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ATTENUATION, SORPTION, AND RELEASE OF PHARMACEUTICAL AND PERSONAL CARE PRODUCTS THROUGH SOILS ON A REUSE GOLF COURSE

Joseph F. Leising, Eric L. Dano, Shane A. Snyder*

ABSTRACT: The Southern Nevada Water Authority (SNWA) encourages Las Vegas area golf courses to utilize reuse water for irrigation in conjunction with the entity's ongoing efforts to manage regional water resources. As one of several proactive attempts to address emerging contaminant issues associated with reuse, in December 2004 SNWA established a field experiment at a course that has irrigated with reuse water for over 15 years. Three soil infiltration lysimeters modified to mimic soil drainage were installed in a fairway. Samples were collected periodically and analyzed at the Southern Nevada Water Systems laboratory for conservative tracer ions and a suite of 31 pharmaceuticals and personal care products (PPCP). Study objectives included establishing PPCP concentrations in the irrigation application water, developing effective field methodologies, and measuring PPCP attenuation in established soils.In the applied reuse water, 7 of the 31 PPCP were not detectable, and 6 others were present close to reporting limits, which generally ranged between 1 and about 70 ng/l. An additional 6 compounds were present in the reuse water but undetectable in soil water due to masking induced by high salinity and small sample volume. Only 5 compounds – carbamazepine, DEET, gemfibrozil, meprobamate, and sulfamethoxazole – were present at sufficient concentration for semi-quantitative evaluation. Some measure of qualitative interpretation was possible with 7 other compounds: dilantin, erythromycin-H2O, iopromide, oxybenzone, trimethoprim, and TCEP. Wetting events flushed major inorganic ions and mobilized sorbed PPCP. Except for erythromycin-H2O and gemfibrozil, all of the 12 interpretable compounds showed some evidence of sorption and release. Weak to significant attenuation appeared to take place with 7 of these compounds: erythromycin-H2O, sulfamethoxazole, meprobamate, dilantin, iopromide, trimethoprim, and gemfibrozil. Two others – DEET and carbamazepine – were not attenuated. The investigation indicates that evaluation of field results requires a number of hydrologic assumptions and event-by-event interpretation. Such limitations pose significant difficulties for the reuse and regulatory communities, and must be addressed through appropriate experimental design and laboratory procedures.

***** Hydrologist II, Southern Nevada Water Authority, 1900 E. Flamingo Rd., Suite 255, Las Vegas, NV 89119, USA, Phone: 702-822-3373, Fax: 702-822-3304, Email: leisingj@snwa.com