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BEHAVIOR OF ENDOCRINE-ACTIVE COMPOUNDS THROUGH MUNICIPAL WASTEWATER AND SLUDGE TREATMENT PROCESSES

James Gray*, Patrick J. Phillips, Kathleen Esposito, Beverly Stinson, Edward Furlong, Larry Barber, Dana Kolpin

ABSTRACT: Endocrine-active compounds (EACs) can induce biological effects in fish and other aquatic organisms at environmentally relevant (low nanogram per liter, ng/L) doses. Many EACs, including steroid hormones, detergent metabolites, and other industrial chemicals, are present in domestic wastewater and are removed to varying degrees by biological wastewater-treatment processes. Less attention has been given to the fate of EACs subjected to biosolids treatment. Disposal of biosolids through land-application represents another potential source of EACs to the environment. Liquid and solids samples were collected at selected points of treatment throughout five large municipal wastewater-treatment plants (WWTPs) across the United States to evaluate the efficiency of individual unit operations for EAC removal, and to conduct a mass balance for EACs across solid and liquid treatment processes in these plants. Preliminary data indicate 50–90% removal of many EACs from the liquid phase during biological treatment, and the solids were enriched in EACs relative to the liquid streams. For example, in one plant, 17-beta-estradiol (E2) had 75% removal from the liquid phase. It was observed at 0.9 ng/L in secondary effluent and is commonly observed in treated biosolids, indicating a sorptive loss process. But estrone, an E2 metabolite, was detected at elevated levels (30 ng/L) during intermediate stages of treatment, highlighting the role of biotransformation in the removal of E2. This result indicates that the attenuation of estradiol results from a combination of physical and biological processes, and that removal is not complete from either the solid or liquid phase.

***** Chemist, U.S. Geological Survey, PO Box 25046, Denver Federal Center, Denver, CO 80225, USA, Phone: 303-236-3776, Fax: 303-236-3499, Email: jlgray@usgs.gov