Emerging Contaminants – Pharmaceuticals and Endocrine Disrupting Compounds

Executive Summary

In early spring of 2008, national news sources released articles based on their own research about contaminants derived from plastic water bottles or pharmaceuticals being found in drinking water supplies in the US. In response to these reports, the Water Utility convened its Water Quality Technical Advisory Committee in April 2008 to discuss potential testing for these emerging contaminants and how the utility might communicate test results to customers. Complicating this task is the fact that no federal or state regulations require such testing and that only limited information exists about the contaminants' potential health impacts when found in drinking water.

The committee meeting featured an environmental toxicologist from the Wisconsin State Laboratory of Hygiene and a pediatric endocrinologist from American Family Children's Hospital who together described the current understanding of the origin, fate, and occurrence of these substances in drinking water and how they affect human health. Following a discussion and comments from the Director of Public Health-Madison and Dane County, the committee agreed that it would be premature to make any recommendation without additional information from regulatory and health agencies on what substances to select for targeted testing and what the thresholds for potential human health impacts might be.

To date, no human health effects have been linked to the presence of these substances in drinking water, although studies have documented physiological impacts on some fish and amphibians. The committee thought that if any pharmaceutical, endocrine disruptor, or personal care product were detected in Madison drinking water, the utility would not have the necessary information to communicate the significance of the test results. Therefore, the committee recommended waiting for the release of an AWWA (American Water Works Association) Research Foundation report on these contaminants, expected later this year, for further guidance on recommended testing and communication. The utility and its technical advisory committee will continue to closely follow the on-going research.

What is an Emerging Contaminant?

The term "emerging contaminant" generally refers either to a contaminant recently introduced into the environment that therefore poses a new or emergent threat to the environment, or to a contaminant previously present in the environment at such low levels that available analytical techniques have not been able to detect its presence. Rather than describing a specific contaminant, the term generally refers to a class of compounds. For example, pharmaceuticals and endocrine disrupting compounds have been labeled emerging contaminants in drinking water. Some of these chemicals were detected in U.S. waterways as early as the 1970's, but more recently they have been identified in some drinking water supplies.

What is an Endocrine Disrupting Compound?

An endocrine disrupting compound, or EDC, is any natural or synthetic chemical that mimics the function of a hormone and can disrupt normal physiological functions. Endocrine disruptors can include hormones, plant products such as phytoestrogens, pesticides, plasticizers, phenols, or other industrial by-products and pollutants. Some scientific studies have shown reproductive abnormalities of amphibians and fish exposed to low concentrations of these hormone mimics; however, there is little information on the likely human health impacts of long-term exposure to trace concentrations of endocrine disrupting compounds.

What are Some Examples of these Contaminants?

Currently, over 3000 pharmaceuticals are prescribed for a variety of therapeutic functions. Some common examples include antibiotics, antidepressants, β-blockers, contraceptives, impotence drugs, lipid regulators, and painkillers. After these medicines are consumed, they enter the wastewater stream following metabolism and excretion. Additional pharmaceuticals originate from people flushing unused medicines and from agricultural runoff, as farmers use pharmaceuticals in fish farming or to help prevent livestock illness and disease or to promote an increase in animal size.

To date, a limited number of these pharmaceutical compounds have been tested or detected in environmental studies. In 2002, the U.S. Geological Survey (USGS) reported that 82 of 95 chemicals tested were detected in a survey of waterways from throughout the country. The study evaluated 139 streams and found that 80 percent of the water bodies had one or more of the chemicals, half contained seven or more, and about a third had ten or more of these chemicals. Steroids, nonprescription drugs, and insect repellant were the chemical groups most commonly encountered. If detected, these chemicals were usually found at very low concentrations, generally at a level below 1 part per billion. However, these substances likely represent a small fraction of the pharmaceuticals, nonprescription drugs, or endocrine disrupting compounds that could occur in the environment.

Click here to read a summary of the USGS report.

What is known about the Presence of these Emerging Contaminants in Drinking Water?

Testing for emerging contaminants such as pharmaceuticals and endocrine disrupting compounds is rare and expensive. With few exceptions, most drinking water sources that have been tested for these emerging contaminants were part of research studies funded by the USGS, AWWA Research Foundation, and the U.S. Environmental Protection Agency (EPA). In addition, methods to detect these substances at the level of a part per trillion or less have only recently been developed. By comparison, most contaminants regulated under the Safe Drinking Water Act have maximum permissible levels that are a thousand or a million times greater than these trace levels.

An AWWA Research Foundation study, with a final report due in fall 2008, tested 19 drinking water sources from across the country for 62 emerging contaminants including pharmaceuticals, potential EDCs, steroid hormones, and plant estrogens. Nearly all samples were collected from surface water utilities. The selection criteria for target substances to test was based on frequency prescribed, potential for toxicity, occurrence data, and resistance to conventional drinking water treatment processes. Of the 62 contaminants, only 24 were detected in raw (untreated) water and 11 were found in finished (treated) water samples. The median concentration when a chemical was detected was typically less than 10 parts per trillion.

Recent advances in analytical techniques have resulted in the ability to accurately detect and measure chemicals at the nanogram per liter or part per trillion level. One part per trillion is equivalent to a single sand grain in an Olympic-size swimming pool or to one second in 32,000 years. As analytical techniques have improved, the ability to detect trace concentrations of pharmaceutical chemicals has proceeded faster than the ability to determine the potential human health impact of long-term exposures to trace concentrations of these emerging contaminants.

Where can I find Additional Information on Emerging Contaminants in Drinking Water?

- U.S. Environmental Protection Agency website – www.epa.gov
- American Water Works Association website – www.awwa.org
- AWWA Research Foundations website – www.awwarf.org

Contact the Water Utility with Questions or Comments

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