USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Settling Characteristics of As-Deposited Cryptosporidium Oocysts

Focus Categories: WQL, TRT, AG

Descriptors: Cryptosporidium, Wastewater treatment, Suspended sediment, Animal waste

Duration: March 1, 1999 - Feb. 28, 2000

FY 1999 Federal Funds: $23,668

FY 1999 Non-Federal Funds: $48,227

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Congressional district: 21st, NY

Critical Water Problem

Attention now is being turned to the occurrence, transport, fate, and treatment of Cryptosporidium. Understanding Cryptosporidium behavior is especially critical to the protection of unfiltered water sources and treated sources with the potential for large protozoan inputs from their watersheds. In New York State (NYS), for example, the unfiltered water sources serving large populations in New York City and Syracuse and the filtered source supplying the City of Troy have a large number of dairy and livestock operations within their watersheds. Watershed Best Management Practices (BMP's) have been designed to mitigate the inputs of farm-generated pollutants to surface and ground water. Many of these practices serve to remove the solids from farm runoff, relying on sedimentation as a removal mechanism. Although the effectiveness of BMP's for removal of solids and nutrients has been documented (e.g. NYSDEC, 1992; Edwards et al., 1996; Meals et al., 1996), to our knowledge, no studies have assessed the effectiveness of agricultural BMP's for the removal of Cryptosporidium. The use of BMP's in NYS watersheds as a means of controlling potential inputs of Cryptosporidium oocysts to reservoirs may or may not be effective. Understanding the settling characteristics of Cryptosporidium oocysts in the environment, then, is critical to the rational design of BMP's that rely on sedimentation for removal of Cryptosporidium. In addition, oocyst settling is a key parameter in modeling and predicting the fate of Cryptosporidium in reservoirs. The rate at which Cryptosporidium oocysts settle is an important element in our efforts to understand and control oocyst transport to and in NYS reservoirs.

Expected Benefits

The proposed study will examine the settling velocity of oocysts under controlled laboratory conditions, using oocysts that have been, as much as possible, unaltered from the form in which they occur in the environment. By using freshly obtained oocyst infected feces in settling column experiments, we hope to overcome the shortcomings of previous investigations by other researchers into oocyst settling. The results of this study will contribute to our understanding of the associations of oocysts with larger particles in fecal matter and whether these associations can significantly impact the sedimentation of oocysts from the water column. A distribution of the settling velocities of as-deposited oocysts will be obtained, which, in turn, can be inserted into existing models describing the fate and transport of oocysts in BMP's (e.g. sedimentation basins) and reservoirs. Knowledge of the distribution of settling velocities of Cryptosporidium oocysts, then, will provide a more rational basis for risk assessment, regulation and monitoring as well as design of BMP's to enhance oocyst removal.

Nature, Scope, and Objectives

Given the constraints on the release of viable pathogens into the environment, our investigation into the settling characteristics of naturally occurring Cryptosporidium oocysts will be performed in settling columns under controlled laboratory conditions. Our objectives in conducting this investigation are:

1. to determine the settling velocity distribution for oocysts, as deposited in infected fecal material, when this material is introduced to a column of quiescent water with known constituents;
2. to examine the effect of the experimentally-determined settling velocity distribution on the fate of Cryptosporidium oocysts as described by models for reservoirs and for sedimentation basins designed to treat agricultural runoff.