

VOLATILE ORGANIC COMPOUNDS (VOCs)

Key Takeaways

Continuing to identify and monitor known sources of VOCs is key to the protection of drinking water. Each year, several hundred contaminated sites, some of which involve VOCs, are reported to the DNR. Thousands of wells have been sampled for VOCs and about 60 different VOCs have been found in Wisconsin groundwater.

Sources of VOCs in Wisconsin’s groundwater include landfills, underground storage tanks and hazardous substance spills. A critical role of GCC agencies is identifying and monitoring all known sources of VOCs, not only landfills

GCC member agencies continue to work on multiple initiatives related to reducing Volatile Organic Compounds (VOCs) in groundwater (see groundwater management sections – DHS, DNR).

For actions to address Volatile Organic Compounds (VOCs) contamination in groundwater, see the Recommendations Section.

Sections in this document

What are Volatile Organic Compounds (VOCs)?	1
What are the human health concerns?	1
How widespread are VOCs in Wisconsin?	2
How is VOCs contamination trending over time?	2

What are Volatile Organic Compounds (VOCs)?

Volatile Organic Compounds (VOCs) are a group of common industrial and household chemicals that evaporate, or volatilize, when exposed to air. Examples of products containing VOCs include gasoline and industrial solvents, paints, paint thinners, air fresheners and household products such as spot and stain removers. Chemical names for the VOCs in these products include benzene, Trichloroethylene (TCE), toluene and vinyl chloride, among others. Improper handling or disposal of VOCs is often the reason why they occur in groundwater.



Collection of household products containing VOCs including paints, stains, and paint thinners. Photo: Tom Murphy VII

What are the human health concerns?

Health risks vary depending on the VOC. Short-term exposure to high concentrations of many VOCs can cause nausea,

dizziness, anemia, fatigue or other health problems. Long-term exposure to some VOCs may cause cancer, liver damage, spasms, and impaired speech, hearing and vision. For more on the health effects of specific VOCs, see the [Wisconsin Department of Health Services \(DHS\) website](#).

How widespread are VOCs in Wisconsin?

Thousands of wells have been sampled for VOCs and about 60 different VOCs have been found in Wisconsin groundwater. Trichloroethylene is the VOC found most often in Wisconsin's groundwater. While about 60 different VOCs have been found in Wisconsin groundwater, only 34 currently have established health based groundwater quality standards in ch. NR 140 (groundwater [WI NR 140.10](#), drinking water [WI NR 809.24](#)). The main sources of VOCs in Wisconsin groundwater are landfills, leaking underground storage tanks (LUSTs), and a variety of facilities that use VOCs in their regular operations, including gas stations, bulk petroleum and pipeline facilities, plating facilities, dry cleaners and other industrial facilities. DNR currently tracks about 700 current or former landfills, 21,000 LUSTs and 8,000 other facilities which are required to monitor groundwater. The DNR also tracks approximately 39,000 spills, some of which are also sources of VOCs. Given how common potential sources of VOCs are, these substances are more frequently found in groundwater near urban industrial and commercial areas. However, exceedances of groundwater standards for VOCs have been reported in every county in the state.



Installation of a compacted clay and geotextile liner at a landfill site in Wisconsin.

How is VOCs contamination trending over time?

Continuing to identify and monitor known sources of VOCs is key to continued protection of drinking water. Each year, several hundred contaminated sites, some of which involve VOCs, are reported to the DNR. And each year, cleanup begins at another several hundred sites. Continuing to track and respond to this ongoing issue remains an important objective for GCC agencies.

Early studies by the DNR and DHS in the late 1980s and early 1990s focused on VOC contamination from landfills, specifically from those without linings to protect groundwater from leachate. DNR scientists found that VOCs contaminated

groundwater at 60% of unlined industrial landfills and 80% of unlined municipal solid waste landfills^{1, 2}.

Further review of monitoring data showed that while VOC levels typically decrease following the closure of unlined landfills, concentrations remain high and do not always show continued improvement within a reasonable period of time³.

In the late 1990s, this knowledge raised concerns since increasing numbers of residential developments were located close to old, closed landfills. In 1999, the DNR and DHS designed targeted sampling of private wells near old, closed landfills to investigate and address the problem. For wells where VOCs were detected above drinking water standards, residents were given health advisories not to drink water and the DNR took follow-up measures at the nearby landfills. Much more stringent engineering standards have guided the design of modern landfills (those built after the 1980s), so these have a much better record in terms of limiting VOC contamination. Older landfills, however, continue to remain a concern⁴.

A critical role of GCC agencies is identifying and monitoring all known sources of VOCs. The Department of Agriculture and Consumer Protection (DATCP) keeps track of all underground storage tanks (USTs) with a capacity of 60 gallons or greater; this registry has identified over 180,000 USTs since 1991. Hazardous waste treatment, storage and disposal facilities must be licensed by the DNR and are subject to corrective action authorities in the event of spills or releases.

The DNR's Bureau for Remediation and Redevelopment oversees investigation or remediation at 128 RCRA 2020 corrective action sites. More broadly, the Hazardous Substance Spill Law requires immediate notification to the DNR when any hazardous spills or discharges occur and requires that all necessary actions be pursued to restore the environment to the extent practicable. The spills program also develops outreach materials to help reduce the number and magnitude of spills and provide guidance for responding to spills. Topics addressed include spills from home fuel oil tanks, responses to illegal methamphetamine labs and mercury spills, all of which can lead to significant environmental impacts, if not properly addressed.



Drilling to monitor for VOCs near a Wisconsin landfill. Photo: DNR

Further Reading

- [DHS resources for contaminants in drinking water](#)
- [DNR overview of VOCs in private drinking water wells](#)
- [DNR map of open and closed contaminated sites](#)
- [DNR database of contaminated soil and groundwater](#)
- [DHS overview of vapor intrusion](#)
- [USGS report on VOCs in the nation's groundwater and drinking water wells](#)

References

1. Friedman, M.A. 1988. Volatile Organic Compounds in Groundwater and Leachate at Wisconsin Landfills. Wisconsin groundwater management practice monitoring project, DNR-004. Available at <http://digital.library.wisc.edu/1711.dl/EcoNatRes.FriedmanVolatile>
2. Battista, J.R. and J.P. Connelly. 1989. VOC Contamination at Selected Wisconsin Landfills - Sampling Results and Policy Implications. Wisconsin groundwater management practice monitoring project, DNR-005. Available at <http://digital.library.wisc.edu/1711.dl/EcoNatRes.BattistaVOC>
3. Battista, J.R. and J.P. Connelly. 1994. VOCs at Wisconsin landfills: recent findings. In: Proceedings of the 17th International Madison Waste Conference, Madison, WI, pp. 67–86
4. U. S. Department of Human and Health Services. 2006. Private Well Impacts from Wisconsin's Old Landfills. Public Health Report. Available at <http://www.atsdr.cdc.gov/HAC/pha/Wisconsin's%20Old%20Landfill/WellImpacts-WisconsinOldLandfills021306.pdf>