ABSTRACT

Across the world, in both developed and developing countries, rapid shifts are occurring where people reside. Today, approximately 15% of the U.S. population, or 48 million people, live in what are called “shrinking cities” while the majority of the world’s population growth is occurring in the expanding cities of low and middle income countries. In both these cases, the population shift has a direct impact on the performance of urban water infrastructure in ways that may impose risks upon public health. Declining populations in shrinking U.S. cities often lead to infrastructure underinvestment linked to a declining tax base. In turn, water infrastructure in these cities is vulnerable to escalating water quality challenges. For example, water distribution systems in shrinking cities that were designed and constructed decades earlier become oversized for the populations they serve and corroded. As a result, the drinking water they convey is vulnerable to microbial contamination from infiltration, loss of residual over long water age, and changes in organic carbon composition that may support microbial instability. If the utility overcompensates with disinfectant to maintain adequate disinfectant residual, excessive amounts of harmful disinfection byproducts can be formed. In contrast, expanding cities in low and middle income countries often have underdeveloped and underinvested water infrastructure. Transitioning entirely to centralized water services is not always practical or sustainable for cities with low and medium income economies. Challenges include: inadequate water source, excessive water storage to mitigate intermittent supplies, inadequate treatment or source water protection, consequences of poor construction and maintenance. Household-scale solutions for water access and treatment are often not well maintained or adequately associated with the actual water quality risk. Therefore, water infrastructure challenges in both shrinking and expanding cities can both lead to problematic drinking water quality, in part due to reduced microbial stability in distributed drinking water and enhanced microbial regrowth of opportunistic pathogens that pose a risk for selected sectors of the population (young, old and immunocompromised). In both cases, residents often migrate toward point-of-use PoU water management strategies, which may solve some public health challenges and introduce others. In this talk, I will lay out the case for water infrastructure trends in both shrinking and expanding cities, and review case studies pertinent to drinking water quality issues that have cropped up as a result of population changes in each.

BIOSKETCH

Dr. Nancy G. Love is the Borchardt and Glysson Collegiate Professor of Civil and Environmental Engineering at the University of Michigan. She has advised over 70 graduate students and post-doctoral research associates. In collaboration with her students, Dr. Love works at the interface of water, infrastructure and public health in both domestic and global settings. The group advances public and environmental health using chemical, biological and analytical approaches applied to water systems, and co-design methods in partnership with communities. The Love group’s core work is centered on identifying and translating fundamental understanding into practical solutions for water utilities and communities. She has co-authored: over 100 peer reviewed papers, chapters and reports; over 250 conference presentations; and a textbook on biological wastewater treatment. Dr. Love has held leadership positions in multiple organizations, including with the Water Environment Federation (WEF), the International Water Association (IWA), and the Association of Environmental Engineering and Science Professors (AEESP). She is a Fellow of all three organizations. Dr. Love is a licensed professional engineer (P.E.) in the state of Michigan and a Board Certified Environmental Engineer (BCEE).