PRESENCE OF PHARMACEUTICALS IN WASTEWATER EFFLUENT AND DRINKING WATER, METROPOLITAN ATLANTA, GEORGIA, JULY–SEPTEMBER 1999

Elizabeth A. Frick[1/], Alden K. Henderson, Ph.D., M.P.H. [2/], Deborah M. Moll, Ph.D[2/], Edward T. Furlong, Ph.D.[3/], and Michael T. Meyer, Ph.D.[4/]

AUTHORS: [1/]Hydrologist, U.S. Geological Survey, 3039 Amwiler Road, Suite 130, Peachtree Business Center, Atlanta, GA 30360-2824; [2/]Epidemiologist, Centers for Disease Control and Prevention, National Center for Environmental Health, 1600 Clifton Road, MS E23, Atlanta, GA 30333; [3/]Research Chemist, U.S. Geological Survey, Denver Federal Center, P.O. Box 25046, MS 407, Denver, CO, 80225-0046; and [4/]Research Chemist, U.S. Geological Survey, 4500 SW 40th Avenue, Ocala, FL, 34474-5731.
REFERENCE: Proceedings of the 2001 Georgia Water Resources Conference, held March 26-27, 2001, at The University of Georgia, Kathryn J. Hatcher, *editor*, Institute of Ecology, The University of Georgia, Athens, Georgia.

Abstract. Human and veterinary pharmaceutical compounds are a source of increasing environmental concern because they are used in large quantities and their physical and chemical properties make them likely to be transported into hydrologic systems, where their effects on human health and aquatic ecosystems generally are unknown. The U.S. Geological Survey (USGS) and Centers for Disease Control and Prevention (CDC) began a study to determine the occurrence of selected pharmaceuticals in treated effluent discharged upstream of drinking-water intakes, in raw drinking water, and in finished drinking water in the upper Chattahoochee River watershed in Metropolitan Atlanta. Water samples were collected at 11 sampling sites once per month during low-flow conditions from July–September 1999. Two research analytical methods, recently developed or modified by the USGS Toxics Program, were used to quantify prescription and nonprescription pharmaceuticals, including antibiotics, at parts per billion (ppb) and sub-ppb concentrations in filtered water samples.

The number of pharmaceuticals detected by site type decreased from 16 in treated wastewater-effluent samples, to 10 in raw-water samples from drinking-water intakes, to three in finished-drinking-water samples. Four prescription pharmaceuticals detected were dilitiazem, dehydronifedipine, metformin, and gemfibrozil. Five nonprescription pharmaceuticals detected were caffeine, 1,7-dimethyl xanthine, cotinine, cimetidine, and acetominophen. Eight antibiotics detected were trimethoprim, sulfamethazine, sulfamethoxazole, sulfadimethoxine, erythromycin-H_2O, roxithromycin, lincomycin, and enrofloxacin. Seven prescription and nonprescription pharmaceuticals and fourteen antibiotics were analyzed for, but were not detected. The only three pharmaceuticals detected in finished-drinking-water samples—caffeine, cimetidine, and acetominophen—are widely used nonprescription pharmaceuticals. The detection of antibiotics in raw drinking water is of particular concern because the presence of these chemicals in the environment may lead to the development of resistant bacterial strains, thus diminishing the therapeutic effectiveness of antibiotics. The combination of the detection of numerous prescription and nonprescription pharmaceutical compounds in treated effluent, raw drinking water, and finished drinking water; and the absence of pharmaceutical manufacturing facilities, suggests that human usage of pharmaceuticals is one source of these compounds in water resources within the upper Chattahoochee River watershed.