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National Water-Quality Assessment Program— Assessing the Vulnerability of Public-Supply Wells to Contamination

In 2001, the National Water-Quality Assessment (NAWQA) Program of the U.S. Geological Survey began to assess the vulnerability of public-supply wells to contamination. Public-supply wells are the source of drinking water for about one-third of Americans.

The contaminants being assessed have been detected in water-supply aquifers, usually at levels below existing drinking-water standards. These include the naturally occurring elements arsenic and uranium, and anthropogenic contaminants such as nitrate, pesticides and their breakdown products, compounds found in wastewater, and volatile organic compounds (VOCs), including disinfection by-products.

The study involves more than 900 public-supply wells within major water-supply aquifers in western (California, Nevada, Utah), central (Colorado, Nebraska), and eastern (Connecticut, Florida, and Ohio) States. In 2005, wells in Texas and New Mexico, and contaminants such as waterborne pathogens, will be added. Wells in Illinois, New Jersey, and New York are scheduled to be incorporated in 2009.

The current study of supply-well vulnerability follows up on findings of 1991–2001 NAWQA studies, in which low levels of a mixture of contaminants were detected in ground water just below the water table in agricultural and urban areas across the Nation. For example, VOCs such as chloroform and the gasoline oxygenate methyl *tert*-butyl ether (MTBE) were detected in about 90 percent of samples from monitoring wells in urban areas (Hamilton and others, 2004).

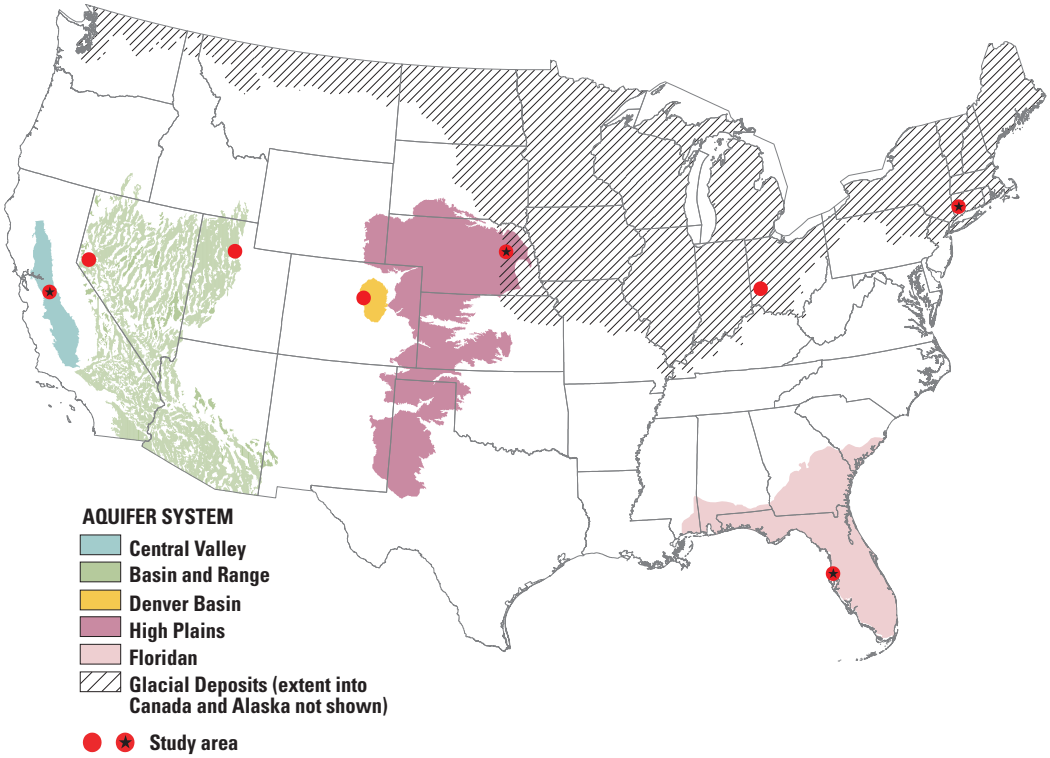
Sinkholes, such as this one in Tampa, Fla., can act as conduits for surface contaminants to reach the underlying aquifer.

The study will increase our understanding of the transport and transformation (breakdown) of contaminants as ground water flows from the water table to public-supply wells in various water-supply aquifers. The study will also increase our understanding of the most important factors affecting the linkage between contaminant sources and public-supply wells—factors such as aquifer characteristics or the amount of pumping at a given well— and provide insight into how better to assess the vulnerability of drinking-water supplies. In NAWQA studies in eastern New England, for example, VOCs were detected more frequently in water-supply wells in sand and gravel aquifers than in bedrock aquifers (Robinson and others, 2004). In the Great Miami River Basin, pesticides were detected more frequently in public-supply wells near streams than in shallower domestic wells, likely because of pumping-induced infiltration of stream water (Rowe and others, 2004).

General objectives of the study

- Identify dominant sources of natural and anthropogenic contaminants in public-supply wells.
- Assess the effects of natural factors (such as hydrogeologic features, see photo) and human activities (such as well construction, pumping, and well-field management) on contaminant occurrence in public-supply wells.
- Develop tools, such as screening models, that incorporate key natural and human factors affecting the transport and transformation of contaminants from sources to public-supply wells. The tools will be useful for extrapolating study findings to unmonitored areas.
- Provide information on water-resource development and management strategies that can lead to effective management of contamination problems affecting public-supply wells.

See map and contact information on back



Studies of contaminant transport began in 2001 in eight States. Stars indicate where the most intensive studies of representative public-supply wells within major water-supply aquifers are occurring. Studies will begin in Texas and New Mexico in 2005 and are scheduled to begin in Illinois, New Jersey, and New York in 2009.

How this information can be used

Study findings, models, and other decision-support tools will be useful to water managers and scientists to:

- Increase understanding of why and how contamination of public-supply wells occurs;
- Improve assessments of the vulnerability of ground water and public-supply wells to contamination, including in unmonitored areas;
- Be applicable to broad classes of contaminants and thus to newly identified, emerging contaminants;
- Help with choosing new sites for water supply and with developing and prioritizing monitoring programs; and
- Identify well construction and well-field management methods that may reduce/prevent future contamination.

National priority issues are being investigated

In the NAWQA Program's second decade that began in 2001, selected basins are being revisited. Long-term trends and factors affecting water quality and aquatic health are being assessed, as well as issues identified as national priorities: (1) transport of contaminants to public-supply wells, (2) effects of urbanization on stream ecosystems (USGS Fact Sheet 042-02), (3) ecological effects of nutrient enrichment (USGS Fact Sheet 118-03), (4) mercury in stream ecosystems (USGS Fact Sheet 016-03), and (5) sources, transport, and fate of agricultural chemicals (USGS Fact Sheet 2004-3098).

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For online information, reports, and data:

http://water.usgs.gov/nawqa

References

Hamilton, P.A., Miller, T.L., and Myers, D.N., 2004: Water quality in the Nation's streams and aquifers—Overview of selected findings, 1991-2001: U. S. Geological Survey Circular 1265, 20 p.

Robinson, K.W., Flanagan, S.M., Ayotte, J.D., Campo, K.W., Chalmers, Ann, Coles, J.F., and Cuffney, T.F., 2004: Water quality in the New England Coastal Basins, Maine, New Hampshire, Massachusetts, and Rhode Island, 1999-2001: U.S. Geological Survey Circular 1226, 38 p.

Rowe, G. L., Jr., Reutter, D.C., Runkle, D.L. Hambrook, J.A., Janosy, S.D., and Hwang, L.H., 2004: Water quality in the Great and Little Miami River Basins, Ohio and Indiana, 1999-2001: U.S. Geological Survey Circular 1229, 40 p.