FAST MOVING FRONTS - 2008

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Paul E. Stackelberg talks with *ScienceWatch.com* and answers a few questions about this month's Fast Moving Front in the field of Engineering.

Article: Persistence of pharmaceutical compounds and other organic wastewater contaminants in a conventional drinking-watertreatment plant
Authors: Stackelberg, PE;Furlong, ET;Meyer, MT;Zaugg, SD; Henderson, AK;Reissman, DB
Journal: SCI TOTAL ENVIR, 329 (1-3): 99-113 AUG 15 2004
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(addresses have been truncated)

SW: Why do you think your paper is highly cited?

The detection of pharmaceuticals and other organic wastewater-related compounds (OWCs) in the environment has generated considerable interest in the scientific community and with the general public. The scientific community is focused on investigating potential adverse ecological and human-health effects, whereas the general public is concerned about the potential contamination of our water and drinking-water resources.

Our paper generated considerable interest because it reports for the first time on the occurrence of a broad array of OWCs in drinking-water supplies and, therefore, has caught the attention of both the scientific community as well as non-technical audiences.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

Prior to the publication of our paper there was little information in the literature concerning the occurrence of OWCs in drinking-water supplies. This study was the first to examine a wide variety of OWCs (over 100) in both source and finished-drinking-water samples and we reported for the first time the occurrence in drinking water for several OWCs (for example, the prescription drug carbamazepine). Most of these compounds are currently unregulated in drinking water and have not been routinely monitored for their presence in streams and drinking-water supplies of the United States.

"...increased public awareness of the ways we handle and dispose of our medications and other extensively used chemicals and

SW: Would you summarize the significance of your paper in layman's terms?

Our paper was one of the first to demonstrate that extensively used chemicals such as prescription and non-prescription drugs, personal-care products, detergent metabolites, plasticizers, flame retardants, and fragrances are capable of surviving

conventional drinking-water-treatment processes and persisting in finished-drinking-water supplies. The long-term human-health effects of exposure to these chemicals in drinking water are not known and, therefore, this is an area of ongoing investigation.

Findings from this study demonstrate that the use of treated municipal wastewater to augment raw-water supplies in urbanized areas is complicated by the presence of OWCs in wastewater effluent and the inability to completely degrade or remove these compounds through the use of conventional water treatments.

has resulted in an increased interest by industries in waste-treatment technologies..."

SW: How did you become involved in this research and were there any particular problems encountered along the way?

Interest in this area of research was prompted by findings from European colleagues who, in the mid-to-late 1990s, reported the nearly ubiquitous occurrence of select pharmaceutical compounds in surface-water bodies that receive effluent from sewage-treatment plants.

The initial obstacle for investigating the occurrence of these compounds in the Unites States was the lack of analytical methods capable of measuring these compounds at environmentally relevant concentrations. This obstacle was addressed by the US Geological Survey which began developing analytical capabilities for OWCs in the late 1990s.

These newly developed analytical methods were used to examine the occurrence of OWCs in streams across the United States in 1999–2000. Results from this national stream reconnaissance provided the motivation to examine the occurrence and persistence of OWCs in drinking-water-treatment facilities whose source waters contain effluent from municipal-sewage-treatment plants.

SW: Where do you see your research leading in the future?

Additional research has been conducted to further investigate the occurrence of OWCs in drinking-water supplies, as well as the effectiveness of water treatments at degrading or removing these compounds from the aqueous phase. See, for example: "Efficiency of conventional drinking-water-treatment processes in removal of pharmaceuticals and other organic compounds," Stackelberg PE *et al.*, *Sci. Total Environ.* 377: 255-72, 2007.

In addition, the USGS, in partnership with other federal, state, and local agencies, is actively involved in additional research to provide information on these compounds for evaluation of their potential threat to environmental and human health.

Current and future research activities include: (1) develop analytical methods to measure chemicals and microorganisms or their genes in a variety of matrices (e.g. water, sediment, waste) down to trace levels; (2) determine the environmental occurrence of these potential contaminants; (3) characterize the myriad of sources and source pathways that determine contaminant release to the environment; (4) define and quantify processes that determine their transport and fate throughout the environment; and (5) identify potential ecologic and human-health effects from exposure to these chemicals or microorganisms. Additional information on these areas of research is available on the Web.

SW: Do you foresee any social or political implications for your research?

The objective of USGS-sponsored research is to provide reliable, impartial, and timely information needed by decision-makers to more effectively manage our water resources and also to protect and enhance these resources for human health, aquatic health, and environmental quality. This information also helps establish research priorities and future monitoring needs.

Findings from this and similar studies have already increased public awareness of the ways we handle and dispose of our medications and other extensively used chemicals and has resulted in an increased interest by industries in waste-treatment technologies and best-management practices that are most effective at removing trace organic chemicals from our water resources and solid and liquid wastes.

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