



## **2008 Environmental Health Summit: Pharmaceuticals in Water - What We Know, Don't Know, and Should Do about It**

### **Recommendations from the Research Triangle Environmental Health Collaborative**

#### **Representing a Synthesis of Opinions**

##### **Overview**

The active ingredients from pharmaceutical preparations are known to occur as trace contaminants in the environment. While this is undoubtedly not a new phenomenon, it has become widely known only in the last decade primarily because of advancements in pollutant monitoring. Drug ingredients gain entry into the environment by a variety of routes, including: excretion of ingredients that resist metabolism; release of dermal medications during bathing; disposal of unwanted medication to sewers and trash; and from various agricultural and veterinary practices. Some of these ingredients resist removal by waste and water treatment technologies. The primary concerns are: exposure of aquatic organisms from residues in surface waters; exposure for sensitive human subpopulations by even lower levels in drinking water; terrestrial fate of residues concentrated in sewage sludge; and unintended, acute poisonings from improperly stored or disposed medications. Except for the special circumstances of acute poisonings, exposure levels are extraordinarily low. A very large and growing body of published research has greatly advanced our understanding of the issues – but at the same time, it has posed many new questions. One of the greatest challenges is faced by toxicologists, where many questions surround the larger issue of chronic, low-level simultaneous exposures to multiple chemical stressors.

An exploration of the issues associated with the presence of pharmaceuticals in water was undertaken by the Research Triangle Environmental Health Collaborative, which organized an Environmental Health Summit held November 10-11, 2008 entitled “Pharmaceuticals in Water - What We Know, What We Don't Know and What We Should Do about It.” More than 150 invited participants and experts from governmental organizations and institutions, academia, industry, water utilities, and public interest groups attended the sessions. The attendees participated actively in discussions and identified innovative solution-oriented recommendations for ultimately reducing any potential risks by targeting research needs, education, communication, prevention/intervention programs, and other public health solutions/actions.

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The summit provided an interdisciplinary forum that considered a multipronged approach to a potential public health challenge. It demonstrated the benefit of collective voices from those who would normally work in disconnected fields. More such interactions between scientists, public advocacy groups, representatives from relevant industries, the healthcare community, other stakeholders, and policy makers will help to more clearly define the challenges faced by emerging issues and provide each sector with a better understanding on how best to assimilate and disseminate their knowledge collectively.

## **Conclusions**

Despite rising fears over the presence of pharmaceuticals in drinking water, there is currently little evidence associating them with adverse human health risks. More and better data are needed to prioritize which pharmaceutical chemicals could potentially pose the highest risk to consumers and to the environment. The identification of those drugs susceptible to formation of degradation and/or transformation products that have equal or more toxicity than the parent compounds is a critical point in this respect. Effectiveness of current wastewater treatment, on-site processes, and emerging animal waste treatment technologies also needs to be evaluated.

In general, ecosystems are more at risk than humans. Ecosystems may respond to lower doses than humans and, in addition, pharmaceutical levels when detected in consumers' drinking waters are much lower than in natural waters to which aquatic organisms are directly exposed. The key challenge in assessing the risk of pharmaceuticals in the environment is to evaluate if long-term, low-dose exposures to mixtures of pharmaceuticals affect humans and wildlife. In this respect, questions regarding susceptible sub-populations or life stage sensitivity (i.e. the fetus) have to be considered. Existing frameworks, such as those developed for pesticides and for disinfection byproducts, may be appropriate for use as models for hazard/risk assessment of pharmaceuticals in the environment.

A list was developed of Best Management Practices that could potentially be implemented within a year, along with an evaluation of those activities. Even though there is limited information about environmental and public health effects derived from the presence of pharmaceuticals in water, there is a need to communicate what is known. The use of new technologies is recommended for facilitating communication and collaboration. However, we must be clear and not provide mixed messages on the subject of potential yet currently unknown risks, remaining truthful without causing alarm. If we communicate to the public that water can be considered safe, we must emphasize that this is based on what we currently know from scientific studies.



Water scarcity, climate change, aging and increasing population density, increasing usage of pharmaceutical products, and rising dependence on water reuse might lead to an increase in the presence of pharmaceuticals in natural and drinking waters in the near future that might pose a risk to water safety or an exacerbation of perceived risk. Scientific techniques to understand and predict the potential for long-term effects of pharmaceutical residues in the environment are continuing to be developed to assess these challenges and to help prevent environmental and human health effects even in exceptional circumstances.

## **Recommendations**

1. The U.S. Congress should designate scientific leadership and define “who is in charge” to provide guidance and background on existing efforts. Some entity needs to provide factual guidance and background on the potential for pharmaceuticals to have effects on human health at the concentrations detected in drinking water. Stakeholders have to be identified starting with pharmaceutical companies, water utilities, healthcare sectors, regulatory agencies, academia, public interest groups, etc. Public policy should be based on accurate and specific scientific knowledge about the potential for effects from low-level chronic exposure of sensitive subpopulations to pharmaceuticals in drinking water.
2. There is a need to create better Federal facilitation. This issue crosses the jurisdiction of multiple regulatory agencies in the United States, creating a challenge to balance the societal need for safe and effective drugs against possible human and aquatic impacts from environmental exposure. Better interagency cooperation, data sharing, and a focal point for communication are essential if we are to take public concerns about this issue seriously and, if a problem is discovered, to determine the most effective manner in which to solve it judiciously.
3. Given the lack of definitive information on human and ecological risks, the U.S. Congress needs to support research efforts to identify the hazards and the degree of risks associated with pharmaceuticals in the environment. There are some barriers to research that Congress should consider; for instance, utilities are electing to not participate in critical studies due to liability concerns which makes it more difficult to conduct environmental studies in the real world.
4. There is a need to communicate, consistent with current scientific understanding, that: a) pharmaceuticals and other consumer products are present in water at very small concentrations (most are less than 10 ng/L with a few in the 10 – 100 ng/L range) and; b)



what the potential implications are from the continuous presence of these contaminants in water, even though we currently have only limited information about environmental and public health effects. The challenge is to be truthful about the subject without causing alarm. The Collaborative proposes this statement as an overall assessment:

*"If your drinking water meets current U.S. standards, your drinking water is considered safe and drinkable. We recognize that trace amounts of pharmaceuticals in combination with other types of chemicals used by humans have been found in water. These substances are coming from a variety of sources and are difficult to remove to levels that cannot be detected by modern analytical techniques. There is limited information on how long-term, low-dose exposures to these chemical mixtures might affect humans and wildlife, but to date no adverse human health effects have been documented. U.S. standards may need to be developed for certain pharmaceutical compounds in drinking water or in aquatic systems as more information becomes available."*

5. There is a need to develop standardized, reliable sampling and analytical methods with adequate quality control. There are currently no standardized methods for measurement of pharmaceuticals in environmental samples although a number have been published, including two by the EPA's Office of Drinking Water. A critical data review process needs to be implemented to ensure credibility and provide a sound basis for source characterization and exposure assessment.
6. There is a need to develop a prioritized list of pharmaceuticals and other chemical contaminants found in both aquatic and drinking waters for further evaluation that is based on: 1) production/use data, 2) occurrence in surface water samples, and 3) their predicted "impact" based on toxicity/activity and their degradation/persistence. Several approaches to help implement this prioritization approach have been published but no widely accepted scheme yet exists. Prioritization would enable efforts targeted toward those contaminants with the highest potential for causing adverse effects.
7. Best Management Practices (BPM) were recommended and assigned to four areas:

**Industrial sphere**

- Establish a "Return Product" program
- Develop new packaging
- Re-evaluate sample distribution and marketing practices
- Examine and possibly change the process for determining expiration dates to one that recommends return of the product

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### **Medical and Veterinary sphere**

- Educate doctors and veterinarians
- Require that pharmacists indicate proper disposal methods on prescriptions
- Reduce down-the-drain disposal of all medical facilities
- Prescribe only what is needed

### **Social and Agricultural sphere**

- Educate public on proper disposal and use
- Educate public on not using down-the-drain disposal
- Education public on environmental impacts
- Increase use of technology (e-mails, websites, blogs, kiosks in public places, video monitors in doctor offices and clinics, etc.) to provide patient education

### **Environmental sphere**

- Identify and promote wider use of Best Management Practices already in place
- Evaluate current treatment technologies for efficiency of removal of pharmaceuticals
- Initiate funding for increased monitoring in a systematic and properly designed way (the USGS pesticide program is one example that could be followed)
- Develop public relations campaign
- Include pharmaceuticals in other water pollution programs

The BMPs that attendees felt had the highest potential to implement or develop within a year centered around education of the health care community and general public on the proper disposal of unused medicine and how they could take steps to reduce the amount of medicine that goes unused. Other BMPs recommended for investigation included return products programs, evaluation of treatment technologies, and increased monitoring of pharmaceuticals in water. Many of the BMPs have not been thoroughly evaluated so this is an area where additional research should be considered.

For additional info: <http://environmentalhealthcollaborative.org/blog/entry/collaborative-issues-statement-regarding-pharmaceuticals-in-water/>

## **About the Research Triangle Environmental Health Collaborative**

The Research Triangle area of North Carolina is unique with respect to the number of world-class organizations focused on environmental health research and policy. Given the outstanding depth and breadth of environmental health expertise in academia, government

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institutions, non-profit foundations, and private businesses in the area, the Research Triangle has become the epicenter of contemporary thinking about environmental health.

To take advantage of these intellectual resources, the Research Triangle Environmental Health Collaborative (the Collaborative) was established as a non-profit 501c3 organization. The Collaborative supports a united environmental health resource that connects organizations and institutions; links research and policy; and joins government, academia, industry and public interest groups to mutually consider, discuss and debate the future of environmental health on a state, regional, national and international level. It provides a neutral forum to host candid discussions and to provide advice on the most significant issues facing environmental health and related public policy. The goal is to create partnerships to enhance global environmental health.