AWRA 2007 SUMMER SPECIALTY CONFERENCE
Vail, Colorado
June 25-27, 2007

FATE AND TRANSPORT OF ORGANIC WASTEWATER CHEMICALS DURING ONSITE TREATMENT AS AFFECTED BY EFFLUENT TYPE AND HYDRAULIC LOADING RATE

Kathleen Conn, Robert L. Siegrist, Larry B. Barber*

ABSTRACT: Organic wastewater chemicals (OWCs) such as endocrine disrupting compounds occur in onsite wastewater treatment system tank effluents frequently and at concentrations often significantly higher than those reported in municipal wastewater treatment plant effluents. In areas where wastewater management is achieved by onsite systems, underlying groundwater often provides the local drinking water source and may recharge nearby surface waters. Understanding the fate of OWCs during soil treatment prior to groundwater recharge will aid in assessing potential risk to humans and ecosystems. Research was carried out at the Colorado School of Mines (CSM) in collaboration with the U.S. Geological Survey to elucidate the mechanisms and extent of removal of select OWCs during soil vadose zone treatment in onsite wastewater systems. Sampling was conducted at the Mines Park Test Site at CSM. Domestic septic tank effluent and textile filter effluent have been applied for 3 years to the infiltrative surface of pilot-scale soil infiltration test cells at hydraulic loading rates from 2 to 8 cm/d. Soil solution from 60- and 120-cm depths below the infiltrative surface was collected and analyzed for a suite of OWCs to quantify removal efficiencies of OWCs during soil-based treatment. In conjunction with this research, a multicomponent tracer test has been ongoing for two years wherein a conservative solute tracer and a pharmaceutical compound surrogate have been applied to the test cells. Soil solution sampling within the test cells revealed significant retardation of the pharmaceutical surrogate relative to a conservative tracer. After 600 days, levels of the pharmaceutical surrogate were still elevated in the soil. Approximately 25% of the mass added had moved through the first 60 cm below the infiltrative surface, suggesting irreversible sorption and/or biotransformation may be important removal mechanisms for OWCs during soil treatment. Correlated laboratory-scale experiments are being carried out to further elucidate key transport mechanisms of OWCs in soil-based onsite treatment systems.

***** Respectively, Ph.D. Candidate, Colorado School of Mines, Environmental Science and Engineering, 1500 Illinois St., Golden, CO 80401, USA, Phone: 303-384-2219, Email: kconn@mines.edu; Professor and Division Director, Environmental Science & Engineering, Colorado School of Mines, Golden, CO; Research Scientist, U.S. Geological Survey, Boulder, CO