

Title: Persistence of Aldicarb Residues in a Groundwater Basin Near Plover, Nine Years After Aldicarb Use

Project I.D.: DNR Project No. 84

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Period of Contract: October 10, 1990 through December 1, 1991

Background/Need: A 1986-88 monitoring study found that aldicarb residues (aldicarb sulfoxide and aldicarb sulfone) continued to persist in the groundwater of a 6 km² basin near Plover, even though aldicarb use there ceased in 1981.

Objectives: The objective of this study was to resample monitoring wells in the basin to determine the areal extent and concentration of aldicarb residues remaining in October 1990. The information gathered in this study is useful for (1) predicting when aldicarb residue concentrations in the basin will decline below groundwater standards, (2) shedding light on the behavior of aldicarb residues in groundwater systems, and (3) providing a basis for evaluating decisions regarding agricultural contaminants.

Results/Discussion: The 1990 sampling indicated aldicarb residue concentrations declined or remained undetected at 14 of 16 monitoring locations. Residue concentrations increased at two locations. Aldicarb residues apparently form four plumes (numbered 11, 14, 15, and 17) originating from different fields, which underlay most of the basin. Plumes from six other fields have likely advected out of the basin.

Two plumes, 11 and 14, are well characterized by monitoring data and contrast markedly. Plume 11 exceeded the current Wisconsin enforcement standard (10 µg/L), had a maximum detected concentration of 27 µg/L and a thickness of 4.5 - >7 m. In contrast, plume 14 had a maximum detected concentration of 7 µg/L and thickness of 1.5 - 4.5 m. This dissimilar behavior appears related to the number of aldicarb applications made on fields where the plumes originated; four for plume 11 vs. one for plume 14.

Plume 17 is not well characterized by monitoring data nor is its aldicarb application history known. The residue concentration at the single monitoring location within plume 17 was 2 µg/L, below the Wisconsin enforcement standard. No monitoring wells are located within the boundaries of plume 15; its existence is inferred from aldicarb application records and advection models. Because plume 15 is the result of 1-2 years application of aldicarb, similar to plume 14, it may have similar characteristics, in which case aldicarb residue concentrations in plume 15 are likely below the Wisconsin enforcement standard.

**Conclusions/
Implications:**

Residue persistence in the Plover basin is longer than that experienced in most of the U.S. and Wisconsin Central Sand Plain (WCSP). The long persistence relative to other U.S. locations is likely due to the cold groundwater temperature (about 10°C) which slows chemical and biological reactions leading to residue degradation. Relative to other WCSP locations, the long residue persistence is likely due to the basin's groundwater chemistry, which in the upper portions of the aquifer coincides with chemical conditions (low pH and aerobic) where residue degradation is slowest.

Advection models indicate residue plumes may remain in the basin beyond 2010. Previous work suggested that conditions more amenable to residue degradation would develop as residue plumes evolved to higher pH and lower dissolved oxygen conditions. However, 1990 data indicates this is not the case in plume 11, where conditions have remained acidic (pH = 5.82) and aerobic for at least nine years.

Related Publications:

Kraft, G.J. 1990. Fate of aldicarb residues in a central Wisconsin groundwater basin. Ph.D. diss. Univ. of Wisconsin-Madison (Diss. Abstr. 91-08722).

Kraft, G.J. and P.A. Helmke. 1991. Aldicarb residue degradation rates at three depths of a Wisconsin central sand plain aquifer. *Pestic. Sci.* 33:47-55.

Kraft, G.J. and P.A. Helmke. 1992. Dependence of aldicarb residue degradation rates on groundwater chemistry in the Wisconsin central sands. *J. Environ. Qual.* v. 21.

Key Words: Aldicarb, agriculture, pesticide fate

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Final Report: A final report containing more detailed information on this project is available for loan from Wisconsin's Water Library, University of Wisconsin - Madison, 1975 Willow Drive, Madison, Wisconsin 53706 (608) 262-3069.