Summary

Condition of Minnesota's Groundwater

What is the issue?

While the majority of Minnesota's groundwater is of good quality, there are areas that show increases in some pollutants. These pollutants can harm aquatic life if groundwater reaches surface water, as well as human health if contaminants remain in drinking water.

Why is it important?

Clean groundwater is vital to the state of Minnesota. Groundwater supplies drinking water to about 75 percent of all Minnesotans and almost all of the water used to irrigate the state's crops. The inflow of groundwater also is important to Minnesota's streams, lakes, and wetlands. Pollution is very expensive to clean up and it costs more to construct water-supply wells in areas with polluted groundwater since wells may need to be drilled deeper to tap uncontaminated aquifers in these areas.

Key findings

The Minnesota Pollution Control Agency looked at monitoring data from 2007-2011 that included traditional pollutants known to adversely affect groundwater such as nitrate, chloride, and volatile organic compounds (VOCs). This report also included some newly recognized pollutants, such as medicines, insect repellents, and fire retardants. The effects of these new pollutants, which are often referred to as contaminants of emerging concern or CECs, onto human and aquatic life are not fully understood at this point.

Nitrates in groundwater

Nitrogen is an essential nutrient for plant and animal growth. Nitrogen also helps promote growth in plants and increases seed and fruit production. However, an overabundance of nitrogen in water adversely affects human health and aquatic life. To protect human health, the EPA established a maximum contaminant level (MCL) of 10 mg/L for nitrate.

- The study found that the amount of nitrate contamination in Minnesota's groundwater generally has not changed over the last 15 years; however, concentrations remain high in certain parts of the state.
- The highest nitrate concentrations occurred in the aquifers in central and southwestern Minnesota.
- In central Minnesota, about 40 percent of the shallow wells contained water with nitrate concentrations that were greater than the MCL.
- Groundwater underlying both agricultural and urban lands contained higher nitrate concentrations compared to the groundwater underlying undeveloped land.
- The highest nitrate concentrations were typically in the shallow groundwater underlying agricultural lands.
- On average, the shallow groundwater underlying agricultural areas was about 9 mg/L; whereas, the groundwater underlying urban land ranged from 2-3 mg/L.

Chloride in groundwater

Chloride is naturally present in Minnesota's groundwater due to weathering of rocks. However, it is also getting into the groundwater through use of road salt (usually used in de-icing). Other sources of chloride contamination to the groundwater include fertilizer, water softening salt, and wastewater.

About this study

The Minnesota Pollution Control Agency assesses the condition of Minnesota's groundwater as part of the agency's overall vision for clean water.

This report gives us a current snapshot of groundwater quality in the state. Monitoring is ongoing, with additional wells being installed to increase the breadth of the monitoring network. This work will serve the state well in the future by detecting contamination problems that occur, and developing and tracking groundwater quality trends.

Excessive chloride concentrations in groundwater are toxic to aquatic life when the groundwater discharges to lakes, streams, and wetlands. High chloride concentrations can also adversely affect drinking water because it imparts a salty taste to water that consumers find objectionable.

- One-third of wells across the state showed an increase in chloride concentrations.
- Groundwater in the Twin Cities Metropolitan Area (TCMA) is impacted by high chloride concentrations.
- 27 percent of the TCMA monitoring wells in the sand and gravel aquifers had chloride concentrations that were greater than drinking water guidelines set by EPA.
- 30 percent of the wells in the TCMA had chloride concentrations greater than the chronic water-quality standard.
- The source of the high chloride concentrations in the TCMA and other urbanized areas is likely from the application of winter de-icing chemicals.
- Outside the TCMA, very few wells contained water with chloride concentrations that exceeded either drinking water or the chronic water-quality standard. However, increasing levels of chloride is showing up in groundwater in some urbanized areas outside the TCMA.
- If chloride continues to increase in the groundwater, more waters will likely exceed drinking water and water-quality standards in the future.

Other pollutants

- Iron and manganese concentrations were detected in about one-half of the sampled wells. About one-third of these wells contained concentrations that were high enough to cause human-health or aesthetic problems.
- While the MPCA is overseeing the clean-up of many contaminated sites, the monitoring of volatile organic compounds (VOCs) in ambient groundwater did not identify any areas that required cleanup or remediation. VOCs comprise a wide variety of chemicals that are refined from petroleum and have many industrial, commercial, and household applications.
- Contaminants of emerging concern were detected in about one-third of the sampled wells. The most-frequently detected chemicals were the fire retardant tris phosphate, the antibiotic sulfamethoxazole, and bisphenol A and tributyl phosphate. No concentrations exceeded any applicable human-health guidance set by the state of Minnesota.

Full report

To view the executive summary and full report on the condition of Minnesota's groundwater:
http://www.pca.state.mn.us/0agx947

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