

Title: Volatile Organic Compound Attenuation in Unsaturated Soil Above and Below an On-site Wastewater Infiltration System

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Background/Need: Studies have not addressed the fate of Volatile Organic Compounds (VOCs) in unsaturated soil surrounding the drainfield in an on-site wastewater infiltration system. It is important to know if the soil could provide possible treatment of VOCs and the potential impacts that these contaminants may have on unsaturated soil and groundwater beneath on-site wastewater infiltration systems.

Objectives: To determine the fate of toluene, chloroform and 1,1,1 trichloroethane in unsaturated Plainfield sand in an on-site wastewater infiltration system.

Methods: Toluene, chloroform, and 1,1,1 trichloroethane (TCA) concentrations were monitored in soil gas and water in unsaturated Plainfield sand above and below a two-dimensional, cross-section model of a soil absorption system in a stainless steel container. The system was dosed with tapwater, tapwater with VOCs, septic tank effluent, and septic tank effluent with VOCs. Bromide tracer was added with most of these solutions.

Results: First detection and maximum VOC gas concentrations in and above the soil surface were detected within 0.25 day and fell to analytical detection limits within 5 days after their addition. There were no differences in VOC gas concentrations between tapwater and septic tank effluent experiments.

At 95 cm below the drainfield, breakthrough of leachate containing VOCs occurred at 0.13 to 0.63 day and before bromide breakthrough. Maximum concentrations of VOCs occurred at 0.50 to 2.17 days and decreased to detection limits in 11 days. Concentrations of VOCs in leachate were sometimes lower for septic tank effluent than for tapwater experiments.

Total recovery of TCA and chloroform was consistently greater than toluene and primarily at leachate and soil gas sampling locations. The nonrecoverable VOC, especially toluene, may have been degraded.

Conclusions: VOCs added to a soil absorption system in Plainfield sand travel rapidly through the soil, in soil gas and water phases, above and below the point of infiltration where they are potential pollutants. It is assumed that some degradation of VOCs will occur in on-site wastewater infiltration systems installed in Plainfield soils.

**Implications/
Recommendations:** The results of this study can be applied to field studies of unsaturated soil in on-site wastewater infiltration systems in Plainfield sand or similar soils.

Key Words: soil absorption system, volatile organic compounds, toluene, chloroform, 1,1,1-trichloroethane, wastewater

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Project Report: A report 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.