Presence of Wastewater Tracers and Endocrine Disrupting Chemicals in Treated Wastewater Effluent and in Municipal Drinking Water, Metropolitan Atlanta, 1999

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Abstract

Insecticides, detergents, processed foods and personal hygiene products contain a wide variety of organic chemicals. Municipal drinking water may contain these chemicals because these products are discarded in sewage systems and may survive treatment at water pollution control plants (WPCP) and at drinking water treatment plants (DWTP) that use surface water containing treated effluent from a WPCP. The occurrence and distribution in municipal drinking water of organic chemicals from commercial products are unknown because these chemicals are not routinely monitored in the U.S. water supplies.

The Centers for Disease Control and Prevention (CDC) and the U.S. Geological Survey (USGS) conducted a study to measure wastewater tracers (organic chemicals that survive WPCP treatment) and endocrine disrupting chemicals in wastewater effluent and in drinking water. Treated effluent was collected at four municipal effluent discharge sites. Raw and finished water samples were collected at three drinking-water treatment plants downstream of the effluent discharges. Samples were collected once per month during low-flow conditions from July through September 1999 from WPCPs and DWTPs in the Chattahoochee River watershed. During these months, treated effluent contributed 1 to 35 percent of the stream flow at the DWTP intakes. Analytical methods developed at the USGS National Water Quality Laboratory used continuous liquid-liquid extraction with methylene extraction and selected ion monitor gas chromatography/mass spectrometry to quantify 31 wastewater tracers and 16 potential endocrine disruptors at parts per billion (ppb) concentrations in filtered water samples.

Of the 47 chemicals analyzed, 37 were detected in treated effluent samples, 15 were detected in raw drinking water (river water) samples, and 14 were detected in finished drinking water samples. All chemicals detected had concentrations in the low ppb range. Chemicals detected in treated effluent and in raw and finished water were plasticizers, products of combustion, disinfectants, flame retardants, surfactants, detergent metabolites, antioxidants, and wood preservatives. All treated effluent samples (N=12) contained tri(2-chloroethyl)phosphate, phthalic anhydride, triclosan, and tributyl phosphate. Eleven samples had 1,4 dichlorobenzene and 10 samples had cholesterol. All 9 raw drinking water samples contained caffeine. The next most commonly detected organic chemicals in raw drinking water samples were pyrene and fluoranthene (6 samples), followed by tri(2-chloroethyl)phosphate (5 samples). Finished drinking water samples contained tri(2-chloroethyl)phosphate (6 samples); phthalic anhydride (5 samples); caffeine, triclosan, fluoranthene, pyrene, 2,6-di-t-butylphenol and ethanol-2-butoxy-phosphate (3 samples), and tributyl phosphate in 2 samples. Seven additional organic compounds were detected in 1 of the 9 finished water samples. Potential endocrine disrupting chemicals were detected in 10 treated effluent samples, in 6 raw drinking water samples, and in 1 finished drinking water sample.

This study shows that some chemicals found in commercial household products survive WPCP treatment, ecologic conditions between a WPCP discharge and a DWTP intake, and DWTP treatment. These organic chemicals may go undetected in treated effluent and in municipal water supplies, either because water utilities do not test for these chemicals or the concentrations of these chemicals are below the detection limit of the analytical method. Additional surveys to measure these chemicals would characterize the scope and magnitude of these compounds in surface and municipal waters and would identify chemicals that may need further studies to assess their human and ecological effects at ppb concentrations.

Biographical Sketches

Alden K. Henderson, PhD, MPH. is a toxicologist at the Centers for Disease Control and Prevention in Atlanta, GA. He received his Ph.D. in toxicology from the University of Arizona and his Masters of Public Health in epidemiology from the University of Hawaii. His projects deal with documenting exposures to environmental agents and determining the human health effects of these exposures.

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Deborah M. Moll, PhD. has worked as an Environmental Health Scientist in the Health Studies Branch of CDC's National Center for Environmental Health since 1998, focusing on exposure to contaminants through drinking water. She received her PhD from the Department of Civil and Environmental Engineering, University of Cincinnati in 1998 with a focus in drinking water quality and treatment. She is a member of the American Water Works Association and the International Water Association.

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Ms. Elizabeth A. Frick, has been a hydrologist for the USGS since 1983. Her Masters degree is in Hydrology from the University of Nevada, Reno. Her recent work is focused on water-quality issues in the Chattahoochee River associated with the USGS NAWQA program, a microbial contamination study in conjunction with the NPS, and emerging contaminants study in conjunction with CDC.

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