything. And we have used it for this kind of work. And we'd say, like, if we have the capacity and the study makes sense, we can do a, you know, a dorm study, or we can do out in the collection system study for you. Um, and, you know, and that wouldn't be funded by interest.

Anna: Thank you. Got it. Okay. And I know you mentioned the corrections. Um, you all did the twice weekly testing for all of the correctional facilities for quite some time. Right?

Kyle: Yeah, yeah, it was 40 facilities across the state and we did the, they would send us and it was a big resource, you know, load to, to get the process and analyze. I mean, we're not a, a high throughput lab, even though a lot of volume goes through a lot of samples go through, you know, our, our little corner of the organization is more research and less cranking out hundreds of the same analysis per week, you know, yeah, but I will say, um, that is another end user of the data that absolutely wanted it and made decisions based on it. They had a standing meeting with role, you know, at the end of every week to say. We saw this going on, you know, help us understand that because we're going to swab everybody at this facility or we're going to, you know, restrict movement or whatever their intervention might have been. That was another end user that was absolutely one of the data and they wanted it every week and they used it.

Anna: Yeah, I mean, I think in situations like that, the sort of the public health actions you can take based on the data are very clear, right? Yeah, and just because you're not analyzing their wastewater anymore. I know that they continue to Virginia Department of Corrections continues to use wastewater surveillance to make decisions about things like, yeah, when do we do point prevalence testing of everyone in the facility? So it's great they see a lot of value in it for sure. Yeah, yeah. Um, okay, uh, just a couple more questions here. So what's the one thing going back two years that would have been helpful for you to know at the start of this program that maybe you would, um, I don't know, share with somebody, you know, initiating a similar type of wastewater surveillance program in their utility?

Kyle: Hmm. Yeah, I know. I've thought about this question a little bit. Nothing. There's no glaring one that I feel like we got hit over the head with, um, there were plenty of things we, you know,

we learned and got better at, but I think they were sort of incremental and kind of expected, you know, you can, you can get better at the assays and understanding what they mean and you can get better at, um, actually I'll say this because this is something that I've had in my hand on more directly so it won't be me speculating about what somebody else was thinking. Um, I think it's worthwhile to figure out what you intend to use the data for. And then, and I mean that specifically, not generically or broadly like we want to know what's going on with infections. I mean, like if you see an upward trend, then what happens? Um, because, you know, sometimes it seems like it would be immediately obvious, but you need the people who actually are responsible for, you know, initiating that intervention to be on board and ready to do that. Um, and, you know, credit to our health department for, for understanding that, but I just mean anybody doing it, it's, it's worth thinking about that on the front end, because it might change how you portray the data and your frequency of sampling, you know, just to give an example. If you had, um, you say you had your health department on board and they're, they're going to mobilize, like, education and testing and vaccination clinic to a local localized area where you're seeing an outbreak. I mean, this is a real thing we've experienced during a study. Um, in one of our localities where we were collecting out in the collection system, we were sampling pump stations and, um, you know, cases were not that high. So when we saw hot spots, it actually made sense to put resources right there. Um, you need to know going in, if that is the end goal, You need your analysis to say, or sorry, you need your, uh, sampling team and your analysts to be on the same page and say, look, this only helps them. If we turn it around in like three days, if we can't do that, then we should reevaluate what makes sense to do. Um, so I think thinking about what the end point is going to be for the end user. And then backing into what the sampling strategy is or the design of the study is what would be useful for somebody who's initiating this.

Anna: Yeah, those are great words of wisdom. It's sort of the old adage, you know, begin with the end in mind and work backwards. Yeah. And I think, I mean, like you said, you iterated and you figured it out because it was COVID. But if you have the luxury of sort of taking that time to, to really formulate how you're going to use the data that will help inform your, your program, um, design, that's great. Okay. If folks want to learn more about your program, it sounds like you have a website, which again, I will share the link to that in the show notes. Um, anything else you want to direct people to in terms of reading about your program online? You mentioned a preprint. Yeah, I'll also share the link to that. I know you also had a publication early on, so I can share the link to that. Anything else, um, you want to share in terms of information, publications, resources?

Kyle: Yeah, those are good ones. Um, the website is good for a snapshot of what we do weekly, and the publications, if you're into the more technical, they give a good overview, um, of kind of what we've been up to. I would say... A lot of times people will just contact Raul Gonzalez or myself, because, you know, I mean, there's a lot of people who've had their hands on this and know it very well, but just to narrow down points of contact, I think contacting either is fine.

Anna: Okay, Kyle, I have one non wastewater question for you. So where are you from? You're from Southeastern Virginia originally?

Kyle: Yeah, I grew up in Norfolk, Virginia.

Anna: Awesome. So you know the area really well and I've heard there are some pretty amazing beaches in your part of the world. So do you have a favorite beach or two or three in the HRSD service area that you could recommend?

Kyle: Sure, yeah, yeah, I, um, growing up around here, I was closer and and still am closer to the Chesapeake Bay than to the ocean. Um, and so I would say, you know, I grew up surfing and it's 1 of my favorite sort of hobbies. Um, so I'll go to the Virginia beach ocean front for that. And I like to go more to the north end, like, the higher number streets, a little quieter, a little, a little bit, uh, easier to find a parking spot. And the wave, as far as I can tell, is all the same, um, but I will say I spend a lot more of my time because I'll take, you know, the whole family will go and my friends will go and it's much closer at, uh, some of the Norfolk beaches that are on the Chesapeake Bay, like Ocean View is, is one of them. And that's the part of Norfolk I grew up in and it's right adjacent to the Bay and it's great. Yeah, I've heard it's beautiful, not big waves and it's usually not that many people, but you still get, you know, the, the sand and the water and everything you want. Yeah, I've spent a lot of time there and planning to as it warms up a little more this year too.

Anna: Yeah, those are great recommendations. So do you think your kids will be surfers? Walk in your footsteps?

Kyle: Yeah, I'm going to try not to be too overbearing, at least let them know how good of a sport it is. Um, just, you know, for your to be out there in the ocean. And it's a good way to get some exercise. I've had my four-year-old on the front of me. This is how much I really want them to like it. I've had the four year old, although he was three last year on the front of this, I bought a long foam top board so that I didn't have to put them on one of my harder like surfboards that I use and paddled into some waves while he held on to the front.

Anna: What did he think?

Kyle: Oh, he loves it, man. It's like a, like a roller coaster if you're three years old, you know, that's awesome. Little wave looks pretty big and yeah, he had a good time. He likes it. He'll be, he'll be excited when we break it back out again this year when the water warms up a little more. Yeah.

Anna: That's so great. All right. Well, there you have it. Wastewater surveillance, beaches and surfing in southeastern Virginia. Um, so like I said, I'll share all this information, the links, the publications, um, information on the beaches and the show notes. And I just want to say thank you so much, Kyle, for taking time to talk with me today. I really enjoyed our conversation.

Kyle: Yeah, no, thanks for the opportunity. This is fun.

Links to papers, dashboards, and beaches mentioned in the episode:

- Preprint by Curtis *et al.* on Wastewater SARS-CoV-2 RNA Concentration and Loading Variability from Grab and 24-Hour Composite Samples
- HRSD COVID-19 Surveillance dashboard
- Virginia wastewater data on CDC COVID Data Tracker

- Article by Gonzalez, Curtis *et al.* on COVID-19 surveillance in Southeastern Virginia using wastewater-based epidemiology
- Virginia Beach Oceanfront
- Ocean View Beach