Maintaining a Safe Water Supply in an Era of Aging Infrastructure and Compromised Sources

Chad Seidel, Ph.D., P.E.
President, Corona Environmental Consulting, LLC, Louisville, Colorado
Technical Director, DeRISK Center, University of Colorado Boulder

Reliable access to safe and affordable drinking water is a cornerstone of public health protection. While the vast majority of public drinking water systems in the United States provide high-quality drinking water, recent high-visibility events have shaken public confidence. Examples include the 2011 and 2013 deaths due to *Naegleria fowleri*, the so-called brain eating amoeba, in Louisiana drinking water supplies; the 2014 Elk River MCHM chemical spill that contaminated the drinking water supply for more than 300,000 people in Charleston, West Virginia; and the lead and *Legionella* health concerns in Flint, Michigan. Underscoring these examples are more widely applicable challenges facing drinking water systems, namely aging infrastructure and increasingly vulnerable surface and groundwater supplies.

In the face of these challenges and limited resources, drinking water systems must decide how and where to prioritize public health protection in and through drinking water. The greatest public health risks attributed to drinking water are well known (e.g. microbial, disinfection byproducts, and metals contaminants); yet the drinking water community is distracted by "emerging" contaminants of much lesser public health concern that detract from resolving the large risk mitigation efforts that are right in front of us and likely to get worse given deteriorating infrastructure, climate change, and other drivers. The Safe Drinking Water Act (SDWA) regulatory framework including the Contaminant Candidate List (CCL) and Unregulated Contaminant Monitoring Rule (UCMR), while well intentioned, promote this distraction away from simply taking care of the basics (e.g. filtration, disinfection, minimizing highest risk contaminants) and achieving compliance with long-standing regulations at all water utilities. The same can be said about public communication of drinking water risks and benefits.

Key challenges and opportunities to address these issues center around source water, distribution systems, and building water systems vulnerabilities:

- Source water vulnerabilities: Water utilities face increasing potential contamination of existing water supplies - as evidenced by the MCHM spill that contaminated the Elk River and the Charleston, WV water supply and groundwaters with rising nitrate concentrations in California. Real-time sharing and management of publicly available and in some cases privately supplied information can better inform water utilities, regulators, and the public about these concerns ahead of critical failures and better support decisions making in the event of emergencies.
- Distribution systems vulnerabilities: Current sampling plans and reporting of drinking water compliance data often miss public health concerns - as evidenced by *Naegleria fowleri* occurrence in public water supplies in Louisiana water utilities in spite of compliant Total Coliform Rule sampling results. The root cause of that problem was inadequate disinfectant residuals. Regulatory requirements were not identifying true challenge areas within distribution systems - spatially and temporally. Real-time collaboratively developed and shared sample plans with corresponding reporting of field

and lab collected data (e.g. chlorine, lead, copper, disinfection byproducts) can discern problems where past paper-based regulatory oversight and utility operations did not. A recent positive example is the Louisiana Monitoring Plan Portal that all ~1,350 public water systems now use to implement, maintain, and communicate their sampling plans with State regulators. The system is soon to share field and lab results between the utility and state regulators, and could also be used for public communication. This system could be a model for national implementation. Recent improvements in online, real-time water quality monitors are also enabling previously incapable water utilities to effectively manage and maintain disinfectant residuals.

- Building water systems vulnerabilities: Building water quality and the corresponding public health consequences are largely ignored by the SDWA regulatory framework. Lead and copper release and *Legionella* are certainly prompting more attention on premise plumbing today, but the SDWA regulatory framework, and even more so, state primacy agencies capacity and building owner awareness preclude meaningful engagement to address premise plumbing issues. Similar to the distribution system challenges and opportunities, regulatory oversight programs must be modernized to facilitate better and more routine communication. Building-specific hazard analysis and critical control points (HACCP) reviews of vulnerable buildings should be facilitated, coordinated, and communicated through such programs. Online, real-time water quality monitors provide the same opportunity to improve building water quality as they do for water distribution systems.

Opportunities remain in the U.S. to improve upon reliable access to safe and affordable drinking water. As described in these three subject areas, leveraging new technology and information management approaches affords opportunities to better prioritize resources to address and solve problems. By doing so, we can meet our drinking water needs and reestablish public confidence.