Small Drinking Water Systems Research and Development

Background

In the United States, there are 152,002 public water systems (PWS) in operation. Of these, 97 percent are considered small systems under the Safe Drinking Water Act (SDWA)—meaning they serve 10,000 or fewer people. While most of these small systems consistently provide safe, reliable drinking water to their customers, many face a number of challenges in their ability to achieve and maintain system sustainability. Some of these include changes in the quality of their source waters, high operator turnover, aging infrastructure, and lack of financial resources.

How EPA Research is Helping Small Systems

Oftentimes, small communities and their state primacy agencies are reluctant to use novel approaches to drinking water challenges because they may have hidden costs or result in unforeseen health consequences for the community. EPA's Office of Research and Development is helping to build confidence in innovative treatment technologies and approaches by conducting research that small communities, including tribal communities, and state primacy agencies can rely on to successfully remove contaminants of interest, without compromising the overall sustainability of their system.

Innovative Research

Contaminants of Emerging Concern (CECs)

CECs are chemicals or microorganisms that may be present in the environment and have the potential to cause adverse human health and ecological effects, but have not historically been regarded as contaminants and are not currently regulated. Factors such as agricultural runoff, harmful algal blooms, and industrial land use increase the probability that CECs, such as algal toxins, pesticides, pharmaceuticals, personal care products, and endocrine disrupting compounds, will remain after treatment—ending up in consumers' taps. This is likely to disproportionately affect small systems due to, among other factors, limited resources and treatment options. EPA's work in identifying and quantifying treatment challenges for these systems is an important step towards mitigating present and future risks from CECs.

EPA research on disinfection technologies at a small community in Puerto Rico. The research includes citizen science efforts to help communities understand drinking water treatment and address issues of concern to them.

Disinfection and Disinfection Byproducts

Drinking water can be a potential source of waterborne illnesses from contamination of source waters or contamination of treated water as it moves through the distribution system to consumer taps. The growth of specific pathogens associated with larger microbial communities, known as biofilms, can occur on drinking water pipe surfaces. Current treatments include the use of disinfectants, which can have the harmful side effect of producing disinfection byproducts (DBPs). A critical challenge for PWS operators is to attain the multiple goals of reduction of DBPs while maintaining microbial and chemical water quality in distributed drinking water. EPA's research is adding to our knowledge of the effects of UV treatment, filtration, and chlorine and monochloramine disinfectants on the microbial communities in distribution systems.

EPA's disinfection research is also focusing on sensing, sampling, and analytical techniques to examine biofilm development, pathogens, nitrification, and exposure to pathogens. The goal is to develop novel and innovative ways to provide actionable data useful for small system operators in optimizing their activities and understanding exposure risks.

Innovative Inorganic Contaminants Treatment

EPA provides a research and development program on cost-effective technologies for small systems to help reduce their compliance costs. From nationwide treatment technology demonstration programs, to current research using biological treatment, EPA is working to provide information and treatment approaches to small systems to help them manage inorganic contaminants—such as ammonia, arsenic, nitrate, lead, and fluoride— in their water supplies. In addition, research results will assist with revisions to drinking water regulations and can be used by the states for communicating novel and effective treatment technologies to their systems.

A pilot system designed, built, and installed by EPA staff in a small community in Iowa demonstrated the ability to effectively remove ammonia and iron from the community's source water, while keeping nitrite and nitrate levels below their maximum contaminant levels in the treated water. As part of a federal HUD grant, the full-scale water treatment plant based on the pilot system was completed, and the community now has a functioning public water system. (Photo: EPA research engineer, Darren Lytle, at the full-scale plant in Iowa).

National Research Centers

EPA has funded two *National Research Centers for Small Drinking Water Systems*: the Design of Risk Reducing, Innovative Implementable Small System Knowledge (DeRISK) Center and the Water Innovation Network for Sustainable Small Systems (WINSSS) Center, as part of the Science to Achieve Results program. They will develop and demonstrate innovative technologies to better reduce, control and eliminate groups of chemical or microbial contaminants in small water systems. They will leverage efforts with stakeholders and researchers involved in facilitating small drinking water system sustainability. Investment in the Center projects will enhance the resiliency of small systems and improve water quality, thereby, protecting public health.

Development of Models and Tools

EPA researchers have developed models and tools to help small systems with understanding treatment and selecting innovative treatment technologies, estimate costs for a national regulation, and provide individual water treatment facilities with tools to estimate costs for different compliance options. EPA will continue to improve existing models and tools, and develop new ones that are relevant to the needs of small systems.

Workshops, Webinars, and Workgroups

State and local officials across the Nation are faced with effectively communicating information and overseeing training for small system owners and operators with a wide range of expertise. To ensure these systems are in compliance with the SDWA, these officials need to stay current on treatment alternatives, regulations, health implications, and emerging contaminants. EPA is committed to helping small systems deliver high quality drinking water to their customers by providing information, training, and technical assistance.

Additional Information

EPA's small systems research, including links to the National Research Centers, models, tools, workshops, and webinars: epa.gov/water-research/small-drinking-water-and-wastewater-systems-research

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