Fellowship Given for High Ionic Strength Waste Stream Research

Summer 2005 - The year 1993 was significant for Wisconsin-native Kenneth Mercer.

For one, it was the year he graduated from high school. For another, it was the same year that there was a treatment failure at a water treatment plant in Milwaukee, Wisconsin, resulting in a massive outbreak of the waterborne parasite, *Cryptosporidium*, that sickened over 400,000 people. The outbreak put *Crypto* on the map in terms of detecting and removing it from drinking water. It also made Ken start thinking about water treatment.

“That year, the outbreak was all over the local and national news,” he said. “It brought to the forefront water treatment and its effects on public health, and I think that it planted a seed as I went off to college.”

Though he studied Chemical Engineering as an undergraduate at the University of Wisconsin-Madison, he began taking courses in Civil Engineering with a professor whose focus was water treatment — a subject that Ken quickly found fascinating. At the same time, he discovered that some of his college classmates and their families had become sick during the outbreak.

“Meeting people who were directly affected by the outbreak in Milwaukee really drove home the importance of protecting public health,” he said.

And it made him want to do something about it. As an undergrad, he interned with the Environmental Health Service, where he helped monitor campus beaches and participated in air- and water-quality studies. Then, during his last semester, he took a job with the U.S. Geological Survey as a hydrologist in its water resources division, working on projects such as monitoring the dredging of pollutants that were spilled into a tributary of the Green Bay by a large paper company.

After earning his bachelor’s degree, Ken moved on to the University of North Carolina at Chapel Hill (UNC) to earn a master’s in environmental engineering, with a focus on drinking-water treatment. At school, the faculty took note of his hard work and dedication and awarded him the 2002 UNC Department of Environmental Science and Engineering Bunker Award for Outstanding Scholarship and Professional Promise.

Ken didn’t disappoint, for he was hired fresh out of college by MWH, a consulting firm that is considered one of the world’s top experts on power, water, and wastewater issues.

During his 2-years with MWH, he worked on water quality and treatment issues in the Northern California region; it was working on one particular project that gave him the idea to go back to school for his Ph.D. The project was on exploring the use of a novel ion-exchange process, which worked very well as a pretreatment process for drinking water, but resulted in a concentrated waste stream. The problem was, what do you do with the waste?

So Ken went to the University of Massachusetts-Amherst to find out. Having just finished his first year as a Ph.D. student, Ken is actively working on his research project, which is called the “Development and Application of a Treatment Model for High Ionic Strength Waste Streams.”

This project was recently awarded an NWRI-Cargill Fellowship because of its potential applicability towards treating industrial wastewaters.

“Every drinking-water treatment process produces at least two streams: one is the clean water that is passed on to consumers,” he said, “and the other is the waste that you are left with, called the residual stream, and it has a high concentration of contaminants. I’m particularly interested in the residual — or concentrate — produced by desalting membrane processes.”

Membrane treatment systems are important, he said, because they can treat poor quality water that other treatment processes can not. The only downside is the resulting concentrate stream.

In certain coastal areas of the United States, for example, membrane concentrate can be disposed of by discharging it into the ocean or by deep-well injection; however, those options are not available to everyone, especially inland communities, who may have to send it to a wastewater treatment plant or use an advanced evaporation system.

Ken hopes that, if he can remove specific contaminants (like arsenic) from concentrate waste streams, it will pave the way in increasing concentrate disposal options and/or allow for its possible reuse.

He is also interested in high ionic strength waste streams because the more ions that are in the water, the more chemical properties can change, making the concentrate more difficult to treat.

“High ionic waste streams have a lot of dissolved solids, some of which may have potential environmental impacts,” he explained. “Drinking water usually has a low ionic strength, while dirtier waters (like brackish waters or concentrated waste streams) have a higher ionic strength. It’s interesting from a chemistry perspective to try to deal with contaminants in a high ionic strength concentrate, which are going to be affected by the fact that concentrations are elevated, as well as by the overall high ionic strength. It’ll be a very interesting project.”

The final product of his research is anticipated to be a treatment model that can that help determine how to best dispose of the concentrate.

“Imagine,” he said, “that you want to build a treatment plant and you have brackish groundwater as your source. You may want to use membranes to treat it, but you don’t know how to dispose of the concentrate. My hope is that you’ll be able to use the

treatment model we're developing to calculate, based on your water quality, what's the best way to dispose of it both economically and for the environment."

Written By Gina Melin
National Water Research Institute
2005