Assessing Contaminant Movement and Age of Water In The Contributing Recharge Area

For a Public Supply Well in the Karstic Upper Floridan Aquifer

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Multiple isotopic and other chemical tracers were used to assess contaminant movement and age of ground water within a contributing recharge area to a public supply well (PSW) near Tampa, Florida, as part of the U.S. Geological Survey National Water Quality Assessment Program. During 2003-2006, water samples were collected from the PSW and 28 monitoring wells in the karstic Upper Floridan aquifer (UFA) and the overlying surficial aquifer system (SAS). Six volatile organic compounds and four pesticides were detected in trace concentrations in water from the PSW, which taps the UFA with an open interval from 39-53 m below land surface (bls). These contaminants were detected more frequently in water samples from 11 monitoring wells in the SAS than in water from 13 monitoring wells in the UFA in the PSW contributing recharge area. Also, nitrate-N concentrations in the PSW (0.72-1.4 mg/L) were more similar to median concentrations in the oxic SAS (2.1 mg/L) than the anoxic UFA (0.06 mg/L). Elevated concentrations of ^{222}Rn and uranium in the PSW appear to originate from water moving downward through sands and discontinuous clay lenses that overlie the UFA. Concentrations of the transient age tracers, SF_6 and $^3H/^3He$, in water from the SAS indicated recent recharge (0-7 years), but tracer concentrations in water from monitoring wells and the PSW in the anoxic UFA were consistent with binary mixtures that contained varying amounts of recent recharge and tracer-free water (>50 years). Although ground-water age generally increased with depth in the UFA, monitoring wells that tapped a highly transmissive zone at 43-49 m (bls) had higher fractions of young water than water from wells in the UFA at shallower depths. Geochemical mass-balance mixing models for the PSW indicate a 40-60% contribution of water from the SAS based on isotopic indicators and ground-water age data, and indicate the high vulnerability of the UFA to contamination from anthropogenic activities at the land surface.

Keywords: ground-water contamination, Upper Floridan aquifer, ground-water age, public supply wells, nitrate

Challenges and Issues: Public Health, wildlife health, and water resource sustainability; Sources and impacts of emerging contaminants