Containment Lysimeter Flow Regime Verification and Instrumentation for Evaluating the Transport of Viruses and Indicators to Shallow Groundwater

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Project Abstract
This project will build research capacity for evaluating factors that govern the transport of viruses from manure applied to crop land to shallow groundwater. Knowledge gained in this work will lead to the development of practical and effective manure management guidelines that protect groundwater quality and public health. A research proposal has been submitted (CSREES NRI-Water and Watersheds; due January 17, 2008; Xagoraraki et al., Transport of Viruses and Indicators through Plant-Soil Systems to Shallow Groundwater following Manure Application). A key component of the proposed NRI project is an evaluation of the breakthrough characteristics for the transport of naturally-occurring wild-type enteric viruses (adenoviruses, enteroviruses, noroviruses, rotaviruses), and naturally occurring microbial indicators (E-coli, coliphage) originating from liquid dairy manure applied on corn, orchardgrass and switchgrass crops. Eight containment lysimeters enclosing a monolith of undisturbed soil (4.2 m$^3$) in large experimental plots (600 m$^2$) on a Kalamazoo fine-loamy, mixed mesic Typic Hapludalfs soil at the Kellogg Biological Station are uniquely designed to provide large quantities of drainage effluent needed to develop breakthrough curves for viruses, pathogen indicators and conservative tracers in field conditions. Currently, switchgrass is established on three of the plots, orchardgrass on three plots, and corn is sown annually on two plots. The funds requested in this application will be used to: (1) purchase and install soil moisture sensors, temperature sensors, and data loggers, (2) build a portable rainfall simulator, (3) elute a chemical tracer through each of the lysimeters to define the flow regime of the soil contained in the lysimeters, and (4) measure baseline water quality. This work is necessary before the proposed NRI research can begin. If the proposed NRI project is not funded, the added capacity and preliminary data resulting from this work will strengthen future applications.