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Quality of Water from Public-Supply Wells in the United States, 1993–2007—*Overview of Major Findings*

About 105 million people—more than one-third of the Nation's population—receive their drinking water from one of the 140,000 public water systems across the United States that rely on groundwater pumped from wells.

USGS scientists assessed water quality in source (untreated) water from 932 public-supply wells (referred to as public wells), and in finished (treated) and source water from 94 of these wells. The USGS study focused primarily on "source" water before treatment or blending and describes the occurrence of naturally occurring and man-made contaminants in source water from public wells and their potential significance to human health.

Selected Findings and Implications

- More than one in five (22 percent) source-water samples from public wells contained at least one contaminant at concentrations greater than greater than levels of human health concern (human-health benchmarks). Source water from these wells may require treatment or blending with higher quality water to decrease contaminant concentrations below levels of potential human-health concern.
- Contaminants from natural sources accounted for about three-quarters (74 percent) of the contaminant concentrations that were greater than human-health benchmarks in source-water samples.
- Traditional wellhead protection approaches designed to reduce man-made sources of contaminants to groundwater are not designed to protect against natural sources of contaminants, thus concentrations of naturally occurring contaminants are unlikely to be reduced by these approaches.
- Contaminants that originate primarily from man-made sources were detected in nearly two-thirds of the source-water samples, predominantly from unconfined aquifers, and accounted for about one-quarter (25 percent) of contaminant concentrations greater than human-health benchmarks.
- Findings for finished (treated) water from the subset of 94 public wells showed that contaminants detected in source water often were detected in finished water. However, contaminants detected in both treated and source water were often less than one-tenth of human-health benchmarks and many of the detections were several orders of magnitude less than benchmarks.
- Contaminants seldom occurred alone in source and finished water, but rather co-occurred with other contaminants. These mixtures of two or more contaminants at concentrations approaching human-health benchmarks were dominated by inorganic, naturally occurring contaminants. Mixtures with the greatest number of contaminants were most often detected in samples from unconfined aquifers. This study identifies which contaminant mixtures may be of most concern in groundwater used for public-water supply and can help human-health researchers target and prioritize toxicity assessments of contaminant mixtures.
- Sampled wells are located in 41 States and withdraw water from parts of 30 regionally extensive aquifers that constitute about one-half of the principal aquifers used for water supply in the United States. Natural and man-made contaminants were detected in source water at concentrations greater than human-health benchmarks in at least one well in each of the principal-aquifer rock types included in the study, indicating that wells in all 30 of the principal-aquifer rock types studied may be vulnerable to contamination.
- The frequent detections of man-made contaminants in samples from aquifers used for public water supply indicate the vulnerability of many water-supply aquifers to contamination from human activities at the land surface. This finding underscores the importance of wellhead protection programs designed to reduce groundwater contamination from man-made sources.

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Briefing sheet prepared for a Congressional briefing in Washington, D.C. on May 21, 2010

Study Context

- Although wells sampled in this study represent less than 1 percent of all groundwater-supplied public water systems in the United States, they are widely distributed nationally and were randomly selected to represent typical aquifer conditions within the sampled hydrogeologic settings.
- Scientists tested water samples for as many as 337 properties and chemical contaminants, such as pH, major ions, nutrients, radionuclides, trace elements, pesticides, solvents, gasoline hydrocarbons, disinfection by-products, and manufacturing additives. This study did not look at pharmaceuticals or hormones.
- Eighty-three percent (279) of the contaminants analyzed in this study are not regulated by USEPA in finished drinking water. The USEPA uses USGS data on the occurrence of unregulated contaminants to fulfill part of the SDWA requirements for determining whether specific contaminants should be regulated in drinking water in the future.
- All source-water samples were collected prior to any treatment or blending that potentially could alter contaminant concentrations. As a result, the sampled groundwater represents the quality of the source water and not necessarily the quality of finished water ingested by the population served by these public wells.
- By focusing primarily on source-water quality, and by testing for many contaminants that are not regulated in drinking water, the findings are intended to complement the extensive monitoring of public water systems that is routinely conducted for regulatory and compliance purposes by federal, state, and local drinking-water programs. In addition, also can help water utility managers and regulators in making decisions about future monitoring needs and drinking-water issues.
- To place study results in the context of human health, concentrations of contaminants that are regulated by the U.S. Environmental Protection Agency (USEPA) in drinking water under the Safe Drinking Water Act (SDWA) were compared to regulatory Maximum Contaminant Levels, and concentrations of unregulated contaminants were compared to non-regulatory USGS Health-Based Screening Levels (HBSLs). HBSLs were developed by the USGS in collaboration with the USEPA and others.
- Comparisons of measured concentrations to human-health benchmarks provide an initial perspective on the potential significance of detected contaminants to human health and help to prioritize further investigations. Such comparisons are not a substitute for comprehensive risk and toxicity assessments. More information is needed on the potential health effects of individual contaminants that do not have benchmarks because of insufficient toxicity data. Research also is needed on the potential health effects of contaminant mixtures; possible additive or synergistic effects of mixtures of compounds at low levels are not well understood.
- This study was implemented by the National Water Quality Assessment (NAWQA) Program, which was initiated in 1991 to support national, regional, State, and local information needs and decisions related to water-quality management and policy. By combining information on water chemistry, hydrology, and physical characteristics of aquifers, the NAWQA Program aims to provide science-based insights for current and emerging water issues and priorities. Companion NAWQA studies on the transport of contaminants to public wells are online at http://oh.water.usgs.gov/tanc/NAWQATANC.htm. In addition, a comparable study on the quality of water in domestic wells is online at http://water.usgs.gov/nawqa/studies/domestic_wells/.

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Visit our web site to access more USGS information on the quality of water in public wells at
http://water.usgs.gov/nawqa/studies/public_wells/

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