**Man-made Pollutants Finding Their Way Into Groundwater Through Septic Systems**



**TROY, NY**. -- Pharmaceuticals, hormones and personal care products associated with everyday household activities are finding their way into groundwater through septic systems in New York and New England, according to the U.S. Geological Survey.

“Septic systems nationwide are receiving increased attention as environmental sources of chemical contamination,” said USGS scientist Patrick Phillips, lead author of the study published in the journal *Science of the Total Environment*.

Two different well networks were studied, one in New England and the other in New York, looking for micropollutants in groundwater samples collected downgradient of septic systems.  “Downgradient” is the term used for how groundwater flows under the ground, and is a similar term to “downstream” when describing surface water. The scientists tested for items such as pharmaceuticals, personal care products, and plasticizer compounds (which make things more flexible).

“High nitrate concentrations in groundwater samples downgradient of septic systems in both these regions led us to investigate what other chemicals might also be present,” said Phillips.

Septic systems are common in areas lacking connection to larger scale sewage treatment, such as a sewer.  Septic systems consist of holding tank (usually below ground) where raw sewage collects and separates into a sludge (solid) and liquid effluent.  The liquid effluent either leaches directly into the surrounding soil or goes into a leach field for final treatment by the soil. The liquid effluent from septic systems ultimately moves into the groundwater.

Septic systems have been identified as the source of a variety of micropollutants in groundwater.  In New York, groundwater samples were collected from a barrier island with a dense (5 dwellings/acre) summer population.  These New York septic systems have minimal treatment of wastewater before mixing with shallow groundwater that moves towards a large, sensitive estuary where a decline in fisheries and shellfish along with a higher ratio of female-to-male fish have been reported.  Shallow groundwater samples collected along the beach of this estuary downgradient of the septic systems were found to have hormones; detergent degradation products; galaxolide, a fragrance found in various products; insect repellent; sunscreen additives; floor cleaner; and two pharmaceuticals (lidocaine, a local anesthetic; and carbamazepine, an anti-convulsant and mood stabilizing drug).

In New England, groundwater samples were collected from below a septic system leachbed   serving an elderly-care 65-bed nursing home and from wells downgradient of this leachbed.  Numerous prescription pharmaceuticals were found in the groundwater samples, such as anesthetics; a muscle relaxant; an antifungal; an antiepileptic; an antibiotic; a sleep aid; and also a floor cleaner.

Natural groundwater flow in this area could transport these contaminants toward areas used for a drinking water supply.

Results from both groundwater networks indicate that septic systems are sources for a variety of micropollutants to groundwater and surface water that potentially affect environmental ecosystems and even drinking water.  Land-use, in particular, is one of the deciding factors that control the type of contaminants entering the groundwater system.  This study found that monitoring for micropollutants, such as pharmaceuticals, hormones, and personal care products in areas experiencing high nitrogen levels was important to understanding the breadth of contaminants present in groundwater and surface-water resources.

This study also presents some of the first results from a new pharmaceutical method developed by the USGS National Water Quality Laboratory that determines more than 100 pharmaceuticals, pharmaceutical degradates and related contaminants.  This method is highly sensitive, with method detection limits for many compounds in the low nanogram-per-liter range, and significantly advances the abilities of the USGS to assess the presence and concentrations of pharmaceuticals in the environment.

The paper, “[Concentrations of hormones, pharmaceuticals and other micropollutants in groundwater affected by septic systems in New England and New York](http://www.sciencedirect.com/science/article/pii/S0048969714017690)” has been published in *Science of the Total Environment* To learn more about USGS environmental health science, please visit the [USGS Environmental Health website](http://www.usgs.gov/envirohealth/geohealth/index.html) and sign up for our [GeoHealth Newsletter](http://www.usgs.gov/envirohealth/geohealth/index.html).