Occurrence, Fate, and Transport of Pathogens and Antibiotics in Dairies

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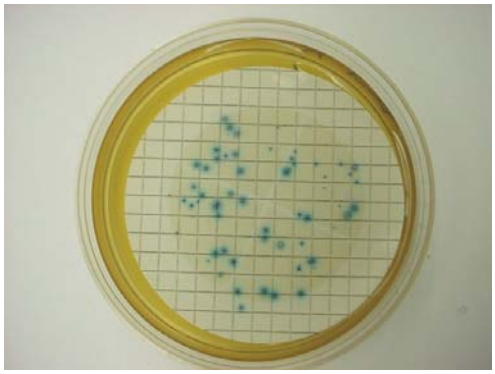
THE ISSUE: Confined animal feeding operations are of growing concern as potential sources of contamination of enteric pathogens and antibiotics. To assess the public health risk from pathogens and their hydrologic pathways, we need to consider that pathogen loading to the soil and possibly to groundwater varies significantly between various management units of a farm. A dairy farm, for example, may include an area with calf hutches, corrals for heifers, freestalls and exercise yards for milking cows, separate freestalls for dry cows, a hospital barn, a yard for collection of solid manure, a liquid manure storage lagoon, and fields receiving various amounts of liquid and solid manure. Levels of pathogen shedding and pharmaceutical treatments can vary considerably between these management units.

PATHOGEN RESEARCH: We implemented a field reconnaissance program to assess the occurrence of three pathogens (*E. coli* O157H7, *Salmonella*, *Campylobacter*) and two indicator organisms (*E. coli*, *Enterococcus*) at the ground-surface and in shallow groundwater of seven different management units on each of two farms, and in each of four seasons (winter/wet season, spring/dry season, summer/irrigation season, and fall/dry season).

Results of the reconnaissance showed many non-detects and occasionally low levels of pathogens in first-encountered groundwater. Also, our results indicate that significant differences exist in the land surface occurrence of these pathogens between management units and between organisms, which suggests that it may be possible to reduce the



contamination further by focusing attention to only a few areas within the dairy. Our results demonstrate the importance of differentiating sources within a dairy farm and the importance of understanding subsurface transport processes for these pathogens.

PHARMACEUTICALS: More than twenty million pounds of antibiotics are sold for use in animal husbandry with 95% going towards therapeutic use. Recommended drug applications are available from national databases. Statistical data on actual usage, however, are not available. We examine dairies as potential contamination source of various disinfectants and pharmaceuticals, particularly antibiotics. We complement national data with interviews and dairy visits for further evaluation of drug and chemical usage and an overall assessment of the potential antibiotics output in dairy waste.

We find that aminoglycosides, tetracyclines, and coccidiostats make up much of the total mass of antibiotics used. On dairies using the ionophoric antibiotic monensin as feed additive, monensin makes up a large fraction of the total antibiotics use (by mass). Other chemicals of potential concern include disinfectants used to prevent mastitis, detergents used in the milking parlor, footbath reagents to prevent and treat lameness, and insecticides used to control flies and mites. Most of these pharmaceuticals are found in the waste collection and storage system, but appear to be appreciably degraded within the dairy. Shallow groundwater occurrence (at the water table) is very limited. Most groundwater detections were associated with manure lagoons, some were in manured fields. Low or non-detectable groundwater concentrations suggest attenuation in the overlying soil.

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