A Reality Check on Water Monitoring

Pixie A. Hamilton[1] and Timothy L. Miller[2]

[1] USGS, 1730 E. Parham Road, Richmond, VA 23228
[2] USGS, 413 National Center, Reston, VA 20192

Biographical Sketches of Authors

Pixie Hamilton has worked as a hydrologist for the USGS since 1984, primarily doing regional ground-water modeling and regional and national water-quality assessments. She currently serves as a Staff Hydrologist and Water Information Coordinator for the National Water-Quality Assessment (NAWQA) Program, which assesses water-quality conditions and trends in some of the nation's most important streams and aquifers. Her current emphasis largely is on communicating research and technical implications of NAWQA information to government, research, and interest-group partners in order to help guide water-resource management and protection strategies and policy.

Mr. Miller has worked for the USGS more than 25 years in both Oregon and at the National Center, Reston Virginia. His academic background included degrees in Mathematics and Engineering. His field experience has included water-quality studies of urban runoff, ground-water quality, atmospheric deposition, and dissolved oxygen modeling in riverine systems. For the past 9 years, he served as the Chief of the National Water-Quality Assessment (NAWQA) Program, which is an assessment of the most important streams and aquifers in the Nation. Mr. Miller currently serves as the Chief of all USGS water-quality programs.

Abstract

The National Water-Quality Assessment (NAWQA) of the U.S. Geological Survey (USGS) has completed its first decade of studies in 51 of the Nation's major river basins and aquifers, documenting complex contaminant patterns that have important implications for water-resource monitoring. Studies show the prevalent occurrence of complex mixtures of volatile organic compounds, nutrients, pesticides, and their chemical breakdown products in streams and ground water in basins with significant agricultural or urban development. Exposure is complicated by lengthy periods of low concentrations punctuated by brief seasonal or storm-event pulses of much higher concentrations. Water-quality patterns show low-level detection of new and emerging contaminants (such as hormones and pharmaceutical compounds), as well as the legacy of persistent compounds used historically (such as DDT). In addition, findings demonstrate the significant dual role of chemical contamination with physical disturbance to stream habitat in the degradation of aquatic communities. Overall patterns reflect the controlling importance of natural features and land practices that make some watersheds more vulnerable to degradation than others over time.

NAWQA's findings demonstrate the need for improved monitoring that better recognizes spatial and temporal complexities in contaminant occurrence and exposure (including mixtures, breakdown products, and seasonal pulses); interrelations among water, land, and aquatic communities; the importance of land and chemical use, natural features, and management practices that control degradation; and, the need for multiple sampling and long-term monitoring for successful solutions and evaluation. Such changing expectations for monitoring are critical for cost-effective water-resource management, standards, and policies at local, state, and national levels.