Texas Student's Research Examines Precipitative Flocculation Processes

Who is Jeffrey Nason, NWRI's newest Fellowship recipient? Well, for one, he's a family man, father to a 16-month old daughter, with another on the way. Two, he's an outdoorsman, an avid camper and hiker who grew up in Idaho and who uses a bicycle to get around. Three, he's a go-getter whose curiosity is so huge it has led him all over the country. And finally, he's a student with a research project so innovative that NWRI had to support him.

Now in his third year as a Civil Engineering Ph.D. student at the University of Texas at Austin, Nason is currently exploring better ways to remove particles from drinking water during treatment processes to "ensure we all have clean water to drink."

Nason's fascination with water treatment processes began years ago while he was an undergraduate studying Chemical Engineering at Cornell University in New York. Two of the courses he took revolved around wastewater treatment, which intrigued him. "Most of us think that we can wash the dishes or flush the toilet, and the dirty water just disappears. The reality is that it goes back into the water supply, meaning it returns to the environment and eventually goes into our bodies. So it's in everyone's best interest to keep it clean."

After he graduated with his Bachelor's degree, Nason married and decided to pursue his interest in water and wastewater treatment processes by working for a small environmental engineering consulting firm in Washington State. There, he had the opportunity to work in wastewater treatment plant design, as well as pump station design. But, it was a desire to learn more that eventually drew Nason back to Cornell for a Master's degree in Environmental Engineering after working over 2 years in the consulting world.

Back at school, he discovered something new — a love for teaching. With the goal of becoming a Professor, Nason decided to pursue a Ph.D. in Civil Engineering under the guidance of Dr. Desmond Lawler, a member of the Academy of Distinguished Teachers at the University of Texas at Austin. It was through Lawler that Nason learned about the NWRI Fellowship for water research and decided to apply. He was one of two students to receive the Fellow-

ship in 2004 from over 80 applicants for his graduate research on "Simultaneous Precipitation and Flocculation in Water Treatment: Modeling and Experiments."

"Any time surface water is used to produce drinking water," he explained, "there are particles present in the water, such as dirt or clay, bacteria, and plant material. One objective of drinking-water treatment is to remove particles before they reach the tap."

Precipitation, coagulation, and flocculation are processes used in conjunction to help remove particles from water by increasing particle size. What precipitation does is create insoluble particles (think, metals) from a soluble solution (water) by adjusting pH and/or

adding chemicals (like lime or aluminum salts) to the solution. In other words, the chemical precipitants produce fine particles. Then everything is mixed together in a big tank called the flocculation basin so that the particles bump into one another and lump together. Now, because the particles are so much bigger and heavier, they either settle on the bottom (of a subsequent sedimentation tank) or can be filtered out.

For decades, these processes have been used together as a means to treat drinking water before it is piped out for human consumption.

As part of his research, Nason will conduct precipitation/flocculation experiments to determine what parameters control how particle size distributions change during flocculation when new solids are formed (as in lime softening and alum or iron coagulation). These parameters include mixing intensity and time in the rapid mix and flocculation basins, chemical dose, water chemistry, and the properties of existing particles.

His goal is to create a mathematical model that can be used as a tool to examine what process parameters are important and how the parameters may be altered (or tailored) to make flocculation and downstream treatment processes more efficient.

This is a unique project because, said Nason, “There’s never been a detailed investigation of what’s really happening to the particles in precipitative flocculation processes, how the particle size distributions are changing, and what’s governing those changes.”

Added his advisor, “Jeff has chosen an extraordinarily difficult problem, but one of great importance. It is nearly impossible to find a subject that impacts almost every operating water treatment plant and that has not been fully and virtually completely understood. Jeff has done so, trying to push the envelope of the understanding of precipitative flocculation, an old process that needs new understanding.”

At this stage in his research, Nason is “just getting into the meat of his experimental work.” He is busy developing the experimental apparatus and sampling procedures, and since he loves working with his hands and building things, he says this has been a lot of fun, even though “things don’t always work on the first try.”

Nason expects to graduate in 2006.

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May 2005