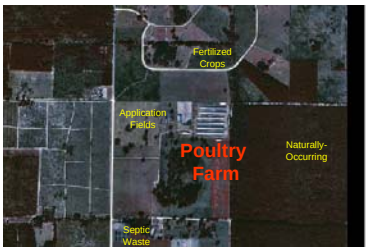
Project Title: Stable Isotopes and Tracers to Evaluate Source and Movement of Ground Water Contaminated by Nitrate (GWERD/EPA Region 4 RARE Project)

Project Officer: S. Hutchins

Project Period: 07/01/2005 - 06/30/2007

Long-Term Goal/APM: This is a Regional Applied Research Effort (RARE) project with EPA Region 4. Research addresses WQ MYP LTG2/APG 94. Specific APMs will be developed for this project.

Abstract: EPA Region 4 investigations have shown several private water supply wells to be contaminated with high concentrations of nitrate near animal feeding operations, including swine farms, poultry farms, and dairy farms. In the rural settings where the animal feeding operations and the private water supply wells are located, there are multiple potential sources of nitrogen in addition to the animal feeding operations. Some of the more common potential sources of nitrogen include over fertilized crop fields, improperly functioning septic tanks, and naturally occurring nitrogen. In order to address the private well contamination, a determination must be made regarding the source of the nitrogen. Extensive research has been conducted regarding the isotopic signature of swine waste and commercial fertilizer. Specifically, the δ15N isotope has been used by EPA Region 4 in conjunction with other ground water data to identify the source of nitrate contamination near swine farms. However, there is little information regarding the isotope signature of poultry and dairy farms.



The Water Management Division proposed a research effort to provide this much-needed data on the isotopic composition of poultry and dairy farms. EPA Region 4 will be involved in field activities to locate 8-10 specific sites within the southeastern U.S. for data collection. Once specific sites are located, field investigations will be conducted by EPA Region 4's Science and Ecosystem Support Division (SESD) based on a work plan developed in conjunction with EPA's Office of Research and Development's (ORD) Ground Water and Ecosystems Restoration Division (GWERD). Isotopes to be considered include δ15N and δ18O of nitrate, and δ18O of water. Isotope data will be analyzed and evaluated by the USGS Research Lab in Menlo Park, CA. In addition to the collection of isotopes, the field investigation will include collection of samples for analysis of nutrients and other water quality indicators by EPA Region 4 SESD, as well as collection of samples for analysis by GWERD for inorganic tracers, including metals, cations, and arsenic anions. Pending availability of funds, GWERD will also analyze samples for environmental estrogens expected to be present from poultry operations. Media sampled will include private water supply wells, ground water, and potential source(s). EPA Region 4 will use a Geoprobe© to take subsurface ground water samples in areas of interest and to fill data gaps. Water levels will be measured to construct subsurface water table elevation maps.

Status: EPA Region 4 RARE funding was approved Mar 2005, and funds have been allocated for the first year into contracts for field sampling and laboratory analyses, as well as an InterAgency Agreement with the USGS for isotope analyses.. EPA Region 4, GWERD, and USGS staff are working now to develop a project plan and sampling procedures. EPA Region 4 plans to conduct initial site screening Aug 2005 to select the study sites, and the project is expected to commence Sept 2005.

Products: Once the data analysis has been conducted a report on the results for each farm will be written by GWERD in conjunction with EPA Region 4. The report will focus on the isotope data collected for each site to determine the applicability of using isotope data for source tracking of nitrate at these farms. A peer-reviewed journal article is expected to be published jointly by EPA and USGS on the use of stable isotopes and other parameters for source tracking of nitrate from CAFO operations in general. In addition, results from this project are expected to be used to fill a critical information gap so that an EPA guidance document, to be produced by both EPA and USGS, can be used for practical source tracking of nitrate from CAFO operations.