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GROUND WATER AND ECOSYSTEMS RESTORATION RESEARCH

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# Evaluation of Reactive Barrier Technology for Remediation of Nutrient-Contaminated Ground Water From a Swine CAFO

## Research Type and Organization

The research type is in-house. The organization is EPA's Ground Water and Ecosystem Restoration Division.

## Project Period

October 1, 2003 to present

## Project Summary

The overall goals of this research are to better understand the chemical and microbiological processes that result in nitrate removal in carbon-based permeable reactive barriers (PRBs) and to evaluate the effect of the PRB on downgradient aquifer/ground water chemistry. This work is being conducted at a now-closed facility in Oklahoma.

The facility was originally a swine concentrated animal feeding operation (CAFO). During seven years of its operation, extensive on-site ground water contamination by both nitrate and ammonium occurred. The selected remediation strategy has been to install an interception trench barrier for recovery and subsequent above-ground treatment of ammonium, and a PRB with commercial hay as the reactive matrix for in situ treatment of nitrate. Personnel from EPA's Ground Water and Ecosystem Restoration Division have been invited to help evaluate the current remediation strategy.

The objectives of this research are to develop monitoring approaches that can be used to better predict the performance and longevity of carbon-based reactive barriers for nitrate removal. This research is organized into four principal topical areas:

- Delineation and installation of closely spaced monitoring wells for detailed PRB evaluation
- Extensive ground water characterization in regions of the site upgradient, downgradient, and within the reactive treatment zone
- Geochemical characterization of the carbon-based PRB
- Development of a site hydrogeological model

A combination of fully screened wells, cluster wells, and/or multilevel sampling cells have been established within and on each side of the PRB at two transect locations, and a quarterly ground water monitoring program has been established for multiple parameters. Initial results showed that denitrification was taking place and that the PRB

chemistry began working as anticipated, with the exception of an initial high ammonium release that rapidly dissipated. However, after about four years, PRB performance was beginning to fail at the transect located near the mid-point of the PRB, possibly due to excessive longitudinal flow within the PRB towards a seep discharge point near this transect. This may have prematurely used much of the organic carbon within the PRB in this location, but additional information is needed. In addition, rapid breakdown of the hay matrix has led to severe subsidence along most of the PRB length. Although these problems can ultimately lead to PRB failure, the influent nitrate levels are also dropping and it remains to be seen whether the PRB performance will outlast the depletion in nitrate mass influx. Questions remain regarding ground water flow within and across the barrier and long-term performance across the vertical profile.

## Products

Wilkin, R.T., S.R. Hutchins, T.R. Lee, and B.T. Scroggins. (2006). “Performance Evaluation of a Carbon-Based Reactive Barrier for Nitrate Remediation.” Presentation, Regional Technology Development Forum Meeting, Charleston, South Carolina, October.

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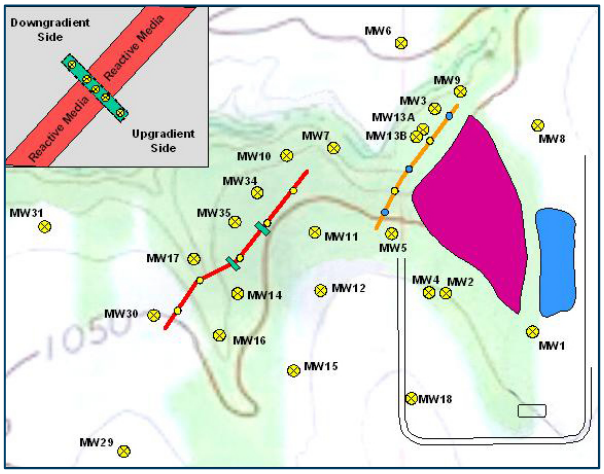


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