Center for Energy Initiatives
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Water — We Can't Live Without It

Our essential physical functions — breathing, digestion, muscle movement, etc. — cannot take place without water. It is our most vital and precious resource. However, water-related problems have persisted throughout history, endangering the safety and well-being of people.

The Flint, MI, water crisis is one very recent issue that was covered heavily by the news media. The integrity of the Flint water source was compromised in April 2014, when the city of Flint, in an effort to cut costs, switched utility providers from the Detroit Water and Sewerage Dept. (DWSD), which draws water from Lake Huron and the Detroit River, to Karegnondi Water Authority (KWA), which was in the process of building a pipeline to connect Lake Huron to Flint.

During the two-year transition period, in which the KWA pipeline would be built, the city had to source its water from the Flint River. The low quality of the river water was no secret. The Michigan Dept. of Natural Resource's July 2001 Flint River Assessment explained that the quality of the Flint River was very low due to "the presence of fecal coliform bacteria, low dissolved oxygen, plant nutrients, oils, and toxic substances."

After the switch, tests of the Flint water supply detected fecal coliform bacteria as well as total coliform bacteria, suggesting the presence of disease-causing organisms such as *E. coli*. To combat the contamination, more disinfectants like chlorine were added to the water supply, but this increased the chemical levels in the water above the Safe Drinking Water Act threshold. The General Motors plant in Flint switched water sources due to concerns that the high levels of chlorine could corrode engine parts.

Citizens reported rashes and other health issues, which prompted tests that discovered high levels of lead in the water. The lead had leached into the water from aging pipes because corrosion inhibitors had not been added to the water supply due to an oversight by the water-treatment company. The number of children in Flint with elevated lead levels in their blood approximately doubled from 2013 to 2015. Although the Flint water system is no longer being fed by the Flint River, issues persist and remediation efforts are ongoing.

While water contamination is an issue for Flint, water scarcity is affecting those whose water is sourced from the Ogallala Aquifer, located near Ogallala, NE, and spanning portions of eight states in the Great Plains region. This shallow water table spans about 174,000 mi^2, and is one of the world's largest aquifers, supplying about 30% of the U.S. groundwater for irrigation and about 82% of the drinking water in the High Plains sub-region of the Great Plains.

The aquifer is being depleted at a faster rate than previously recorded. The lower water level has reduced the flow of some rivers fed by the aquifer, limiting the usefulness of dams such as the Optima Lake Dam in Texas County, OK, which is only able to utilize about 5% of its capacity. Although rainwater recharges the Ogallala Aquifer, very little rain water — only about one inch annually — actually reaches it.

Problems like those in Flint and the Ogallala region raise questions as to what can be done to prevent or quickly remediate similar issues. Chemical engineers, working with other engineering disciplines (*e.g.,* environmental, civil, etc.), have the acumen necessary to develop and improve processes for treating, conserving, and reusing water.

In an effort to encourage collaboration on water solutions between the engineering disciplines, AIChE's International Society for Water Solutions (ISWS) hosts workshops to inform and discuss water-related topics. The theme of the October 2016 workshop is strategies for sustainable water management for mining. With relatively recent mining disasters involving tailings dam (*i.e.,* dams that store byproducts of mining operations) failures in Canada and Brazil, this workshop is quite timely.

In August 2014, the Imperial Metal Mount Polley copper and gold mine in British Columbia suffered a breach of its tailings pond dam, which released water and a slurry of mining waste that contained arsenic and selenium into Polley Lake and other nearby bodies of water.

In November 2015, an iron ore tailings dam in Bento Rodrigues, Brazil, released about 60 million m^3 of waste into the Doce River. Flooding due to the release caused at least 17 deaths and 16 injuries, and the contamination reached the Atlantic Ocean within 17 days.

The Industrial Water Use and Reuse Workshop: Strategies for Sustainable Water Management for Mining, Oct. 24–25, 2016, Denver, CO, will enable leaders in the mining and water-treatment industries and academia to exchange solutions for treatment options and to share research plans. Attendees will gain an understanding of how water quality impacts mining operations and what cost-effective solutions exist or can be developed for treatment. To find out more or get involved with the International Society for Water Solutions, contact derrw@aiche.org. CEP