Summary

Nitrate in Surface Waters

What is the issue?

The MPCA study shows elevated nitrate levels, particularly in the southern third of Minnesota.

Why is it important?

Elevated nitrate levels can be harmful to fish and aquatic life. Because much of the nitrate moves into rivers and streams from groundwater (not surface runoff) it may also pollute drinking water wells.

Also, nitrate loads leaving Minnesota via the Mississippi River contribute to the oxygen-depleted "dead zone" in the Gulf of Mexico. The dead zone cannot support aquatic life, affecting commercial and recreational fishing and the overall health of the Gulf.

Key findings

- More than 70 percent of the nitrate is coming from cropland, the rest from sources such as wastewater treatment plants, septic and urban runoff, forest and the atmosphere.
- Municipal wastewater contributes nine percent of the statewide nitrate load.
- Nitrate leaching into groundwater below cropped fields, and moving underground until it reaches streams, contributes an estimated 30 percent of nitrate to surface waters.
- The amount of nitrate reaching surface waters from cropland varies tremendously, depending on the type of crops, tile drainage practices, cropland management, soils, climate, geology, and other factors.
- Tile drainage is the highest estimated cropland source pathway.
- The Minnesota River adds twice as much nitrate to the Mississippi River as the combined loads from the Upper Mississippi and St. Croix Rivers.
- Nitrate concentrations and loads are high throughout much of southern Minnesota, resulting largely from leaching through large parts of intensively cropped soils and into underlying tile drains and groundwater.
- The highest nitrate-yielding watersheds are Cedar, Blue Earth, and Le Sueur in south-central Minnesota.
- Precipitation amounts have a pronounced effect on nitrate loads.
- Cropland sources account for an estimated 89 -95 percent of the nitrate load in the Minnesota, Missouri, and Cedar Rivers, and Lower Mississippi River Basins.
- Groundwater nitrate can take from hours to decades to reach surface waters.

About this study

The study was led by the Minnesota Pollution Control Agency with assistance from the University of Minnesota and U.S. Geological Survey.

The report team used more than 50,000 water samples collected at 700 stream sites, 35 years of monitoring data, and findings from 300 published studies.

- Nitrate concentrations have steadily increased in the Mississippi River since the mid-1970's.
- On average, 158 million pounds of nitrate leaves Minnesota per year in the Mississippi River—75 percent comes from Minnesota watersheds.

Reduction approaches

Tactics for reducing cropland nitrate losses to waters fall into three categories:

- ***In-field nutrient management*** (i.e. optimal fertilizer rates; apply fertilizer closer to timing of crop use)
- ***Tile drainage water management and treatment*** (i.e. tile spacing and depth; controlled drainage; constructed and restored wetlands for treatment purposes; and bioreactors)
- ***Vegetation/landscape diversification*** (i.e. cover crops; perennials planted on marginal cropland)

Nitrate fertilizer efficiency has improved during the past two decades. While further refinements in fertilizer rates and application timing can be expected to reduce nitrate loads by roughly 13 percent statewide, additional and more costly practices will also be needed to make further reductions and meet downstream needs. Statewide reductions over 30 percent are not realistic with current practices. To see further progress, nitrate leaching reductions are needed over large parts of southern Minnesota, particularly on tile-drained fields and row crops over thin or sandy soils.

What is next?

A state-level Nutrient Reduction Strategy is being developed to address Minnesota's contribution to the Gulf of Mexico's hypoxia issue. Minnesota, which contributes the sixth highest nitrate load to the Gulf, is developing a strategy to identify how further progress can be made to reduce nitrate and phosphorus entering both in-state and downstream waters. The MPCA is also working with the U.S. Environmental Protection Agency and other states to evaluate the effect nitrates have on aquatic life in order to develop and adopt toxicity standards.

Full report

To view the executive summary and full report on nitrogen in surface water:
http://www.pca.state.mn.us/report-on-nitrogen-in-surface-water/

Contact person

David Wall
Minnesota Pollution Control Agency
david.wall@state.mn.us
651-757-2806