Squillace, P.J., Caldwell, J.P., Schulmeyer, P.M., and Harvey, C.A, 1996, Movement of agricultural chemicals between surface water and ground water, lower Cedar River Basin, Iowa: U.S. Geological Survey Water-Supply Paper 2448, 59 p.

Abstract: Movement of agricultural chemicals alachlor, atrazine, cyanazine, deethylatrazine, deisopropylatrazine, and metolachlor between surface water and ground water is documented by data collected from May 1989 through July 1991 at an unfarmed study site adjacent to the Cedar River in Iowa. During periods of runoff, these chemicals moved from the Cedar River into the alluvial aquifer with bank-storage water. Results of simulation of ground-water flow conditions during March-April 1990 indicated that bank-storage water moving through the river bottom accounted for 70 percent of the total bank-storage water, whereas the remaining 30 percent moved through the riverbank. The largest concentrations of the chemicals in bank-storage water during 1990 were: alachlor, 2.1 micrograms per liter (µg/L); atrazine, 4.7 µg/L; cyanazine, 3.2 µg/L; deethylatrazine, 0.54 µg/L; deisopropylatrazine, 0.33 µg/L; and metolachlor, 2.2 µg/L. Larger concentrations of some herbicides and their metabolites were detected in the ground water after the study site was inundated by floodwater between June and August 1990. The concentration in a water sample from one well after this flooding on February 5, 1991, were: alachlor, 0.06 µg/L; atrazine, 18 µg/L; cyanazine, 1.3µg/L; deethylatrazine, 1.4 µg/L; deisopropylatrazine, 0.40µg/L; and metolachlor, 7.0 µg/L.

During base-flow conditions, the movement of agricultural chemicals from ground water to surface water was quantified for two periods of time in 1989 and 1990 along a 117-kilometer reach of the Cedar River. The principal source of atrazine, deethylatrazine, deisopropylatrazine, and metolachlor in the Cedar River during base flow was ground water discharged directly from the alluvial aquifer adjacent to the Cedar River. This discharge exceeded the combined tributary inflow of the chemicals along the entire reach.

Bank storage is probably an important source of agricultural chemicals discharged from the alluvial aquifer but becomes depleted with time after surface runoff. Herbicides discharged from the alluvial aquifer during periods of extended base flow entered the alluvial aquifer with ground-water recharged at some distance from the river. The movement of nitrate between surface water and ground water is minor, when compared to the herbicides, even though nitrite was detected in the Cedar River during runoff.