



Water Quality of Potential Concern in US Private Wells

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More than 20 percent of private domestic wells sampled nationwide contain at least one contaminant at levels of potential health concern, according to a study by the U.S. Geological Survey (USGS).

About 43 million people - or 15 percent of the Nation's population - use drinking water from private wells, which are not regulated by the Federal Safe Drinking Water Act.

USGS scientists sampled about 2,100 private wells in 48 states and found that the contaminants most frequently measured at concentrations of potential health concern were inorganic contaminants, including radon and arsenic. These contaminants are mostly derived from the natural geologic materials that make up the aquifers from which well water is drawn. Complete findings are available [online](#).

Nitrate was the most common inorganic contaminant derived from man-made sources-such as from fertilizer applications and septic-tanks-that was found at concentrations greater than the Federal drinking-water standard for public-water supplies (10 parts per million). Nitrate was greater than the standard in about 4 percent of sampled wells.

The study shows that the occurrence of selected contaminants varies across the country, often following distinct geographic patterns related to geology, geochemical conditions, and land use. For example, elevated concentrations of nitrate were largely associated with intensively farmed land, such as in parts of the Midwest Corn Belt and the Central Valley of California. Radon was found at relatively high concentrations in crystalline-rock aquifers in the Northeast, in the central and southern Appalachians, and in central Colorado.

"The results of this study are important because they show that a large number of people may be unknowingly affected," said Matt Larsen, USGS Associate Director for Water. "Greater attention to the quality of drinking water from private wells and continued public education are important steps toward the goal of protecting public health."

The USGS sampled private wells from 1991 to 2004 in 30 of the Nation's principal aquifers used for water supply. As many as 219 properties and contaminants, including pH, major ions, nutrients, radionuclides, trace elements, pesticides, volatile organic compounds, and microbial contaminants, were measured. Sampled water was taken from private wells before any home treatment.

Other contaminants found in the private wells were man-made organics, including herbicides, insecticides, solvents, disinfection by-products, and gasoline chemicals. Few organic contaminants (7 out of 168) exceeded health benchmarks, and were found above health benchmarks in less than 1 percent of sampled wells. Organic contaminants were detected at

lower concentrations in more than half (60 percent) of sampled wells, indicating that a variety of contaminant sources-including agricultural, residential, and industrial-can affect the quality of water from private wells. The study measured organic chemicals at very low concentrations-often well below human-health benchmarks-in order to assess occurrence and sources; detections do not necessarily indicate human-health concerns.

Contaminants found in private wells usually co-occurred with other contaminants as mixtures rather than alone, which can be a concern because the total combined toxicity of contaminant mixtures can be greater than that of any single contaminant. Mixtures of contaminants at relatively low concentrations were found in the majority of wells, but mixtures with multiple contaminants above health benchmarks were uncommon (about 4 percent). The USGS report identifies the need for continued research because relatively little is known about the potential health effects of most mixtures of contaminants, and the additive or synergistic effects on human health of mixtures of man-made chemicals at low levels are not well understood.

Bacteria, including total coliform bacteria and *Escherichia coli*, were found in as many as one third of a subset of 400 wells. These bacteria are typically not harmful but can be an indicator of fecal contamination. About half of the 2,100 sampled wells had at least one property or contaminant outside recommended ranges for cosmetic or aesthetic purposes, such as total dissolved solids, pH, iron, and manganese.

Human-health benchmarks used in the study included drinking-water standards for contaminants regulated under the Federal Safe Drinking Water Act and non-enforceable USGS Health-Based Screening Levels (HBSLs) for unregulated contaminants, developed by USGS in collaboration with the U.S. Environmental Protection Agency. About half of the wells deemed to have potential health concerns had concentrations greater than Maximum Contaminant Levels specified by the Safe Drinking Water Act for public-water supplies. In relating measured concentrations to health benchmarks, this study offers a preliminary assessment of potential health concerns that identifies conditions that may require further investigation. The research is not a substitute for comprehensive risk and toxicity assessments.

Private well owners, who generally are responsible for testing the quality of their well water and treating, if necessary, can contact local and State health agencies for guidance and information about well maintenance and siting, water quality and testing options, and in-home water treatment devices. Access the [Quality of Water from Domestic Wells in the United States Web site](#) for related links to sources of information and recommendations for private well owners.