

Livestock manure impacts on groundwater quality in Alberta

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In January 2002, the Alberta Government assumed responsibility for the regulation of confined feeding operations (CFOs) when the Agricultural Operation Practices Act (AOPA) was amended. The Natural Resources Conservation Board (NRCB), the Provincial agency responsible for the administration of AOPA, and Alberta Agriculture and Forestry (AF) are concerned that some manure storage facilities and associated activities, such as land application of manure, may be releasing manure constituents into shallow groundwater resources. An integral part of the administration of AOPA is determining environmental risk, as outlined in a provincially adopted Risk Management Framework policy. This has led to the development and use of a risk screening tool and risk based compliance initiative, both currently focused towards groundwater.

Although the environmental risk based policy being implemented utilizes the best available, current, and relevant science, limited Alberta-specific information exists on the impacts of manure storage and handling on groundwater quality, leading to uncertainty in the actual extent and risk that these activities pose to groundwater. A multi-year groundwater research program was conducted through the establishment and instrumentation of field-scale CFO pilot study sites to improve the understanding of impacts from manure handling and storage on groundwater quality in Alberta and the fate and transport of various manure constituents in groundwater beneath CFOs. Long-term study sites were identified through site characterization, geological investigations, and monitoring well installation, and represent the primary typical hydrogeological conditions in Alberta affected by manure storage and handling activities.

Activities were focused at specific earthen manure storage (EMS) facilities at site specific CFOs, and were also designed to examine the effects of manure land application and on a regional scale on Alberta's groundwater. Research program activities included characterization of the contaminant (i.e., aqueous) source, characterization of the hydrogeological and physical controls on the transport of contaminants, characterization of the background aqueous and solids chemistry, characterization of aqueous and solids chemistry within the contaminant plume, and quantification of the geochemical controls on the fate of contaminants. Results and findings will be presented.

By improving the scientific and practical understanding of the fate and transport of manure constituents in the groundwater in typical Alberta CFO settings, improved management, policy, regulation, and protection of the groundwater and environment can be achieved. The results also provide insights and understanding into the impacts of other point- and non-point-sources of manure associated contamination, particularly land application of inorganic and organic fertilizers and disposal of human waste, on Alberta groundwater. Instrumentation installed may also provide the opportunity to investigate the fate and transport of other emerging contaminants (e.g., pharmaceuticals, viruses, etc.) and thus assess their impact on groundwater.