Chemical Indicators of the Influence of Septic Tanks on Ground-Water Quality In Four Principal Aquifers In The United States

Brian G. Katz, U.S. Geological Survey, Tallahassee, FL, and
Sandra M. Eberts, U.S. Geological Survey, Columbus, OH

2007 Ground Water Protection Council Annual Forum, September 16-19, 2007, San Diego, CA.

Biographical Sketches
Brian G. Katz, PhD, is a research hydrologist with the U.S. Geological Survey in Tallahassee, Florida. During his career with the USGS, he has conducted numerous geochemical studies of processes that control the composition of natural and contaminated waters. His current research involves the use of isotopic and other chemical tracers to quantify hydrochemical interactions between ground water and surface water, and determine sources and chronology of contamination in karst and other aquifer systems.

Sandra Eberts is a Professional Hydrogeologist certified and registered by the American Institute of Hydrology. She has been with the U.S. Geological Survey for over 20 years and is currently team leader of the USGS National Water-Quality Assessment Program Transport of Anthropogenic and Natural Contaminants to Supply Wells (TANC) topical study. Prior to her work on the TANC study, Sandra spent 8 years as a USGS technical liaison to the U.S. Air Force for clean-up of ground-water contamination at weapons manufacturing facilities nationwide.

Abstract
The impact of septic tanks on the quality of ground water used for domestic and public water supply around the United States is being investigated using data collected during 1993-2005 from the U.S. Geological Survey National Water-Quality Assessment Program. Four study areas in principal aquifers of the U.S. (Central Valley, Floridan, Glacial Deposits in the Eastern U.S., and High Plains) were selected for an initial assessment, including water-quality samples from 123 monitoring, 62 public-supply, and 411 domestic wells. Statistical methods were used to determine the relation of major ions, nitrogen isotopes, oxidation-reduction conditions, volatile organic chemicals, and organic wastewater compounds with land use, soil, and hydrogeologic characteristics in a 500-meter radius circle around each well. Mass ratios of chloride to bromide (Cl/Br) relative to Cl and nitrate-nitrogen to chloride (NO_3N/Cl) indicated a range of values where the influence of septic tanks was discernable from other possible sources affecting water quality including agricultural chemicals, animal wastes, seawater, and road deicers. There were significant correlations ($p<0.01$) between the percent of housing units on septic tank systems (1990 census data) and chloride, trichloroethylene, and the Cl/Br.
In water samples collected near the water table to depths of 100 feet, the Glacial Deposits in the eastern U.S. and the northern High Plains aquifers had the highest number of wells that indicated the influence of septic tanks on ground-water quality. These results may reflect higher numbers of housing units using septic tanks, higher permeability of overlying sediments, more oxic conditions, and well sampling intervals closer to the water table in the eastern Glacial Deposits and northern High Plains compared to the Central Valley and Floridan aquifer study areas.