This is Wisconsin Water News, a production of the University of Wisconsin Sea Grant Program. I'm your host, Marie Zhuikov. Today's episode is:

Percolating pollution
Groundwater pollution project is first to use cancer imaging technology in a novel way

A Wisconsin Water Resources Institute project is exploring how bacteria and other water contaminants flow through soil by applying a medical technology usually used for cancer imaging.

Chris Zahasky, assistant professor in the Department of Geoscience at the University of Wisconsin-Madison, received two years of funding to study soil types in the two most vulnerable geologic settings in Wisconsin for groundwater pollution. Those are the Central Sands district, which features sandy soil, and Kewaunee County along Lake Michigan, which features fractured bedrock. Zahasky is investigating how E. coli bacteria – one of the main water contaminants in Wisconsin – percolates through the soil and ends up polluting groundwater and people's private wells.

His research team hypothesizes that flow of contaminated water though soil that's highly porous leads to bacterial contamination of groundwater at greater distances from the pollution source than what was thought possible based on previous laboratory measurements in more stable geologic materials.

Zahasky explains the application of his study.

"With a better understanding of these transport and travel pathways, we can build better models to understand and manage the risks associated with these contaminants. We all know the source of bacteria and nitrate. In Wisconsin, it's largely from certain agricultural activities. Ideally, we can make better decisions about the times of the year that you might do manure spreading or certain geologic setting that shouldn't have manure spread on them because of the ability for these bacteria to travel through this material and get down to the groundwater."

Zahasky and his team are conducting their research in the lab with soil samples they've gathered from the Central Sands area and Kewaunee County. They measure the soil's properties, then pack it into large tubular columns and inject water through the materials in a controlled manner. Then they add bacteria they've grown and pump them into the columns.

This is where the cancer imaging technology comes in. It's called positron emission tomography (or PET). In medical situations, doctors use PET with radio tracers to identify tumors in the body. It's also used in some cases for cancer therapy treatment. The radio tracers are basically radioactive sugar molecules. Cancer tumor cells have a high metabolism and so they, in essence, eat these sugar molecules at a higher rate than other cells in the body, which is what the PET ends up imaging.

Zahasky described how this works for his purposes.

"We leverage that imaging technique by radio labelling these bacteria, which means that we attach these radioactive isotopes to the bacteria that are emitted as they travel through these columns. As we're imaging them, we can essentially track where these bacteria are going, how fast they're getting there and where they're getting stuck.

"We're the first people in the world to radio label bacteria for environmental and geologic purposes. We're pretty excited about this."

How do they attach radioactive isotopes to tiny bacteria? Zahasky said it's not complicated.

"We grow the bacteria until just the right point – where they're starting to get hungry. Then we add this radio-labeled sugar and they just gobble it up. The bacteria eat the sugars just like tumor cells do."

Zahasky developed this approach during his Ph.D. work at Stanford University. However, many of the isotopes required for this imaging are produced at the University of Wisconsin Cyclotron Lab. So, it made sense for him to continue his research at UW-Madison, where he has built capability with support from a National Science Foundation grant.

"It allowed my research group to leverage this type of imaging in lots of new ways that just weren't possible without having access to these facilities here on campus."

Zahasky plans to apply this technique to future studies involving the movement of microplastics and other contaminants such as heavy metals.

That's it for this episode of Wisconsin Water News, just one of the ways that Wisconsin Sea Grant, which is 50 years old this year, promotes the sustainable use of Great Lakes resources through research, education and outreach. Listen and subscribe to us through I-Tunes and Google Play or at seagrant.wisc.edu. Thank you to Chris Zahasky and thank you for listening.

If you like Wisconsin Water News, you might like our other new podcast about environmental justice issues called "The Water We Swim In."

MANNY TEODORO: We have, right in our backyard, the greatest source of accessible fresh water on the entire planet. So that's the happy part. The depressing part is, all of our problems are kind of our own making.

HALI JAMA: From Wisconsin Sea Grant, I'm Hali,

BONNIE WILLISON: And I'm Bonnie.

HALI JAMA: And you're listening to The Water We Swim In - stories about the Great Lakes and the people working toward equity.

BONNIE WILLISON: Twice a month, we bring you stories from the community organizers, researchers, and leaders navigating Wisconsin's waters.

SUBJECT 1: Water is the lifeblood of Mother Earth then I just want to help take care of things.

SUBJECT 2: It kind of felt like I could run again.

SUBJECT 3: If we let those issues be invisible, they'll never get fixed.

SUBJECT 4: A huge wave came by and all of a sudden they sucked him in.

SUBJECT 9: Suddenly, the world woke up and realized that drinking water is an environmental justice issue.

SUBJECT 5: You can see the passion that they have for that fishing, like they love it.

SUBJECT 6: We heard about it in the newspaper. And it was this little blurb that said, this pool is going to close.

SUBJECT 7: Giving access is justice.

HALI JAMA: We're looking at this milky broth. The fish and I are currently making eye contact.

BONNIE WILLISON: Subscribe to The Water We Swim In wherever you get your podcasts.