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Pesticides in Selected Water-Supply Reservoirs and Finished Drinking Water

In 1999, the National Water-Quality Assessment Program (NAWQA) and U.S. Environmental Protection Agency (EPA) initiated a 2-year "Pilot Monitoring Program" for assessment of pesticide concentrations in drinking water. In support of EPA's responsibility under the Food Quality Protection Act of 1996, the program was designed as a first step towards a long-term goal of characterizing human exposure to pesticide residues in drinking water derived from surface-water sources. Reservoirs were selected for sampling because they are important sources of drinking water and because they integrate pesticide loadings within their watersheds.

Twelve water-supply reservoirs and Community Water Systems (CWSs) were sampled, ranging in size from 120 to 92,600 acre-foot normal capacity, with contributing watersheds ranging from about 3 to 785 square miles. The sites are located in California, Indiana, Louisiana, Missouri, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, and Texas. Samples were collected from the raw-water intake and the finished-water tap located at the entry point to the distribution system. Each site generally was sampled every quarter, with bi-weekly sample collection during a four-month period coincident with intensive pesticide applications. Sampling was extended through 2000 because drought conditions affected parts of the Eastern United States and California in 1999 and, therefore, conditions measured at selected sites during the first year were not representative of average runoff patterns.

Analysis included 186 pesticides and degradation products. A total of 116 compounds were detected in at least one sample of raw water or of finished water. Many of the compounds, however, were detected in fewer than 5 percent of the samples and at concentrations very near the reporting level, which ranged from 0.001 to about 0.1 micrograms per liter. Detection does not necessarily translate to risk. The NAWQA Program measures chemicals at very low concentrations, often 10 to 1,000 times lower than EPA standards and health advisories. The low-level sampling is used to detect and evaluate emerging issues, as well as track contaminant levels over time.

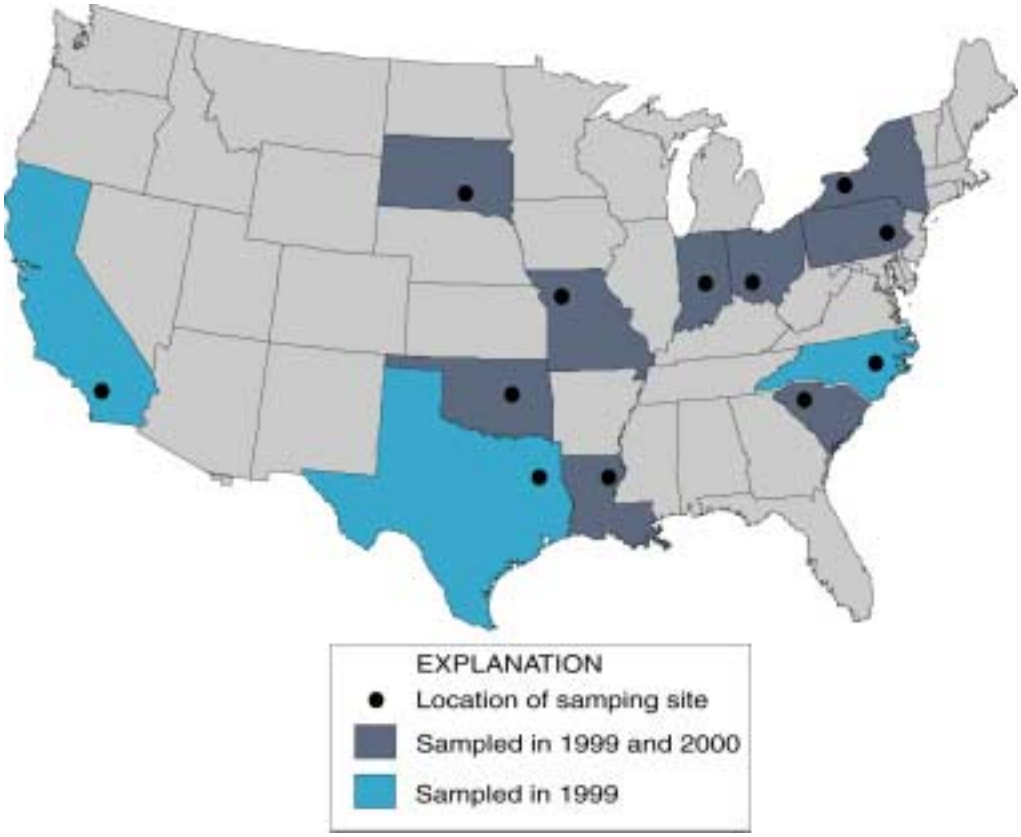
Herbicides—Widely used herbicides, including atrazine, simazine, metolachlor, prometon, cyanazine, 2,4-D, tebuthiuron, metalaxyl, and acetochlor were the most frequently detected compounds in raw and finished water (detected in about 36 to 96 percent of raw-water samples and in about 19 to 96 percent of finished-water samples). Atrazine and simazine were detected at every site and in about 85 percent of all raw- and finished-water samples. Triazine-herbicide degradation products also were frequently detected (in greater than 60 percent of raw- and finished-water samples). None of the herbicides was detected in finished water at a concentration greater than a national drinking-water criterion.

Insecticides—Insecticides occurred less frequently than herbicides, but also were detected in both raw and finished water. For example, p,p'-DDE, azinphos-methyl, and carbofuran were detected in about 5 percent of raw-water samples and in about 3 percent of finished-water samples. Diazinon and chlorpyrifos were the two most frequently detected insecticides in raw water (detected in about 35 and 5 percent of the samples, respectively). Neither of these organophosphorus insecticides was detected in finished water.

Several studies have shown that organophosphorus insecticides, such as diazinon, chlorpyrifos, and malathion, are readily oxidized in the presence of chlorine to oxidative transformation products, including diazoxon, chlorpyrifos-oxygen analog, and malaoxon. Oxidation may, in part, help to explain the detection of malaoxon in three samples of finished water where the corresponding sample at the raw-water intake showed detections of malathion. Similar analyses for diazinon and its degradation product, diazoxon, were not completed in this study because laboratory methods for diazoxon are not fully developed. Chlorpyrifos-oxygen analog, the degradation product for chlorpyrifos, was not detected in any samples.

(See map, technical reference, and contact information on back)

Locations of twelve reservoirs and community water systems included in the USGS and EPA Pilot Monitoring Program



State	Reservoir name	Community water system name
California	Canyon Reservoir	Elsinore Valley Municipal Water District
Indiana	Eagle Creek Reservoir	Indianapolis Water Company
Louisiana	Lake Bruin	Tensas Water Distribution Association, Inc.
Missouri	Higginsville Reservoir	City of Higginsville Municipal Utilities
New York	LeRoy Reservoir	Village of LeRoy, Water Department
North Carolina	Tar River Reservoir	Tar River Water Treatment Plant
Ohio	East Fork Lake	Clermont Water Authority
Oklahoma	Lake Arcadia	Edmonds Water Supply
Pennsylvania	Blue Marsh Reservoir	Western Berks Water Authority
South Carolina	South Pacolet Reservoir	Spartanburg Waterworks
South Dakota	Lake Mitchell	Mitchell Water Department
Texas	Lake Waxahachie	City of Waxahachie Water Treatment Plant

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Internet access to supporting technical information (USGS Open-File Report) and raw data: http://md.water.usgs.gov/nawqa (available by December 7, 2001)