Arsenic Removal Strategies for A New, More Stringent

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Until last year, arsenic levels in drinking water were regulated at 50 parts per billion (ppb) because of the potential long-term, chronic effects of arsenic exposure. However, in October 2001, the United States Environmental Protection Agency (EPA) lowered the arsenic Maximum Contaminant Level (MCL) to a more stringent 10 ppb, based on new studies that indicate cancer risks decrease considerably at lower levels.

The EPA studies included an examination of risk by The National Academy of Sciences, a calculation of costs presented by The National Drinking Water Advisory Council, and an assessment of benefits from the EPA's Science Advisory Board (all available online at www.epa.gov/safewater/arsenic.html). After reviewing new science and data, the EPA decided in October 2001 to uphold the standard as set forth in January 2001.

The new standard will impact utilities throughout the United States, where the country's 54,000 community water systems, serving approximately 254 million people, must comply with the new standard by 2006 – or face penalties. About 3,000 of these systems will require some level of treatment to comply with the 10 ppb standard, and the costs and implications of the new standard will be especially hard for small public water systems to absorb.

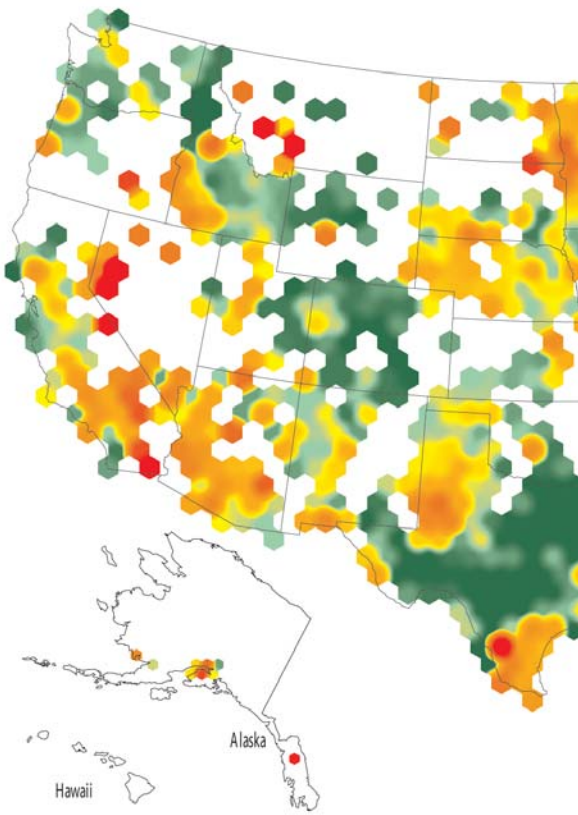
Currently, the EPA estimates that 97 percent of all impacted systems are smaller systems that serve fewer than 10,000 people. Immediate action and careful planning will be necessary if these systems are to adopt the standard by 2006.

Treatment Approaches

Choosing the right treatment technology for arsenic removal depends on several factors, with consideration for whether the water source is surface water or groundwater. Source-water arsenic concentration and treatment objective are the most critical factors, followed by utility size, existing processes, and process residuals.

In the arid Southwest, water scarcity may preclude several treatment methods, including reverse osmosis and electrodialysis reversal, which can result in water losses of 15 percent or more. Instead, ion exchange and adsorption technologies such as activated alumina or granular ferric hydroxide may be more appropriate. In all cases, pre-oxidation can greatly improve removal.

Surface water systems may be able to enhance existing treatment processes to meet the new arsenic MCL. Enhanced coagulation or softening methods may be particularly effective when combined with preoxidation. For groundwater, proven adsorption technologies such as activated alumina and granular ferric hydroxide, or anion



Standard

exchange, may be the most technically and economically feasible options, appropriate for single or multiple wellhead treatments. For a more in-depth discussion of these and other technologies, see "Assessing Arsenic Removal Technologies," on page 20.

Alternatives to Treatment

Utilities may be able to avoid centralized treatment by abandoning existing supplies or developing new water sources, such as wells. Smaller community water systems may opt for regionalization, which allows one system to purchase water from another, with consideration for water availability, water quality, geography, and economic factors.

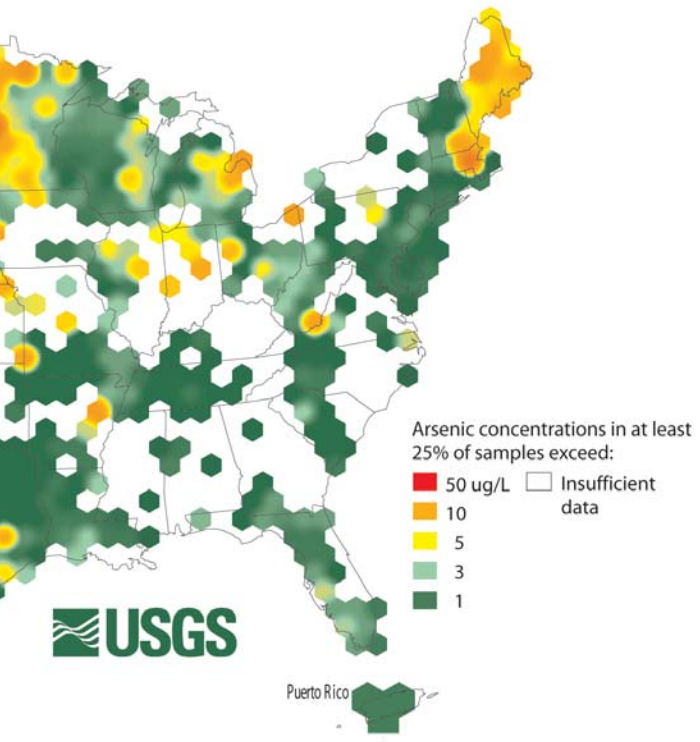
Here in the Southwest, development of new water sources may be limited by naturally occurring arsenic concentrations. Similarly, regionalization will be impacted by the sustainability of neighboring water supplies, as well as the proximity of water supplies that can meet the new arsenic MCL.

If small systems can demonstrate that centralized treatment is too expensive, point-of-entry (POE) and point-of-use (POU) devices, which offer treatment at the curbside or at the tap, may be an appropriate compliance option to effectively remove arsenic. However, monitoring POE/POU devices will present a challenge. The EPA allows POU/POE devices that minimize the concerns over treatment options and residuals by essentially distributing the burden over the entire customer base.

High Stakes Entail Detailed Planning

With some 3,000 community water systems expected to take corrective action, the annual national compliance cost is estimated at $181 million, with annual household costs ranging from $327 for the smallest systems and $.86 for the largest. However, another voice in the water community, the Arsenic Research Partnership, estimates the annual national compliance cost at a much higher $1.2 billion. Depending on the system size and source water arsenic concentration, this estimate may increase annual household costs by as much as $200.

In any case, it is important that all affected utilities begin planning now. Utilities opting for increased treatment may have to conduct treatability studies, identify treatment and disposal options, and design and construct treatment upgrades. Systems considering alternative water sources will need time to prepare necessary permits, make arrangements with regional wholesalers, construct necessary transmission mains, or identify areas with permissible source water arsenic concentrations. Allowing sufficient time in the planning process will be critical to the ultimate success of the treatment project, and proper planning will also prevent hasty, technically unsound judgments in the future.



USGS maps available at co.water.usgs.gov/trace/arsenic

Malcolm Pirnie consultants Tim Brodeur (Orlando, FL) and Chris Hill (Newport News, VA) also contributed to this article.