STATEMENT
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Madam Chairman and Committee members, I appreciate the opportunity to appear before the Committee on Environment and Public Works to testify on the findings of U.S. Geological Survey (USGS) studies of drinking water quality and related issues. I am Matthew C. Larsen, Associate Director for Water at the USGS.

The USGS serves the Nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life. Assessment of water-quality conditions and research on the transport and fate of pollutants in the hydrologic cycle are important parts of this mission. For decades, USGS studies of water quality have focused on the natural environment – streams and aquifers. Because of recent increased interest in potential human exposure to contaminants through drinking water, the USGS has increased its focus on studies of water quality in domestic wells, untreated water at the intakes of drinking water treatment facilities ("source" waters), and more recently on treated ("finished") drinking water. As part of these studies, the USGS has also increased its coordination with other Federal agencies that have formal public health responsibility, including the U.S. Environmental Protection Agency (USEPA), the Centers for Disease Control and Prevention, and others, by sharing information and lending its expertise to the interpretation of linkages between environmental data and human exposure. The following statement provides an overview and examples of these activities.

Water Quality of the Nation's Streams and Aquifers

The USGS has conducted systematic investigations of the quality of the Nation's water resources since the early 20th century. Much of these data are archived in the USGS National Water Information System and are accessible on the Internet via NWISWeb. These data have provided a valuable source of information on water-quality conditions for drinking water managers.

In the late 1990s, the USGS conducted a retrospective data analysis of arsenic occurrence in thousands of wells across the Nation, including community and domestic drinking water wells and observation wells (Focazio and others, 1999). The results showed regional patterns in arsenic occurrence and the relative proportion of wells above threshold arsenic concentrations. The information was used by the USEPA in revising the arsenic drinking-water quality standard (referred to as the Maximum Contaminant Level or MCL), which occurred in 2000.

Today, the USGS conducts national-scale assessments of the occurrence and behavior of contaminants in streams and groundwater of the United States. These assessments evaluate the potential for contaminants such as volatile organic compounds (VOCs) and pesticides (Zogorski and others, 2006; Gilliom and others, 2006) to adversely affect aquatic ecosystems or drinking-water supplies. Many of the contaminants investigated are unregulated. In addition, the USGS helps identify contaminants of emerging environmental concern by developing new methods and providing the first information on environmental occurrence, sources, persistence, and potential ecological effects (Kolpin and others, 2002; Focazio and others, 2008; Blazer and others, 2007; Vajda and others, 2008). The information from these studies is provided to USEPA for use in drinking water protection, including for implementing the Unregulated Contaminant Monitoring Rule (UCMR) and Contaminant Candidate List (CCL).

Source Water Quality

Motivated by the susceptibility of groundwater supplies to naturally occurring radionuclides, the USGS investigated the occurrence of radionuclides including Ra-224, Ra-226, Ra-228, Po-210, and Pb-210 in untreated water from community supply wells (Focazio and others, 1998). The data were provided to USEPA and assisted in determining revisions for combined-radium MCL compliance monitoring and prioritization for the Unregulated Contaminant Monitoring Rule.

A national reconnaissance of emerging contaminants in streams and groundwater at drinking water intakes (Focazio and others, 2008) provided the first nationally consistent dataset on the occurrence of pharmaceuticals, personal care products, and other wastewater-associated chemicals in untreated drinking water. Seventy-five community drinking-water facilities were sampled from 25 States and Puerto Rico. Stream samples from this study were analyzed for correlations between a range of wastewater-related chemicals and pathogenic bacteria (Haack and others, 2009). Some chemicals are consistently present when fecal contaminants are present and may serve as cost-efficient chemical indicators of contamination by bacterial pathogens.

In 2009, a USGS report described the occurrence of 258 synthetic chemicals in untreated water from 221 wells in community water systems (Hopple and others, 2009). One hundred and twenty chemicals were detected in at least one sample; 52 of the 120 were detected only once. . Twelve chemicals were detected in about 10 percent or more of the samples. The study provided knowledge of the most commonly detected chemicals (for example, some pesticides and chemicals used in personal care products) and the factors that affect the vulnerability of wells.

In a more comprehensive study of 1,096 samples of untreated water from community supply wells (Zogorski and others, 2006), one or more VOCs was detected in about one-fourth of samples. About three-fourths of the 55 VOCs tested for were detected. Multiple VOCs were detected in about one-half of the samples; total VOC concentrations were less than 1 part per billion. Trihalomethanes (disinfection byproducts such as chloroform) and solvents had the largest detection frequencies (15 and 10 percent, respectively), and gasoline oxygenates, predominantly MTBE, occurred in about 5 percent of the samples. All other groups were detected in about 3 percent or less of the samples. Spatial patterns of occurrence differed for VOC classes. Detections of solvents, trihalomethanes, and gasoline hydrocarbons were distributed throughout the Nation. Gasoline oxygenates were detected primarily in the New England and Mid-Atlantic States and in Florida and California. Detections of fumigants were predominantly in Hawaii and in the eastern coastal area of the United States.

Water Quality of Domestic Wells

Approximately 43 million Americans get their drinking water from self-supplied sources, the vast majority is from domestic wells (Kenny and others, 2009). The quality of water from domestic wells which serve fewer than 25 persons is not protected by the Safe Drinking Water Act. However, information on factors that affect the quality of water from these wells can help well owners make good choices regarding installing their wells and voluntary periodic testing of water quality.

In a study of 2,401 domestic well samples, one or more VOCs was detected in 14 percent of the wells. More than two-thirds of the monitored VOCs were detected, and about 90 percent of the samples had total VOC concentrations less than 1 part per billion (Zogorski and others, 2006). The 15 most frequently detected VOCs indicate multiple contaminant sources, with gasoline oxygenates, refrigerants, solvents, and trihalomethanes detected in more than 2 percent of the domestic well samples. Chloroform, a disinfection byproduct, had the largest detection frequency, almost double that of MTBE, the second most frequently detected VOC. Solvents were detected throughout the Nation. Gasoline oxygenates were detected most frequently in the New England and Mid-Atlantic States. Few samples contained fumigants, and most of these occurred in the Central Valley of California and in New Jersey, Arizona, and Washington.

The USGS published a retrospective analysis of the chemical quality of almost 19,000 privately owned drinking water wells throughout the United States (Focazio and others, 2006). The study found that naturally occurring inorganics (such as arsenic) exceeded human-health benchmarks (MCLs) more frequently than any other contaminant group, including pesticides and VOCs.

Another USGS study of domestic well-water quality found that 23 percent of 1,389 domestic wells sampled exceeded a human-health benchmark for at least one chemical (DeSimone and others, 2009). Again, the contaminants that exceeded human health benchmarks most often were inorganic chemicals, including radon, arsenic, uranium, nitrate and fluoride. All but nitrate are predominantly naturally occurring. Only 7 of the 168 organic compounds that were analyzed—three pesticides, two solvents, and two fumigants—were found in one or more wells at concentrations greater than human-health benchmarks, and they were found above benchmark levels in less than 1 percent of sampled wells. About half (48 percent) of the sampled wells contained at least one contaminant at a level outside the range of values recommended by USEPA National Secondary Drinking Water Standards, non-enforceable guidelines largely for aesthetic, plumbing, and other purposes.

Community Drinking Water Quality

The Safe Drinking Water Act (SDWA) protects community drinking water quality through a process of establishing water quality standards (acceptable levels) for specific chemicals and periodic monitoring of supplied water. USGS studies of finished drinking-water quality are relatively new and very modest in comparison to studies of source water. This information is intended to inform the SDWA process primarily by providing information on the occurrence of unregulated chemicals in finished drinking water. Although the presence of a chemical alone may not be sufficient to warrant regulation, information on the levels and mixtures of chemicals that persist after drinking water treatment is essential to that process. All data on drinking water quality that the USGS develops are shared with USEPA and made available to the public. The types of water treatment utilized by community water systems often are not designed to remove the unregulated or emerging contaminants being tested. Therefore, results of these studies provide a starting point for development of improved treatment alternatives.

A USGS study of source and finished drinking water at 9 stream intakes detected 134 of 258 organic compounds analyzed (Kingsbury and others, 2008); this study did not include pharmaceuticals and hormones. Concentrations generally were less than 1 part per billion, and annual mean concentrations of all compounds were less than available human-health benchmarks. The most commonly detected compounds in source water were a disinfection by-product, several herbicides, a herbicide degradation byproduct, and a musk fragrance. The number of compounds detected and their total concentration were largest at source-water withdrawal sites for community water systems with considerable agricultural and urban land in their watersheds. Most of the compounds detected commonly in source water also were detected in finished-water samples at similar or lower concentrations and almost always at concentrations less than available human-health benchmarks.

Late last week, the USGS released a report on selected man-made compounds in water sampled from community water systems across the Nation that are supplied by groundwater (Hopple and others, 2009); this study also did not include pharmaceuticals and hormones. Concentrations of 258 manmade organic compounds in finished water, sampled at 94 systems, were always less than human-health benchmarks. The chemicals tested included pesticides and pesticide degradates, gasoline hydrocarbons, personal-care and domestic-use products, and solvents. USGS findings documented the occurrence of mixtures of organic compounds in the majority (greater than 55 percent) of source and treated water samples, which is an area for further consideration as the potential human-health significance from the low-level presence of chemical mixtures in drinking water remains largely unknown.

Currently, the USGS is working with USEPA to conduct a national assessment of over 200 emerging environmental contaminants in finished drinking water at community water systems across the United States. The chemicals that will be tested include prescription and nonprescription pharmaceuticals and their metabolites (the modified chemical form in which the drug leaves the body), hormones, perfluorinated compounds, fragrances, detergent byproducts, chlorinated flame retardants, and other household and industrial chemicals.

The USGS also works closely with individual drinking-water purveyors to provide information for use in resource planning and management and to coordinate communication of information to the public in an objective and understandable manner. For example, the USGS worked with the U.S. Army Corps of Engineers, which manages the Washington Aqueduct, one of several community water systems on the Potomac River upstream from Washington, D.C. The study provided information on the occurrence of 277 chemicals in source and finished water samples collected approximately monthly over the period 2003-05 (Brayton and others, 2008).

Understanding the Potential for Contaminants to Persist to Finished Drinking Water

The USGS provides a wide range of information and knowledge related to the chemical contaminants that persist in the environment, are transported to drinking water intakes, and resist removal during drinking water treatment. This information also is essential for assessing and designing monitoring programs and prioritizing chemicals for studies of potential human health effects.

Study results show that some hormonally active chemicals that enter streams with wastewater effluent are degraded under a range of naturally occurring conditions and do not persist downstream, while other chemicals may not be removed (Bradley and others, 2009). Another study evaluated the transport of hormonally active chemicals in groundwater (Barber and others, 2008). Understanding the natural assimilative capacities of streams and aquifers – their natural capacity to reduce the levels of potentially harmful chemicals to harmless forms – is essential to making wise decisions related to the potential effects of hormonally active chemicals in sources of drinking water and mitigation measures.

The USGS is providing knowledge of the stream and groundwater source areas of community drinking water supplies. Developing and applying methodologies for estimating the land area that contributes recharge ultimately flowing to community supply wells enables resource managers to design improved well-head protection strategies (Franke and others, 1998; Masterson and Walter, 2009). Other detailed studies of the pathways of contaminants to community supply wells have identified the importance of age distribution of groundwater discharging to a community supply well and the importance of short-circuit pathways to deeper water supply aquifers, such as breaches in confining layers (Landon and others, 2009; McMahon and others, 2008).

Working with Public Health Agencies and Scientists

The USGS also collaborates with public health scientists and agencies on local and regional studies of diseases that may be attributed to drinking water exposures. The USGS can provide insights into the landscape and hydrogeologic factors that may affect human exposure to environmental contaminants in drinking water and may improve studies that explore linkages between chemicals in the environment and health outcomes.

For example, a modeling study of the probability of arsenic occurrence in New England groundwater (Ayotte and others, 2006) is being used in collaboration with the National Cancer Institute and others to assess potential linkages between arsenic in drinking water and bladder cancer in the population. The study shows that parts of New England have arsenic in the groundwater at levels far exceeding the MCL. This ongoing work has produced a number of regional water-quality databases, as well as a map of the probability of encountering arsenic in groundwater at levels above the MCL.

USGS research also is helping to explore possible linkages between lignite aquifers, pathogenic microbes, and renal pelvic cancer in northwestern Louisiana (Bunnell and others, 2006). Drinking water was sampled and analyzed for a range of chemical and microbial contaminants and correlations were identified with incidence of renal pelvic cancers.

Drinking-water quality was also assessed in association with a leukemia cluster in Nevada (Seiler, 2004). Groundwater used as a source of drinking water in an area with high incidence of leukemia was sampled and analyzed for a range of contaminants, including radionuclides. Uranium, polonium, and other potential carcinogens were found at concentrations of human-health concern.

Finally, USGS investigations at a drinking-water treatment facility in New Jersey described the changes in concentrations of emerging contaminants from the source water through multiple stages of the treatment process (Stackelberg and others, 2004, 2007). Additional investigations like this one will inform decisions on improving existing and developing new treatment works that are more efficient at removing these chemicals from source waters (the sources of drinking water).

While traditionally USGS studies have had great emphasis on the quality of our streams, lakes, and aquifers, there is a significant need for the information on the quality of source and finished drinking water and understanding of the landscape and hydrogeologic factors that affect that quality. The primary USGS contribution to drinking-water management and protection is providing information on unregulated and emerging environmental contaminants and working closely with resource managers and regulators, community water-supply system managers, and the public to ensure that they have access to and understanding of that information.

This statement provides a brief overview of USGS activities related to drinking-water quality. We welcome the opportunity to provide any further information or assistance to the Committee.

Thank you, Madam Chairman, for the opportunity to present this testimony, and I will be pleased to answer questions you and other Members might have.

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