

Department of

Chemical and Environmental Engineering

2015—2016 Seminar Series

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9:30-10:30am

Winston Chung Hall 205/206



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WATER SUPPLY CHALLENGES IN THE U.S.

The public tends to take the supply of water for granted in the United States. However, there are several challenges emerging that will impact our ability to supply adequate amounts of water in the future. Some of these challenges include energy requirements for water conveyance and treatment, decaying infrastructure, influence of climate change on water availability, and the need to use waters of impaired quality. Water reuse is receiving increased attention as one strategy for meeting present and future water demand. The presence of pharmaceuticals and personal care products (PPCPs) impedes public acceptance of water recycling, which could otherwise mitigate water shortages. My laboratory is evaluating the fate of certain pharmaceuticals and personal care products (PPCPs) in model porous media. Through a series of batch experiments, nearly all of the tested PPCPs exhibited greater than 80% biodegradation after 50 days of incubation under aerobic conditions. Additional studies examined the biodegradability of the target PPCPs at trace levels in biofilm systems. Several factors influencing the performance of biofilm reactors were tested, including influent substrate concentrations, contact time, temperature, and biofilm loss through decay. Overall, results from this study suggest that soil-aquifer treatment and other biofilm-based water treatment systems have great potential for effectively removing PPCPs from impacted water. In a second study, we are detecting antimicrobial resistance to triclosan using a novel microfluidic device. A high-throughput microfluidic droplet system with the ability to encapsulate single bacterial cells at a rate of over 100,000 drops per minute is being tested to enhance identification, quantification, and back-end genetic analysis for antimicrobial resistant bacteria. Each droplet, a few picoliters in volume, is an isolated bioreactor with a single cell inoculum, enabling cell-by-cell experiments. The droplet technique eliminates isolation steps during which significant bacterial diversity can be lost, while also reducing incubation periods for rapid results. Tracing the development of antimicrobial resistance and its spread from sources through wastewater treatment and into the environment is crucial for identifying the risks from contact with antimicrobial contaminants.

Bio: Dr. Edward J. Bower earned his Ph.D in environmental engineering and science from Stanford University, Stanford, CA in 1982. He is the Abel Wolman Professor of Environmental Engineering and the Department Chair in the Geography and Environmental Engineering Departments at the Johns Hopkins University. Dr. Bower has extensive experience with drinking water and wastewater treatment processes, microbial process engineering, and contaminant transport and fate. Dr. Bower's research interests encompass factors that influence biotransformation of contaminants, bioremediation for control of contaminated soils and groundwaters, biofilm kinetics, biological processes design in wastewater, industrial, and drinking water treatment, transport and fate of microorganisms in porous media, behavior of metals in contaminated sediments, and defining and managing environmental risks. Dr. Bower has served on several National Research Council committees that provided guidance on managing human and ecological risks to congress, regulatory agencies, and the scientific community. He serves as the Editor in Chief for *Biodegradation* and on the editorial boards of *J. Contaminant Hydrology* and *Environmental Engineering Science*.