

Title: The Occurrence of Volatile Organic Compounds in Wastewater, Sludges and Groundwater at Selected Wastewater Treatment Plants in Wisconsin (Study No. 21)

Investigators: Principal Investigator

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Objectives: To determine the extent to which volatile organic compounds (VOCs) are found in Wisconsin's wastewater systems and the extent of groundwater contamination at treatment plant sites.

Background/Need: Complete removal of VOCs from wastewater is rarely accomplished with conventional wastewater treatment, though state and federal drinking water standards increasingly focus on VOCs. This study gathered data on municipal wastewaters and sludges to determine the need for alternative wastewater treatment methods, whether VOCs were reaching groundwater and where VOCs would eventually remain.

Methods: 56 Wisconsin communities were chosen for this study based on past VOC detections and proximity of municipal facilities producing wastewater sludge as well as similar soil types. Sampling of influent, effluent, groundwater and sludge was conducted throughout the four seasons over an 18-month period. Samples were screened for 45 different VOCs.

Results: 21 of the compounds were detected from 223 grab, groundwater and soil samples, though no VOCs were detected in soil samples from fields treated where sludge had been applied which contained VOCs. 2 of the 49 well water samples contained detectable levels of VOCs. All influent samples and one quarter of the effluent samples contained at least one VOC at or above the detection limit. Concentrations of VOCs in influent samples were less than 10 micrograms per liter in 88% of the samples, compared to 96% of the effluent samples, meaning VOCs were extensively removed from wastewater during treatment. Groundwater samples at effluent seepage ponds had VOC levels which exceed limits set by the Environmental Protection Agency (EPA) and the Department of Natural Resources (DNR) for drinking water safety and groundwater quality. Sludge contained more VOCs than either soil or water, both in concentration and variety.

Conclusions: Investigators conclude that VOCs are prevalent in Wisconsin municipal wastewater, their concentrations are reduced in the water portion of the wastewater during treatment and many are partitioned to the sludge and concentrated there. VOCs are not commonly entering the groundwater via the discharge of effluent to seepage cells, though they are reaching the groundwater through unlined sludge storage and drying sites. Heavier aromatic compounds prevail in the sludges and lighter organics appear in

groundwater. Application of sludges containing VOCs to agricultural soil does not appear to elevate VOC levels in the soil. Concentrations of contaminants detected in soil exceeded limits set by the EPA and DNR for drinking water safety, groundwater quality and aesthetics.

**Recommendations/
Implications:**

Investigators suggest additional sampling to provide statistical significance to their findings. Research is needed to confirm the sources of VOCs found in the groundwater at effluent seepage cell sites and sludge drying and storage sites. More sludge and soils research is needed to determine the extent of groundwater contamination at agricultural sites where sludge containing VOCs is spread. Future investigation should also consider potential health hazards presented to workers from VOC emissions at treatment plants.

Availability of Report:

This report is available for viewing and loan at:

The Water Resources Center
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