Pesticides persist in ground water

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Numerous studies over the past four decades have established that pesticides, which are typically applied at the land surface, can move downward through the unsaturated zone to reach the water table at detectable concentrations. The downward movement of pesticide degradation products, formed in situ, can also contribute to the contamination of ground water. Once in ground water, pesticides and their degradation products can persist for years, depending upon the chemical structure of the compounds and the environmental conditions.

Scientists at the U.S. Geological Survey (USGS) investigated the occurrence of selected pesticides and their degradation products in ground water during a study funded by the USGS National Water-Quality Assessment (NAWQA) Program.

Specifically, the authors examined several of the factors that can influence the likelihood with which pesticides and their degradation products are detected in shallow ground water—including oxidation-reduction (redox) conditions and ground-water residence times—at four study sites across the United States. Results from the study were published in the May-June 2008 issue of the *Journal of Environmental Quality*.

The study revealed that the pesticides and degradation products detected most frequently in shallow ground-water samples from all four areas were predominantly from two classes of herbicides—triazines and chloroacetanilides. None of the insecticides or fungicides examined were detected in ground-water samples.

In most samples, the concentrations of the pesticide degradation products greatly exceeded those of their parent compounds. Pesticides or their degradation products were detected most commonly in ground water that recharged between 1949 and 2004, and in monitoring wells spanning the full depth range (about 2 to 52 m) examined—from the shallowest to the deepest wells—in all four study areas.

Comparisons of pesticide concentrations with a variety of environmental variables indicated that redox conditions, ground-water residence times, and the concentrations of dissolved oxygen and excess nitrogen gas from denitrification (the breaking down of nitrogen compounds such as nitrate) were all important factors affecting the concentrations of pesticides and their degradation products in all four ground-water systems.

The four sites selected for this study were located in agricultural landscapes in Maryland, Nebraska, California, and Washington. They were also selected for variability in overall land use, crops grown, climate, agricultural practices, irrigation, geohydrologic settings, and redox conditions. During the spring of 2004, water samples were collected from a network of 59 shallow single or clustered monitoring wells and analyzed for the occurrence of 45 pesticides and 40 pesticide degradation products, including herbicide, insecticides, and fungicides.

Greg Steele, senior author for this study, stated "Atrazine and its degradation product deethylatrazine both persisted in similar amounts at the Nebraska site, but in water samples from the other three study sites, there was little change with apparent age of water as the fraction as deethylatrazine generally exceeded 80% of the sum of atrazine and deethylatrazine. On the other hand, in three of the four areas studied (Washington excluded because it did not have any detections of metolachlor or its degradation products), the proportion of metolachlor in ground water was far less than that for its degradation products."

Source: American Society of Agronomy