Tracey: 00:00 Hello and welcome to NC State's Audio Abstract. I'm your host, Tracey Peake. If you live in North Carolina, then you've heard a lot about GenX in the past year, and we aren't talking about the cynical generation sandwiched between baby boomers and millennials. GenX is a chemical generated in the production of nonstick coatings for cookware. In early 2017, GenX was detected in North Carolina's Cape Fear River, which serves as a drinking water source for around 300,000 residents in the lower Cape Fear River Basin. We don't know much about GenX's toxicity or how long it remains in the body or the environment. We're speaking today with Jane Hoppin, Associate Professor of Biological Sciences and Deputy Director of NC State's Center for Human Health and the Environment. Jane is leading a study into the effect of GenX on the human body. Welcome Jane. Thanks for being here.

Jane: 00:50 Thanks, Tracy.

Tracey: 00:52 Let's start by talking about what exactly GenX is. What is this stuff?

Jane: 00:56 GenX is part of a family of chemicals that are per and polyflora alcohol substances. It's a long name and we usually call them PFAS now. PFAS, in general, are chemicals that have some really unique properties that make them really stable and more importantly for things that, products that we like, it makes things nonstick, stain resistant. It's used in a lot of different processes. GenX is one of the new generation of these PFAS chemicals. The original chemicals were called PFOA and PFOS. Those were the most important chemicals in the class. PFOA was used to make Teflon. When it got phased out GenX was introduced as its replacement.

Tracey: 01:57 Okay. Why did the original PFOA get phased out in favor of GenX?

Jane: 02:06 The original got phased out because PFOA, PFOS are very environmentally and biologically persistent, which means that we can measure them in the bodies of every person in the United States and probably most parts of the planet. They're not as long lived as PCBs and those kind of chemicals, but very long lived. Even though most manufacturers stopped producing PFOA in 2002 or 2003, we still can measure these chemicals in everybody.

Tracey: 02:50 So GenX was, hopefully, going to be a slightly better version of this that wouldn't last as long or get into the human body?

Jane: 02:58 GenX was designed to have better properties, less biologically and environmentally persistent. But because it has, that's fine. I'll just stop there.

Tracey: 03:13 Okay. We'll stop there. Sorry. We're moving the microphone far away. Am I spitting on it.

Mr. Bill: 03:22 You're leaning forward.

Tracey: 03:24 Oh, I'm leaning forward. Okay. I'm sorry.

Jane: 03:25 I'm like fighting from it.

Mr. Bill: 03:27 Don't do that because I'll just keep getting closer.

Tracey: 03:30 With the PFOA and GenX and other related chemicals, what do we know about their health risks? Do we know anything about it?

Jane: 03:38 PFOA has been studied for a long time, primarily because of a community in West Virginia, Parkersburg, West Virginia. All their drinking water was contaminated by PFOA as a result of manufacturing of Teflon by DuPont in the Parkersburg, West Virginal area. As part of consent decree, the whole community of almost 70,000 people participated in having their blood drawn for measuring PFOA and related chemicals in the body and then looking at health outcomes. This is the largest population that we have data from. While there are limitations in the study, this study and others have shown that PFOA is associated with increased cholesterol, altered thyroid function, so pretty common outcomes in the general population, but also some rare outcomes like ulcerative colitis, pregnancy induced hypertension, as well as kidney and testicular cancer in this population. People are also concerned about potential immune impacts of these chemicals.

In some other studies, it's been show that people with higher exposures to PFOA and other chemicals have a lower response to vaccines. Most vaccines are super effective and so it's not going to impact something like the measles, but if you have a vaccine like the flu, which is not super effective and you're giving it to older people who have older immune systems, so less likely to have a good immune response, and then you have these chemicals that would also alter that, so there are potential broad public health concerns that we don't understand at this point.

Tracey: 05:57 Okay. Let's restate the part about, there are potential broad public health concerns that we don't understand. Then, can we do sort of, start with just a laundry list of, these chemicals have been associated with, and just everything you just said? That was very long.

Jane: 06:15 Okay. All right.

Tracey: 06:16 But, a little more abbreviated. Then, we can just kind of go from.

Jane: 06:20 I know. I know. You're killing me.

Tracey: 06:22 I'm killing you here.

Jane: 06:22 I know. That's fine. That's right. Okay.

This class of chemicals has been associated with potentially a broad public health implications. Not only have they been associated with things like elevated cholesterol, and tyroid dysfunction, but also some cancers, kidney and testicular cancer, as well as poor immune function in response to vaccines.

Tracey: 06:53 Excellent. Perfect. Very good. Okay. Tell us a little bit about the study that you're doing.

Jane: 06:59 The study that I'm doing arose as a result of community concern about GenX. The Town of Wilmington woke up one morning of June of 2017 to learn that GenX was in their drinking water. They woke up to learn that potentially they've been drinking Teflon related chemicals since 1980. We didn't know anything about some of these new chemicals like GenX or even what these new chemicals were. People were very concerned and wanted to know, is it in me, how much is in me, what are the health effects? We designed, me and others, as part of the Center for Human Health and the Environment, we submitted a grant to NIHS, National Institute of Environmental Health Sciences, as part of their time sensitive environmental health grants. We submitted a grant to look at this question on August 1st, and then we were funded November 1st, and then two weeks later we enrolled 310 people in Wilmington. The study is designed to answer those big questions like, is it in me, how much is in me, what predicts it's in me, and are there health effects?

We collected blood and urine from people ages 6 to 86 who had lived in Wilmington at least a year, and where serviced by public utility water, so we could know what their potential GenX exposure had been. We also collected tap water samples from people's homes. First, we analyzed the water samples, and so we identified GenX, but also some of the other historically used chemicals in water. But, we also identified some new chemicals that we had no analytic standards for, which means that we could say that, we knew that Jane was there, but we didn't know what she weighed. What we could say is that these new chemicals are there and so we wanted to figure out what those were, so that when we analyzed the blood, we could actually tell people how much they had.

Then, we analyzed the blood samples, as well. We analyzed the blood samples for 23 different PFAS chemicals. We had the 310 people that we enrolled initially, and then we did an additional sampling in May of 2018 where we enrolled 34 additional people. We also re-sampled 44 people. That gave us the opportunity, not only to have more people in the study, but also let us look at changes in the chemicals over a six month period.

Tracey: 10:17 Because during that six month period, the water utilities people were taking measures to try to remove it from the drinking water supply.

Jane: 10:28 Actually, they found out about this problem in June of 2017, the beginning of the month. By the end of the month, the Department of Environmental Quality had already required the manufacturer to stop discharging to the Cape Fear River. Within a few days of that decision, the levels in the river went from 700 parts per trillion to less than 100 parts per trillion. That happened in June, so we were already chasing reduced levels in drinking water. And, also in June of 2017, people stopped drinking the water if they could afford to. They might have started using bottled water or used a reverse osmosis filter to reduce their exposure. The exposures we know had been coming down, so even when we sampled in November, it was about five months after they turned off the source.

One of the reasons we wanted to move fast is, we don't know how long these chemicals may stay in people's bodies. One of the things we think about with chemicals is half-life and how much time it takes for half the chemical to leave the body. One estimate of the half-life of GenX was 30 days. It's estimated that five half-lives are complete removal from the body. If it was 30 days, we might miss it, sampling in November. That was really the soonest we could do that study. We're trying to get an idea of the half-life, and moving fast so that if these were shorter lived in the body, we might catch it.

Tracey: 12:24 So how successful have you been? What have you found so far?

Jane: 12:28 What we've found so far is that, in the blood samples, we did not measure GenX in any of the blood samples we analyzed, though we did have a good analytic method. We're confident that we didn't measure GenX. We also measured four new chemicals that we had obtained analytic standards because we identified them as part of the water sampling, so then we could quantify them. These chemicals have names like nafion byproduct 2, and hydro-EVE. They're brand new chemicals, so we don't know much about how long they stay in the body, what the health effects are, anything like that. We found these new chemicals in people's bodies. But what we also learned is with these new chemicals that the levels did drop over the six month period. The levels were coming down for these new chemicals. That's a little bit reassuring. How long they've been there, we don't know. We found that and that was, I think, important for the community to know, but not necessarily surprised because they had heard that there were other chemicals in their drinking water.

What we also found that we were surprised about is that the level of these historically used PFAS compounds, like PFOA and PFAS, were much higher in the Wilmington population than the rest of the United States. The Center for Disease Control conducts the National Health and Nutrition Examination Survey, or NHANES survey, in the United States. They collect blood samples from about 5,000 Americans every year. In these samples, they analyze for PFOA and PFAS, so it gives us really good national data on the levels of these things so we can compare them. We did see that the levels of PFOA in our sample were about four times the national average. The levels of PFAS were about two times the national average. Where these are coming from, what the levels might have been historically, we don't know yet. Those are some of the questions that we're trying to answer.

Tracey: 15:30 Okay. So let's back up and see if we can summarize a little bit of what we said. Let's just do a quick, first of all, let's do quick summary timeline. They discovered it in the drinking water in June. It was cut off at the source by the end of June. We applied for a very quick grant to start taking samples. We weren't able to do it until November, which could affect the exposure rates. But, we found that those levels decrease over time, but we also identified new chemicals. Can we just kind of go, like that okay?

Jane: 15:30 Sure.

Tracey: 16:09 Okay. So do that.

Jane: 16:10 All right. Yeah. You know I'm like out of my, I'm like in my post holiday haze.

Tracey: 16:13 No. It's fine. It's fine. Because that way we can kind of cut to the chase and then we can intersperse in with detail, if we need it.

Jane: 16:20 The overall timeline of the study is, the problem was identified in early June. The Center for Human Health and the Environment got involved because. I'm not helping.

Tracey: 16:33 Yeah. Okay.

Jane: 16:35 Okay. The problem was discovered in early June. Then, by late June the Department of Environmental Quality had required the chemical company to stop discharging GenX to the Cape Fear River. We applied for a grant on November 1st. These are time sensitive grants. They awarded the grant November 1st. That's incredibly fast for most scientific research grants. Then, two weeks later, we collected blood and urine from 310 people. Then, in May of 2018, we enrolled and additional 34 other people and re-sampled 44 of our original participants.

Tracey: 17:25 Okay. The collection and re-sampling gave you, what kind of information did that collection and then re-sampling give you?

Jane: 17:39 What we measured for in the blood and urine, as well as in the tap water samples that we collected, were per and polyflora substances, or PFAS. In blood, we measured up to 23 different chemicals. Some of the chemicals we knew what we were looking for, others we knew kind of their family and were able to identify them through our high resolution mass spectrometry. We identified in the blood, we did not detect GenX in the blood, but we did detect four new chemicals. Then, what we were also able to see is that these new chemicals were coming down. When we compared the 44 people who participated in November and in May, we could see that overall the levels were coming down of these chemicals. What we also saw were the traditional chemicals of PFOA and PFAS were much higher in concentration in blood of people in Wilmington than the national average. We don't know why or how long it's been there.

Tracey: 19:02 Great. Perfect. Now, in order to do this study, you've worked very closely with the community in the Cape River Basin and in Wilmington. What has that experience been like?

Jane: 19:15 We could not have done this study without working with the community members. We have two former partners, Cape Fear River Watch and the New Hanover County Health Department. But then we also have other partners like the local NAACP, and the Cape Fear Public Utility Authority. This has been really critical. I mean, we were moving really fast, and so to have these trusted people in the community helping us has really allowed us to be able to do the study and to do a study that represents all of Wilmington. We've had large public meetings at the Community Center, but we've also shared results in a church basement as part of the local NAACP meeting. It's really given us an opportunity to hear people's concerns. GenX was the big topic in June of 2017, and now we've shifted to PFAS. How do we do that? Scientists, we just keep going, so understanding the community concerns has been really helpful in how we communicate what we're finding.

Tracey: 20:41 Okay. That's good. That's good. What would be the best possible outcome here for you, in terms of this study?

Jane: 20:54 That's terrible. That's a terrible question.

Tracey: 20:56 What I guess I'm trying to get at here is the idea that we need to learn more about these emergent chemicals that we think are better than the traditional ones, but we're just not sure. Setting benchmarks. Setting baselines. Informing the public. That kind of public service stuff.

Jane: 21:17 Yeah. Part of the whole issue of these PFAS chemicals is they're not going anywhere and there's lots of new ones coming on the market, and we can't keep up with that. As a scientist, it's super fascinating, let's understand how these move through the environment, how they move through people's bodies. But, from the community perspective, you don't want that happening in your life. I think that one of the most important outcomes of this study is that we've got a lot of scientists engaged with people, not just talking to each other, but talking to the community, and trying to figure out how you answer questions. Like, oh, it's in my water. How do I get rid of it? Scientist are more part of that conversation. On the flip side, is that people are paying more attention to where their water comes from. I think that, that level, that's an important outcome, even as we don't have all the answers to what does this mean.

Tracey: 22:36 Right. So it's more about you're improving community engagement in their own sort of awareness of what's going on in their environment? Because I know I like my Teflon pan. I don't want to give up my Teflon pan, but I also don't want to poison the water supply or hurt people's health, so this information is good information to have. What was the most surprising thing you discovered during this process?

Jane: 23:03 The most surprising thing. I think that we were very surprised that the levels of PFOA and PFAS were so high in this community. When we shared it at the community meeting, there was an audible gasp, and so it is a surprise. That's something that we need to think about more and to try and understand.

Tracey: 23:28 Good. That leads me to the final question, which is, what are your next steps with this study?

Jane: 23:36 We have a lot of work to do. We collected urine samples and we are going to analyze that. We might see GenX in there, so some chemicals are more likely to be in urine and others in blood. We are also going to do sampling for the people who live around the chemical plant. These people have wells that have been impacted by GenX, so we're going to do the similar study for the people who live around the plant and see how they compare to the people in Wilmington.

Tracey: 24:08 Okay. Thank you so much for being here today, Jane. We've been speaking with Jane Hoppin, Associate Professor of Biological Sciences and Deputy Director of NC State's Center for Human Health and the Environment. I'm Tracey Peek. This has been Audio Abstract. Thanks for listening.