Title: **A Study of Nitrate and Atrazine Concentrations in Groundwater from Agricultural use on a Sandy, Irrigated Corn Field in the Lower Wisconsin River Valley**

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Investigators: Kim Cates, Soil Scientist, WGNHS
Fred Madison, Professor, UW-Madison, Department of Soil Science and WGNHS

Period of Contract: July 1, 1990 through June 30, 1994

Background/Need: The Lower Wisconsin River Valley is one of the most hydrogeologically vulnerable settings in the state: a shallow water table under irrigated sands. Various studies have shown widespread contamination of the aquifer from nitrate and atrazine but little is known about the immediate effects on groundwater quality from changes in management practices.

Objectives: To document nitrate and atrazine concentrations in shallow groundwater immediately below a sandy, irrigated corn field in the Lower Wisconsin River Valley under differing management practices.

Methods: The field site chosen in the LWRV near Muscoda, Wisconsin was also a demonstration site for the Nutrient and Pest Management program to show different management practices for corn production on a sandy, irrigated soil. Six monitoring wells were installed in-field along 2 rows. A 3-foot screen was located just below the water table. Water samples were taken throughout the study period and were analyzed for nitrate-nitrogen (nitrate) and atrazine concentrations. Samples were analyzed for nitrate at a university lab. Samples were analyzed for atrazine and its metabolites at the State Lab of Hygiene.

Results: Nitrate concentrations fluctuated greatly throughout the study period (0.2-64 ppm). Over-application of nitrogen in addition to untimely, heavy rainfall events moving unused nitrate downward contributed to the highest level of nitrate in groundwater. Levels below the drinking water standard were achieved with the application of nitrogen to meet crop needs in addition to a lack of heavy rainstorms and the use of a nitrogen inhibitor.

Atrazine was applied at rates of 1/2 and 1 lb for 2 years. Atrazine and/or its metabolites were detected approximately 7 months after the initial application of the pesticide. Over the study period atrazine concentrations fluctuated but generally increased so that by 3 years after the initial application atrazine concentrations exceeded the enforcement standard (ES) in 4 of 6 wells. Four years later, atrazine exceeded the ES in 1 well and preventive action limit (PAL) in 3 wells.

Conclusions: The results from nitrate testing indicate that nitrate leaching in this sandy soil is strongly related to the amount and timing of rainfall/irrigation events particularly as those events relate to the amount of available nitrogen in the upper root zone. Changes in nitrate concentrations in the shallow aquifer occurred rapidly depending on rainfall, irrigation and/or snow melt.

Atrazine, although not nearly as leachable as nitrate nevertheless did move through the soil and vadose zone materials to groundwater. Although the site offers little sorptive surfaces (sandy soil, low organic matter content) some sorption and/or

retardation did occur as there was no apparent relationship between application rates, rainfall events and atrazine concentrations in groundwater. Instead it seems to be released slowly over time and does not "flush" out of the system quickly.

Recommendations: Nitrogen should be applied at rates that meet realistic yield goals. Nitrogen crediting should be utilized to minimize nitrogen application of commercial fertilizer. Other practices which reduce nitrate leaching and increase plant usage should be implemented.

Atrazine should not be used on sandy soils. The study area is included in an atrazine prohibition area defined by the DATCP.

Keywords: atrazine, Lower Wisconsin River Valley, metabolites, nitrate, pesticides, best management practices

Funding: DNR

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.