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To: Water Utility Board

From: Joseph Grande, Water Quality Manager

Date: June 23, 2009

Subject: Pharmaceuticals and Endocrine Disrupting Compounds

BACKGROUND

Public concern about the presence of pharmaceuticals and endocrine disrupting compounds in drinking water was prompted by an Associated Press (AP) news series on the subject in March 2008. The article made headlines in newspapers across the country and was the subject of national and local evening news reports. The series stated that pharmaceuticals including antibiotics, anti-convulsants, mood stabilizers, and sex hormones had been found in the US drinking water supplies of at least 41 million people.

However, steroid hormones, drugs, and drug metabolites have been reported in wastewater since at least 1972 and in drinking water since the late 1990's. Advances in the available analytical techniques have allowed researchers to measure concentrations of dozens of pharmaceuticals down to a fraction of a part per trillion, where one part per trillion is equivalent to one second in 32,000 years or a single sand grain in an Olympic-size swimming pool. The research arms of the drinking water industry, including the US Environmental Protection Agency (EPA) and the Water Research Foundation (formerly the AwwaRF), continue to fund and carry out studies that examine the occurrence, fate, and removal of these "emerging contaminants" as well as the toxicological relevance of exposure to trace concentrations. The AP series likely resulted in additional funding being made available to expand such studies.

THE ISSUE

Pharmaceuticals and endocrine disrupting compounds were recently labeled emerging drinking water contaminants not because they are a new threat to the environment or to human health but rather that novel analytical techniques have allowed their detection in drinking water. The ability to detect these chemicals has outpaced research into the significance of trace level exposures from drinking water on human health. A recent American Water Works Association Research Foundation (AwwaRF) report, published in December 2008, concluded that although some pharmaceuticals and potential endocrine disrupting compounds have been detected in US drinking waters there is no evidence of human health risk from the consumption of these waters. From the executive summary of that report,

> *"Without question, the detection of pharmaceuticals and hormones in drinking water, even at extremely low concentrations, is likely to cause concern about the safety of water*

supplies. A number of factors could fuel this concern, such as the perception that people are being medicated unknowingly, the fact that many of the compounds originate from human waste, and the fact that some of these compounds could cause health effects including cancer and developmental effects. Because of this, it is critical that the levels of exposure be placed into proper context. The reality is that nearly any chemical known to man could be detected in water using the most modern and sensitive of analytical instrumentation."

Currently, there are no federal or state regulations requiring the testing for these contaminants. The measurement of ultra-trace contaminants is costly and unfortunately may not lead to any significant benefit in terms of protecting public health. Water quality monitoring is performed to evaluate chemicals of concern and to compare the occurrence data to established (health-based) standards. Monitoring informs Water Utility staff on issues related to water supply management including treatment, if necessary, and helps the general public determine whether they should seek point of use treatment or an alternative water source.

Here is what we know about pharmaceuticals and endocrine disruptors in drinking water:

1) The primary source is human excretion. They enter the wastewater stream following metabolism and excretion. They also arise from the flushing of unused medicines and agricultural runoff.
2) As water is recycled or reused by downstream communities, some pharmaceuticals and endocrine disruptors are completely degraded or removed by water treatment or natural attenuation while others survive treatment and occur at trace levels.
3) Studies have documented environmental impacts and physiological effects on amphibians and fish that live in impacted waters; biomagnification through the aquatic food chain is a key factor in producing these effects.
4) No human health effects have been linked to the presence of pharmaceuticals and endocrine disruptors in drinking water.
5) EPA Method 1694 was published in December 2007. It is an approved method for the analysis of a select list of pharmaceuticals and personal care products in environmental media including drinking water. However, the method does not target contaminants that have been most frequently encountered in finished drinking water or those identified by the AwwaRF study as probable indicator chemicals, including meprobamate, phenytoin, atenol, estrone, and progesterone, of impacted waters.
6) In February 2008, EPA released for public review and comments the draft Contaminant Candidate List 3 (CCL 3). Narrowed down from over 7,500 potential candidates, CCL 3 includes 93 chemicals – none of which are pharmaceuticals, personal care products, or suspected endocrine disruptors. Publication of a contaminant candidate list is the initial stage of a process by which EPA selects contaminants that may require regulation under the Safe Drinking Water Act.
7) Limited testing was previously conducted on suspected endocrine disruptors (e.g., atrazine, metolachlor, and perchlorate) as part of required regulated and unregulated contaminant monitoring or voluntary testing initiated by Water Utility staff. None of the contaminants were detected in Madison tap water.

8) Method validation at the State Laboratory of Hygiene has been performed using Madison tap water. To date, all analytes have been less than the reporting limit.

THE APPROACH

After the March 2008 release of the AP investigative study, Madison Water Utility convened its Water Quality Technical Advisory Committee. A pediatric endocrinologist from American Family Children's Hospital and an environmental toxicologist from the Sate Laboratory of Hygiene, and co-author of the December 2008 AwwaRF report, were invited to address the committee on origin, fate, and occurrence of these substances in drinking water and how they affect human health. The director of Public Health – Madison Dane County and the general managers of several Dane County water utilities also attended and participated in the discussion.

Water Utility staff provided the following handouts:

1) A Water Systems Council fact sheet on emerging water contaminants dated September 2005, which served as a template for the Water Utility emerging contaminants fact sheet.
2) US Geological Survey (USGS) Fact Sheet FS-027-02, published in June 2002, summarizing the occurrence of pharmaceuticals, hormones, and other wastewater contaminants in 139 US streams between 1999-2000.
3) Preliminary results from AwwaRF Study #3085 identifying and quantifying the twenty one pharmaceuticals and potential endocrine disruptors which had been found in either raw or treated water from nineteen water utilities located throughout the US.
4) A spreadsheet comparing testing capabilities of three private labs and the Wisconsin State Laboratory of Hygiene in the analysis of ~100 pharmaceuticals and endocrine disruptors.
5) The transcript of Dr. Shane Snyder's April 15, 2008 congressional testimony on behalf of the American Water Works Association regarding pharmaceuticals and endocrine disruptors.

At the conclusion of the presentation and discussion, Water Utility staff asked the committee for a recommendation on testing for pharmaceuticals and potential endocrine disruptors. The Director of Public Health and the pediatric endocrinologist both commented that there was insufficient information to recommend screening at this time. The committee members instead recommended a fact sheet, which was reviewed by the committee at the July 2008 meeting and later posted to Water Utility website.

The committee has regularly reviewed and discussed the latest developments including the executive summaries of both AwwaRF reports (*State of Knowledge of Pharmaceuticals and Endocrine Disruptors in Drinking Water* and *Toxicological Relevance of EDCs and Pharmaceuticals in Drinking Water*) as well as the content of this memorandum. Copies of the two AwwaRF reports are available for review at the Water Utility main office.

RECOMMENDATION

The committee is unanimous in its opinion that, at the present time, Madison Water Utility should not independently test for pharmaceuticals or endocrine disruptors. Rather, it encourages participation and

support for research efforts that could facilitate a better understanding of this issue. For example, one possibility is a regional examination of the occurrence of pharmaceuticals and endocrine disruptors in groundwater coordinated with Madison-area or Dane County water utilities. The committee further recommends that the decision whether or not to test for these substances should be reviewed annually.

In addition, if any of the following conditions were to occur, it might trigger the Water Utility to initiate testing. They include:

1) Studies on deep, groundwater wells that document the detection of pharmaceuticals and/or endocrine disruptors at significant levels (almost all current research has examined surface waters that are under the influence of waste water),
2) Evidence suggesting significant contamination of Madison deep wells from leaking sewers or faulty well construction,
3) New information shows potential human health effects at ultra-trace levels, or concentrations below one part per trillion, or
4) The establishment of a new federal or state health-based standard (none currently exist).