Department Newsletter
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Could Low-Flow Create High Risk?

Drexel Tapped to Study Water Quality Impact of Conservation Practices

by Britt Faulstick

As public awareness of the need for water conservation and new technology have become increasingly effective at stemming excess water use, new questions are surfacing about how our plumbing, which was built to handle a regular flow of water, might now be a risk factor for bacterial and chemical contamination. In hopes of preventing future public health crises related to the systems that carry and treat our water, the Environmental Protection Agency is taking a team of researchers, led by Drexel University, with a $2 million project to bring together existing and new experimental data on building plumbing - the stretch of pipes that takes water from main to tap - into a risk assessment tool that can guide new water use and safety regulations.

EPA Quote - "As consumers become more aware of the need for water conservation, they are decreasing water consumption which has led to lower flows of water being conveyed in water systems and buildings designed to manage higher flows. In turn, these lower flows influence water quality, costs, energy consumption, and public health. As water shortages and competition for water resources increase the need for using water more efficiently, we need to consider how systems and buildings can be better designed, renovated, or managed so that water can be used efficiently while ensuring public health and safety."

According to a report from the National Research Council, a substantial portion of waterborne disease outbreaks in the United States can be traced to building plumbing systems. Recent outbreaks of Legionella in New York and the pandemic of high lead in drinking water discovered in Flint, Michigan and many urban areas around the country, have raised questions about how to best manage aging and underused water systems.

Patrick Gurian, Ph.D.

The answers, according to Patrick Gurian, PhD (pictured right), a professor at Drexel who is leading the research team, are difficult to pin down because the combinations of scenarios that can cause problems are myriad and perpetually evolving.

"This is a difficult issue to explore in the lab because microbial environments in water infrastructure are ever-changing, due to age of the pipes, how much they've been used, what chemicals have been used to treat the water and any number of things that can affect the water source," Gurian said. "There is plenty of information out there about all of these various aspects, but it needs to be brought together and validated, so we can move toward a consensus on the 'right' way to manage building water issues going forward."

The group, which includes environmental engineering and public health experts from Drexel, as well as the University of Colorado, Penn State University and the Environmental Science Policy and Research Institute (ESPRI), will work to corral the answers over the next three years through an exhaustive literature analysis, a close examination of 20 case studies from around the country, and a series of lab experiments on household plumbing.

"Through the literature analysis, we want to get our arms around the many water conservation regulations and procedures that are guiding building water system design and use today," Gurian said. "Things like water use restrictions Southern California, or LEED building certifications, all affect the amount of water that is flowing through our pipes at a given time and how long that water is remaining in them - these are important factors to consider when determining risk."

Gurian suggests that new water infrastructure could harbor harmful bacteria and chemicals just as easily as the aging systems that have been the focus of national attention due to concerns about lead levels in drinking water in the aftermath of the Flint crisis.

"New systems are being designed with historic flow rate and capacity in mind, but current data and future projections suggest that much less water will be going through those pipes, and that is significant when it comes to making decisions about treatment. The same can be said for systems in aging cities, or urban areas that have experienced depopulation," Gurian said.

This is where new case study and experimental data will help the team get a clearer picture of the stresses placed on today's water infrastructure. Researchers are designing experiments to look at how household appliances like water heaters and radiators can harbor microbes when water is reduced. And teams at the University of Colorado at Boulder will look at newer practices and water systems, while partners from ESPRI will lead investigations on more seasoned infrastructure, such as Philadelphia's. Penn State will bring expertise on building water system design practices that will enable the team to identify where changes in design practices are warranted.

"We have a nice contrast setup between Boulder and Philadelphia, both in the type of water disinfectants being used and the relative age and use of the systems," Gurian said. "Philadelphia's is obviously an older system and a city that has seen some depopulation in areas - this is one way to study how change in water use affects water quality. Another is Boulder's situation, where the city is new and growing, and the population is savvy about water conservation - they're building super green buildings with low flow technology and great conservation features, so the pipes are getting a fraction of the flow that they're designed to accommodate. We could see increased biofilm development in both situations though, on the surface, they seem to be very different types of cities."

Ultimately, the group will produce a web-based tool that will integrate all of their findings - on how water age, disinfectant type and concentration, and flow rates affect water quality - to help facility and utility managers make decisions about treatment, create guidelines for household use and better assess risk when crises arrive.

"We want to make the massive volume of data as useful and accessible as possible," Gurian said. "We see it as a tool for utility-level decisions, but it could also affect us at the homeowner-level when it comes to something like setting the temperature of a water heater."

Drexel Peace Engineering Launches an M.S. Degree Program

Mira Olson, Ph.D.

Peace Engineering at Drexel University is the nation's first program dedicated to preventing and reducing violent conflict through education, research and community engagement that integrates innovative technologies with the practice of peacebuilding. Starting in the fall of 2017, Drexel will offer an **M.S. in Peace Engineering**, teaching the art of conflict management to engineers with the goal of preparing them to mitigate conflict and its drivers, both locally and around the world. Peace Engineering at Drexel was developed with support from faculty in six colleges and schools, and represents a fusion of engineering design and practice with conflict management to address the needs of society at a grand scale.

The M.S. program is the result of a two-year partnership between the College of Engineering and the PeaceTech Lab, a non-profit entity launched by the U.S. Institute of Peace to amplify the power of technology, media and data to prevent and resolve violent conflict. Students in the program will gain an understanding of the social dimensions of conflict, develop expertise in engineering approaches and technologies applicable to peacebuiling, and gain practical experience working alongside peacebuilding practitioners. Drexel Peace Engineers will work with stakeholders, and a sense of humility, to identify challenges, implement solutions, and ultimately build peace in regions of conflict around the world. More information on Peace Engineering can be found at http://www.drexel.edu/engineering/areas-of-study/peace-engineering/.

Undergraduate Students Receive Scholarships

Danielle Schroeder, a BS/MS Civil Engineering Senior, has been selected as a recipient of the 2017 Delaware Valley Engineers Week Scholarship. Applicants for this scholarship were based on the following criteria: Curriculum and Grades (20%), Response to Essay - Content (20%), Response to Essay - Writing Skills (25%), and Extracurricular Professional and Community Activities (25%).

Maissoun Ksara and **Sarina Tufano**, both BS/MS Civil Engineering Seniors, received the Philadelphia Section of the ASCE scholarship of $1,000.

Evan Newcomer, an Environmental Engineering Senior, received the Chi Epsilon Metropolitan District Scholarship for 2017. The scholarship was given in honor of the 58th Chi Epsilon National Honor Member, Robert D. Bay. Bay is a retired Principal of Black and Veatch, former National President of ASCE, and achieved the rank of Major General by the time he retired from serving with the U.S. Army Corps of Engineers in 1983. This scholarship was awarded in recognition of Evan's outstanding academic work and significant, enthusiastic, and excellent involvement in extracurricular activities.

Drexel Hosts STEM Summer Camp with Girls, Inc. of Philadelphia

Simi Hoque, Ph.D.

This summer, middle school girls will be hosted on Drexel's campus for a one week long STEM camp. In collaboration with Girls, Inc., the program targets girls from underrepresented Philadelphia neighborhoods and aims to engage girls in engineering, technology, and math workshops taught by Drexel faculty and graduate students.

Some of the workshops that will be created for the girls involve building solar cells with Dr. Aaron Fafarman in Chemical and Biological Engineering, conducting multimedia forensics with Dr. Matthew Stamm in Electrical and Computer Engineering, and building a spaghetti bridge with Dr. Nariman Mostafavi in Architectural Engineering. The STEM camp will focus on building confidence in STEM subjects by exposing the girls to hands-on activities and lab experiments that will also simulate their interest in pursuing a STEM career.

We plan to work with the same cohort of girls each summer for the next five years until they graduate from high school. The hope is that by fostering a long-term relationship with these girls, we can help to close the STEM gap that emerges among girls in the middle and high school years.

Faculty and students interested in volunteering for the Drexel STEM program are encouraged to contact Dr. Simi Hoque or Kim Spina in the CAEE Department at simi@coe.drexel.edu or kspina@coe.drexel.edu for more information.

CAEE Department to Host Annual Engineering Alumni Lecture

Christine Fiori, Ph.D.

On Wednesday, April 26, 2017 at 4 p.m. in Mitchell Auditorium, the CAEE Department will host its annual Engineering Alumni Lecture supported by Dr. Wesley O. Pipes (1932-2013) and his wife, Jane Pipes. Dr. Pipes joined Drexel in 1975 as the inaugural LD Betz Professor of Ecology and served as Head of the Department of Civil Engineering from 1983 until 1987. This year the Department will be hosting alumna **Christine Fiori, Ph.D**., who is a Professor and Program Director of the Construction Management Program at Drexel University. Prior to joining Drexel in 2015, she was the Preston and Catharine White Fellow and Associate Director of the Myers-Lawson School of Construction at Virginia Tech.

Christine's research, teaching, and service work has taken her to many countries throughout the world and helped to shape her passion for the global engagement of constructors and engineers. She has led diverse teams of researchers and students on three separate expeditions to the Andes Moutains of Peru to investigate the engineering practices of the ancient Inka as part of an NSF grant and partnership with the Smithsonian Institute.

Domestic and international service work helped to shape her approach to both teaching and research and enabled her to develop a robust service learning program founded on the principles of community engagement, environmental stewardship, and sustainable infrastructure. She has mentored student teams to complete construction projects in Vietnam, Kenya, Belize, Honduras, Haiti and Guatemala in collaboration with Peacework and Bridges to Prosperity. Christine's lecture will discuss her academic journey back to Drexel University using her research experiences from around the world as a road map.

Christine has received numerous awards for her teaching, research and service. Most recently, her work on Inka Engineering practices has been collected as part of the "Great Inka Road: Engineering and Empire Exhibit" at the Smithsonian's Museum of Native American Indians in Washington, D.C. and was featured on the Discovery Science Channel. Christine has a B.S. in Civil Engineering ('92), M.S. in Engineering Geology ('94), and a Ph.D. in Civil Engineering ('97) from Drexel University.