Title: **Field Study of Atrazine Contamination of Groundwater in Dane County, Wisconsin**

Project I.D.: DNR Project No. 64

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Background/ Need: Previous well-water sampling programs by DNR and DATCP identified atrazine contamination in a large percentage of potable wells in south-central Wisconsin. In Dane County, over 50 percent of the wells sampled contained detectable atrazine. More information was needed to assess the susceptibility of bedrock aquifer to atrazine contamination and to determine the sources of the contamination.

Objectives: To determine the extent of groundwater contamination by agricultural pesticides in bedrock aquifers in part of Dane County, Wisconsin, seasonal variations in contamination, rates and directions of groundwater movement, and the sources of the contamination.

Methods: Phase I of the project consisted of a survey of pesticide concentrations in water produced by domestic wells in five small groundwater basins in the unglaciated part of western Dane County. The object of this phase of the project was to characterize regional pesticide concentrations in groundwater at a greater sampling density than was available from previous atrazine surveys, to attempt to relate pesticide concentrations to physical basin characteristics, and to identify one basin for more extensive study.

Phase II of the project consisted of a detailed hydrogeologic investigation of a single small groundwater basin where atrazine was present in several domestic wells. The objectives of phase II were to attempt to identify the source of the atrazine and to characterize the local groundwater flow system in the basin. After selection of a small basin near Mt. Horeb, Wi, a series of monitoring wells was installed and sampled for pesticides and other constituents. Numerical modeling, particle tracking, and isotopic analyses were used to determine groundwater age in the basin.

Results: Atrazine and/or its metabolites were detected in groundwater samples collected from wells and springs in three of five basins in western Dane County. Contamination was not limited to farms or agricultural fields; Wells supplying public buildings and private homes also contained detectable atrazine. Most detections were at concentrations less than 0.5 µg/l. Wells with atrazine commonly contained elevated nitrate, chloride, and specific conductance. In the small basin study only atrazine, desethylated atrazine, alachlor, metolachlor, and metribuzin were detected in groundwater samples collected from the study area. Atrazine was detected in 23 of 105 samples analyzed (22%) and desethylated atrazine was detected in 26 of 69 samples analyzed (38%). The overall average concentration of atrazine in wells where it was detected was 0.38 µg/l, and the average concentration of desethylated atrazine was 0.68 µg/l. The overall average of atrazine plus desethylated atrazine was 0.76 µg/l. Although 21 percent of the samples with detectable atrazine contained concentrations of atrazine or atrazine plus metabolite greater than the PAL of 0.30

µg/l, no samples contained concentrations greater than the ES of 3.0 µg/l. The maximum concentration of atrazine plus metabolites was 2.45 µg/l.

Conclusions: Pesticide contamination of groundwater has occurred in bedrock aquifers in the unglaciated part of western Dane County, Wisconsin, where water samples were collected from wells in five small groundwater basins. Detectable amounts of atrazine were found in samples collected from three of the five basins at an average concentration of 0.58 µg/l. Contamination was not limited to individual farms or agricultural fields. Wells with atrazine contamination were found on sites of various land uses, including dairy farms, private homes, and public buildings. In addition to the parent compound, desethylated atrazine, an atrazine metabolite, was detected in 18% of the samples tested, and was found in four samples where the parent compound was not detected.

In the small basin study atrazine and/or desethylated atrazine were detected in 35 percent of 26 bedrock and alluvial wells and piezometers sampled. The presence of atrazine was not confined to a single stratigraphic horizon, depth, or geologic unit. In the bedrock aquifer, atrazine was detected both at the water table and up to 70 feet below the water table. In the alluvium, atrazine was found both at the water table and up to 20 feet below the water table. Atrazine was found in aquifers composed of dolomite, sandstone, and sand and gravel. Desethylated atrazine, a metabolite of atrazine, was detected in 50 percent of the 26 piezometers. The average concentration of desethylated atrazine in samples where it was detected was 0.74 µg/l. All groundwater samples with atrazine also contained desethylated atrazine, but not all samples containing desethylated atrazine also contained the parent compound at concentrations above the 0. 15 µg/l analytical detection limit.

Implications/ Recommendations: The frequency of detections of atrazine and its metabolites in properly constructed wells finished in bedrock aquifers in western Dane County implies that many such wells in Dane County and in similar areas of southwestern Wisconsin are at risk from atrazine contamination. Many of the detections were at locations without a history of atrazine use or pesticide mixing around the well or even on the property, suggesting that atrazine and its metabolites are mobile in the subsurface. While it is impossible to rule out accidental and unreported pesticide spills as contaminant sources, the frequency of atrazine detections in this study strongly implies that field application of atrazine at historic rates is a source of groundwater contamination to deep bedrock aquifers.

Related Publications **:**McGrath, R.W. 1991. Investigation of Atrazine Contamination in Bedrock Aquifers, western Dane County, Wisconsin. Unpublished M.S. Thesis, Dept of Geology, University of Wisconsin-Madison. 218 p.

Key Words: atrazine, bedrock, Dane County, pesticides

Funding: DNR, DATCP

Project Report: A report on this project is available for loan from the Wisconsin's Water Library, University of Wisconsin - Madison, 1975 Willow Drive, Madison, Wisconsin 53706.