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## Providing Quality Water

In the U.S., water services are so safe and reliable that many of us do not think twice about what comes out of our faucets or what it's been through to become safe enough to drink. We often overlook the complex process, highly technical science and investments required to supply the public with quality water. Indeed, for many of us, having access to clean and dependable water is a given, not a luxury. In order to raise awareness regarding the value of water, it is important to understand the efforts behind providing this resource in a clean and reliable way.

### IDENTIFYING A SOURCE

The first step in providing drinking water is to determine the source and quality of the water available to any given community. The quality of a water source is important to gauge as it dictates the type of treatment required. To do this, water systems will determine the characteristics of the source water (i.e. water in its raw or natural state).<sup>1</sup> Depending on availability in the region, Americans typically draw from two general sources.

- **Ground water** is water that is extracted from aquifers (i.e. underground sand and gravel or rock formations) and is an ideal source as it often requires only simple treatment methods.<sup>2</sup> However, ground water is not always available.
- **Surface water** is water derived from areas open to the atmosphere, such as rivers, lakes and reservoirs. Generally, water systems serving larger populations will obtain water from surface water systems and indeed, the vast majority of Americans depend on surface water for their water needs.<sup>3</sup> Because surface water is directly exposed to the atmosphere and precipitation runoff (i.e. the flow of rain or snowmelt over the land), it requires more intensive, and thus costlier, treatment as well as more complex treatment plants.<sup>4</sup>

Additional factors can also affect water quality. Regional differences, for example, mean that in some areas, source water will have higher levels of salt, silt or other particles. In other instances, source water is contaminated by industrial byproducts and chemicals. In both cases, water requires more rigorous treatment. For residents and businesses in regions where more intensive treatment measures are needed, it is likely that these challenges are reflected in higher monthly water rates. So while water is a resource that is held in the public trust throughout most of the U.S., the source quality of water differs across systems, thus affecting treatment measures and associated costs.

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<sup>1</sup> Tiemann, Mary. "Safe Drinking Water Act: Implementation and Issues." Congressional Research Service. 3 May 2006.

<<http://ncseonline.org/nle/crsreports/06Apr/IB10118.pdf>>.

<sup>2</sup> Environmental Protection Agency. "Water on tap: what you need to know." October 2003.

<sup>3</sup> Environmental Protection Agency. "Water on tap: what you need to know." October 2003.

<sup>4</sup> Kelleher, Dan. American Water. Telephone Interview. 25 October 2007.

### DETERMINING TREATMENT METHODS

Once source water quality has been assessed, water providers must then determine how to treat it. An essential method of treatment is disinfection. Prior to the 20<sup>th</sup> century, contaminants found in water were considered major health hazards. Untreated water was to blame for deadly disease like cholera.<sup>5</sup> Today, advanced science keeps drinking water free of harmful contaminants through disinfectants, a technique initiated more than 100 years ago and refined over time. In this process, microorganisms such as viruses, bacteria and protozoa are eliminated from the water by using common chemical disinfectants such as chlorine and ozone.

Water can also undergo the process of coagulation, which entails the use of aluminum and iron salts as sticky particles to attract dirt and other matter suspended in water. The particles then become heavy enough to sink to the bottom through sedimentation and naturally settle out of the water.<sup>6</sup>

Another treatment method is filtration. In this process, filters are employed to remove particles such as clay, silts, natural organic matter, iron, and microorganisms, among others. Filtration is particularly effective not just in purifying the water, but in enhancing the effectiveness of disinfection as well.<sup>7</sup>

As a final treatment option, some water providers may choose to implement additional methods to improve the aesthetic quality by removing non-health related compounds that affect water taste, color and odor. While such treatments are not required, they improve residents' overall water experience.<sup>8</sup>

In terms of the process, source water is generally pumped from its origin to a treatment plant where it undergoes any number of the above-mentioned methods. The water is then either stored in a reservoir or immediately pumped through the distribution system that encompasses the large network of pipes, delivering water to homes and business.

Water must be monitored and tested throughout this entire process. Water utilities are responsible for monitoring the distribution system for disruptions such as water main breaks, pipe leaks, pressure variations, microorganism growth and inadequate pipe materials that can affect water quality or cause adverse health effects.<sup>9</sup> This can pose a challenge in systems with deteriorating infrastructure since leaky or rusty pipes may alter water quality. In addition, transporting water over long distances within the distribution system can degrade water quality so that additional treatment closer to the source of consumption is required. Additional treatment to correct these issues adds complexity to the water treatment process, translating into higher costs for both water providers and consumers.

As science progresses, water utilities continually respond by adapting treatment methods. Because the treatment process is always evolving, the cost of providing high quality water rises as new technologies are implemented or more expensive chemicals are used.

### COMPLYING WITH REGULATIONS

The third part of the process of providing high quality water is ensuring that all water systems meet regulatory compliance as determined by the United States Environmental Protection Agency (EPA). Since federal regulation began, significant progress has been made as compliance rates have improved and the number of contaminants regulated has increased.<sup>10</sup> This progress is due to the EPA continuously updating

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<sup>5</sup> Environmental Protection Agency. "The History of Drinking Water." February 2000.

<sup>6</sup> Environmental Protection Agency. "Water on tap: what you need to know." October 2003.

<sup>7</sup> Environmental Protection Agency. "Water on tap: what you need to know." October 2003.

<sup>8</sup> Kelleher, Dan. American Water. Telephone Interview. 25 October 2007.

<sup>9</sup> Environmental Protection Agency. "Water on tap: what you need to know." October 2003.

<sup>10</sup> Tiemann, Mary. "Safe Drinking Water Act: Implementation and Issues." Congressional Research Service. 3 May 2006.

<<http://ncseonline.org/nle/crsreports/06Apr/IB10118.pdf>>.

regulations on water safety in response to scientific testing and research. Increasingly stringent federal regulations require treatment processes to be frequently updated and tested, demanding advanced levels of technology and operator skills that make meeting compliance continually more difficult and costly.

In response to these challenges, utilities and industry organizations often work together with the USEPA to establish regulatory solutions. For example, water providers will determine if a new regulation is effective in providing value to the public by comparing its implementation cost to the consumer to the overall benefit from the regulation.<sup>11</sup> Likewise, the USEPA National Drinking Water Advisory Council has created an Affordability Work Group composed of senior members of the water industry to determine whether new federal compliance regulations will be affordable for customers and communities. Knowing that the water bill may increase to over \$1000/yr in the next decade, the Group is working to find ways to ensure that all communities can afford to become compliant without sacrificing their water quality.<sup>12</sup>

### CHALLENGES<sup>13</sup>

Enabling communities to provide their residents with clean and compliant water, though, is not without challenges. Inadequate funding continues to be a primary complaint by water systems, many of which struggle to update aging infrastructure and meet EPA regulations. When costs become too much to handle, some systems look to consolidate or form public-private partnerships with private water providers to relieve the pressure.<sup>14</sup> Other systems choose to access government loans to finance projects and upgrade water systems.

The identification of new contaminants to our source water is another challenge. Recent research has found chemical and pharmaceutical residues, from products such as cleaners and antibiotics, as a threat to the integrity of the country's water system.<sup>15</sup> As a result, EPA and water industry experts will collaborate to develop effective treatment methods that can address these new contaminants.

### CONCLUSION

There is no service more valuable than water. That the average consumer rarely thinks about such an essential resource is a testament to the efforts of all those committed to effective water treatment, management and supply in America. But it has also impacted the basic understanding of the value of water and the significant hurdles to provide their communities with reliable and clean drinking water. It is essential that people understand the value of water so that they can better appreciate its process, improvements, challenges and impact. Indeed, providing high quality water is not just about treatment and supply. Rather it is a comprehensive and collaborative endeavor that is taken on by government groups, industry experts, and communities committed to providing the public with the most basic – and critical – service.

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<sup>11</sup> American Water has worked collaboratively with the EPA on developing drinking water standards since the enactment of the Safe Drinking Water Act.

<sup>12</sup> For more information on the EPA Affordability Work Group

<sup>13</sup> For a complete overview of challenges in the water industry, please refer to additional white papers at:

[http://www.amwater.com/awpr1/newsroom/white\\_papers/index.html](http://www.amwater.com/awpr1/newsroom/white_papers/index.html)

<sup>14</sup> Braden John B. and Min-Yang Lee. "Consolidation as a Compliance Strategy for Small Water Systems." Universities Council on Water Resources. 2007. <[http://www.ucowr.siu.edu/proceedings/2007%20Proceedings/2007\\_Powerpoints/PDFs/Lee.pdf](http://www.ucowr.siu.edu/proceedings/2007%20Proceedings/2007_Powerpoints/PDFs/Lee.pdf)>.

<sup>15</sup> Ricks, Delthia. "Antibiotic traces found in waterways." *Newsday*. 30 Oct. 2007