Title: **Fate of Aldicarb Residues in a Groundwater Basin Near Plover, Wisconsin (Study No. 3)**

Investigators:

Principal Investigator

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Period of Contract: December 5, 1985 through June 30, 1988

Objectives: To measure the extent of aldicarb residues persisting in the study area groundwater, to determine factors which cause the persistence and to measure the rates of aldicarb residue degradation.

Background/Need: Toxic aldicarb residues persist in groundwater of the study area much longer than is typical in Wisconsin and the United States. There is a need to (1) determine what causes the long persistence, (2) determine when groundwater will meet enforcement standards, and (3) use data generated from this study to provide insight on the fate of other groundwater contaminants.

Methods: The study had both field and laboratory components. The field investigation defined the study area geology, hydrogeology, groundwater chemistry and extent of aldicarb residue contamination. It consisted of placing about 70 monitoring wells and borings at 24 locations and then sampling sediments and groundwater for analysis. Laboratory studies consisted of experiments to measure aldicarb residue degradation rates in incubations ("aquifer microcosms") simulating field conditions.

Results/Conclusions: An aldicarb residue plume is present in groundwater throughout most of the 6 km^2 study area. The plume was typically 6 to 8 meters thick and resided in a zone 1 to 12 meters below the water table. The maximum observed concentration in the 1986-1988 monitoring period was 51 micrograms/liter (ug/l); similar concentrations were found during private well sampling in 1990.

The long persistence relative to the U. S. as a whole probably id due to the low prevailing groundwater temperature (106, 36°C), which slows both chemical and biological degradation of aldicarb residues. Relative to other locations in Wisconsin, the persistence is due to the basin's groundwater chemistry. Groundwater chemistry is the calcium-magnesium-bicarbonate-nitrate type. The pH is about 5.6 at the water table and rises linearly to about 7.2 at 10 meters, while dissolved oxygen (DO) is about 8 milligrams/liter (mg/l) at the water table and decreases to <1 mg/l at 10 meters. The pH and alkalinity of shallow groundwater is at the lower extreme of W CSP values, thus, the study area is somewhat unique. Laboratory studies showed that degradation rates of aldicarb residues are slowest in the low pH, high DO conditions that occur in the shallower part of the study area aquifer.

Aldicarb residues have been persistent because the plume has resided in the upper part of the aquifer where groundwater chemistry is not conducive to degradation. As the plume advents downward in the aquifer and undergoes chemical evolution to higher pH and lower DO, conditions more amenable to degradation should develop and the 10 ug/l should be attained throughout most of the basin by the year 2000.

Recommendations/ Implications:

The investigator recommends an approach of defining the groundwater chemical factors that influence the degradation rates of groundwater contaminants, and then measuring degradation rates as a function of those chemical factors, such as was done in this study. This would provide valuable data useful in making "how-clean-is-clean" decisions, setting up wellhead protection areas and mandatory setback distances for potential pollution sources.

Availability of Report:

This report is available for viewing and loan at:

The Water Resources Center
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Madison, WI 53706
(608) 262-3069
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