

Title: Volatile Organic Compounds at Wisconsin Landfills: Recent Findings

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Background/Need: Since the early 1980s, the DNR has sampled groundwater monitoring wells at municipal solid waste landfills for volatile organic compounds (VOCs). The DNR recognizes the need to evaluate the occurrence and fate of VOCs at Wisconsin landfills in order to design efficient management strategies to minimize the migration of VOCs to groundwater.

Objectives: 1) Evaluate trends in VOC contamination at closed, unengineered landfills over time; 2) Evaluate the performance of older, engineered landfills in retarding the migration of VOCs to groundwater; 3) Determine whether DNR should expand its list of required VOCs to include numerous non-standard VOCs (included with EPA requirements for municipal landfill assessment monitoring); and 4) Investigate the reliability of the VOC data reported to DNR.

Methods: DNR staff sampled groundwater for VOCs on two separate occasions at each of 11 closed, unengineered landfills, sampled during earlier studies and at 6 older, engineered landfills. Most of the samples were analyzed for an extended list of VOCs. The analytical results and quality control data were reviewed for accuracy and precision. Historical data for the unengineered landfills were combined with the recent data for trend analysis. A baseline list of VOCs and a fixed set of monitoring wells were used for the trend analyses. VOC trends were compared with inorganic indicator parameter trends and with the length of time since landfill closure. The 6 engineered landfills were selected for the quality of their construction and the length of time they have been in operation.

Results and Discussion:

VOC levels decreased at all but 2 of the 11 municipal solid waste landfills since the mid to late 1980s. At many of these sites VOC levels do not show continued decline, and the level of contamination remains high at several. Neither current contaminant levels nor VOC trends appear to correlate with either the time since landfill closure or with the type of landfill cover. Trends in indicator parameters match trends in VOC levels at most of the sites, with only a few exceptions.

None of the 6 engineered landfills investigated appear to have significant amounts of VOC contamination in groundwater after 7 to 14 years of operation.

Evaluation of the laboratory's QA/QC data showed that out of the 362 total VOC detects reported, 87 (24%) were sample or laboratory contaminants; 241 (67%) were confirmed to be true groundwater constituents; and 34 (9%) were ambiguous. Ninety five (26%) of the detects would have been lost if the laboratory had followed its usual practice of censoring data below the laboratory's reporting limit. This represents more than one-half of the confirmed low level detects. Four VOCs were detected that are not part of routine analysis of solid waste groundwater samples. However, the non-standard VOCs did not occur alone but were found in association with other VOC detects.

**Conclusions/
Implications/**

Recommendations: Many older, unengineered landfills continue to contribute VOCs to groundwater despite being covered and closed for many years. We recommend that unengineered landfills be routinely monitored for VOCs until they show several consecutive years of non-detects, or until the site experiences decreasing trends of low levels of VOC contamination. After that time, inorganic indicator parameters can be relied on to predict changes in VOC contamination.

Landfills that are engineered to state standards, that is, designed with 4 to 5 foot compacted clay liners and leachate collection systems, appear to be performing well in retarding the migration of VOCs to groundwater after 7 to 14 years of operation. These landfills should be monitored for VOCs on a routine basis during their years of operation and throughout their long-term care period.

The EPA assessment monitoring list of VOCs contains several compounds which appear only occasionally at Wisconsin landfills. However, these compounds appear to occur only at sites contaminated with more frequently occurring VOCs. Therefore monitoring for the extended list of compounds may not be necessary on a routine basis.

Based on the large number of true detects that would be lost, laboratory data should not be censored above a limit of detection (Method Detection Limit). Instead, estimated or questionable values should be flagged for data validation. Based on comparisons of field duplicates and split samples, the reliability of the VOC data reported to the DNR appears high. Low level VOC detects often contain laboratory contaminants. Data reporting should be improved so that flagged data are not lost or compromised.

Related Publications:

Battista, J. and J. P. Connelly, 1989. VOC Contamination at Selected Wisconsin Landfills - Sampling Results and Policy Implications. WDNR PUBL-SW-094 89.

Friedman, M. 1988. Volatile Organic Compounds in Groundwater and Leachate at Wisconsin Landfills. WDNR PUBL-WR-198 88.

Key Words: volatile organic compounds, municipal landfills, laboratory QA/QC

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Project 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.