John Snow proved that the cholera outbreak in 1854 England was, in fact, waterborne.

Same Old Story

New contaminants studies teach us the same old lessons.

By Colin Fricker

In the summer of 1854, British physician John Snow linked the consumption of cold water to an outbreak of cholera in London. Due to the heat, people were drinking cold water from the Broad Street pump, unfortunately located downstream of many sewage inputs. While Snow is remembered for dispelling the theory that cholera was airborne and conclusively proving that, in fact, it is a waterborne disease, the most important, and yet most overlooked, finding of Snow's early work was that consumption of sewage-polluted water leads to disease.

A recent article in the Journal of Environmental Monitoring highlighted the problem of wastewater contaminating drinking water intended for consumption downstream. The authors investigated the presence of pharmaceutical residues in both the wastewater and drinking water and found a relationship. While it was alarming to see the levels of pharmaceuticals present in drinking water, it was in no way surprising.

We've progressed in leaps and bounds since 1854. Nonetheless, it seems that some authorities haven't learned their lessons. Filmmaker Jeff McKay's documentary *Crapshoot* (*available at safewater.org*) shows that, around the world, sewers may be compounding rather than alleviating our waste problem. And they may pose health risks.

Historically, there has understandably been more concern about microbial contaminants in sewage-polluted water than about chemical contaminants. Of course, until relatively recently, ensuring adequate chlorine disinfection was deemed to be sufficient to prevent waterborne disease. The recognition that the protozoan parasite cryptosporidium was waterborne and that it was almost completely resistant to chlorine disinfection changed our understanding of the procedures necessary for prevention of waterborne infectious disease.

Or did it?

The large outbreaks of cryptosporidiosis in the 1980s and 1990s focused attention on both coagulation and filtration for removal of the cryptosporidium oocysts, but this is nothing new. Sanitary engineers have recognized for many years that chlorine disinfection works more effectively when preceded by adequate filtration to remove particulates. The presence of cryptosporidium oocysts in drinking water supplies merely reinforced two facts that were already well established: water contaminated with human sewage represents a health threat; and, in order to maximize drinking water safety, all treatment processes need to be operated as effectively as possible.

As medical science and epidemiological knowledge develops, the number of recognized waterborne contaminants that represent a threat to public health will increase markedly and technologies for the treatment of both drinking and wastewater will become more sophisticated and increasingly expensive. The emergence of new health threats that are derived from sewage contaminated water highlights something that has been well known for decades: higher quality raw water is likely to result in higher quality drinking water.

In its Water Safety Plan, the World Health Organization recognizes that catchment protection is an important part of the quality drinking water process. Human sewage is, undoubtedly, the single most important source of health-related contaminants in drinking water catchments. This, too, is not surprising. Pathogens that have caused infection in the human community will be subsequently present in domestic sewage—even after sewage treatment, they will find their way into water courses that are subsequently used as sources for drinking water. Yet wastewater is mainly regulated by discharges of chemical compounds that can either consume oxygen (organic compounds) or be a nutrient (nitrogen and phosphorus), and not by the content of pathogens. While sophisticated wastewater treatment systems, such as biological nutrient removal, are highly effective in the removal of nutrients, these systems may not be equally effective in removing pathogens.

The repeated lesson is that attention must be paid. Public water suppliers must work to prevent outbreaks of waterborne diseases caused by the traditional bacteriological aetiological agents (e.g. cholera, typhoid and dysentery) alongside viruses, protozoa and chronic illnesses caused by chemicals present in human domestic sewage.

Fortunately, most public water suppliers work hard to produce drinking water that is safe and represents little risk to the consumers. Bigger suppliers have significant resources available to them and their larger consumer base means that, in general, their treatment facilities are more sophisticated.

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The task for smaller communities can often be much more difficult. Raw water sources are frequently of much poorer quality, and, in many cases, river sources contaminated by much larger communities upstream. Furthermore, smaller communities tend not to have the sophisticated treatment options or the technical expertise to operate drinking water facilities. It's imperative that communities upstream pay attention to reducing the contamination of rivers that may serve as a source of drinking water to communities downstream.

Spending money on removing contaminants from wastewater effluent is a more effective financial approach than installing specific treatment options at all drinking water facilities, and it has the added benefit of improving the environment. Whether the contaminants of concern are microbiological or chemical, preventing them from entering drinking water catchments makes substantially more sense than trying to remove them at each water treatment facility downstream. To ensure safe drinking water, we need to focus on preventing the contamination of raw water catchments, as well as developing effective drinking water treatment systems that can deal with the threat of different types of pathogens. W

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