Groundwater Quality

The quality of groundwater is good in most parts of Minnesota. And that’s a good thing because about 90 percent of Minnesotans get some or all of their drinking water from wells that pump from underground aquifers. Protecting our groundwater from a variety of threats, most of them related to the way we use the land, is critically important to our health and the health of future generations.

A few parts of Minnesota have naturally occurring minerals—arsenic, boron, iron and manganese—that make the water unfit or undesirable for drinking without extensive treatment. But a bigger concern, on a statewide basis, is the array of chemicals and biological agents that we produce and use on a daily basis and that routinely seep into groundwater.

The contaminants include: nitrate from farm and lawn fertilizers and from failing septic systems; volatile organic compounds from fuels and solvents used and disposed of by all kinds of industries; coliform bacteria from some of those same septic systems, from feedlots and from dog droppings we fail to pick up; plus antibiotics and other pharmaceuticals that we use ourselves and feed to our livestock.

Harmful compounds that would break down and become safe if exposed to sunlight, air and bacteria may remain dangerous for years after they seep into groundwater. Reactions between those chemicals within the ground may produce new compounds.

Two statistics illustrate the potential problems with groundwater quality:

- The U.S. Geological Survey in March 2009 said that more than one in five private household wells sampled nationwide between 1991 and 2004 contained at least one contaminant at levels of potential health concern.
- The Minnesota Health Department estimates that, at any given time, as many as one-fourth...
Some volatile organic compounds have been proven injurious to human health, damaging the liver, kidneys and central nervous system. Links between some of the compounds and cancers also have been documented.

The Minnesota Pollution Control Agency has identified more than 15,000 sites around Minnesota, many of them at former gas stations, where fuels and other contaminants have leaked into soil and groundwater. The agency also has identified more than 1,000 sites where industrial chemicals—paints, dry cleaning fluids and solvents—have leaked into groundwater.

There are a number of areas throughout the state where polluted groundwater is being removed from the ground, treated and utilized or discharged to surface waters. In 2007, about 5 billion gallons of water—enough to fill the Metrodome to the top 11 times—was pumped from the ground for that purpose, according to Minnesota Department of Natural Resources water records. In addition, there are many other technologies (e.g., bioremediation, which promotes natural processes to chemically break down contaminants) that are employed to clean up contaminated groundwater.

Perfluorochemicals (PFCs), a class of chemicals used as fire suppressants, stain and grease repellents, and emulsifiers, are being found in lakes and drinking water wells in the Twin Cities metropolitan area and in treated wastewater throughout the state. Groundwater where such contamination has been identified is usually treated with activated carbon, and in some cases may be used for drinking water after such treatment.

Relatively few studies have been conducted on the effects of PFCs on

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**Groundwater facts**

- About 70 percent of all the freshwater on Earth is frozen in ice caps and glaciers. About 1 percent is in the rivers, lakes and wetlands we see around us. Twenty-nine percent is groundwater, hidden in the sand, gravel and rocks beneath our feet.

- About 90 percent of Minnesotans get some or all of their drinking water from the ground—a higher percentage than in many other states.

- No one knows for certain how many wells there are in Minnesota. Estimates range between 1.2 million and 2 million. Some of these wells are used every day, some are sealed, and some are abandoned but not sealed. Unsealed wells can allow surface pollutants to reach groundwater.

- The Minnesota Department of Natural Resources issues about 6,000 permits to large water users who pump at least 10,000 gallons a day or 1 million gallons a year. Those big users pumped about 302 billion gallons of groundwater in 2007.
Minnesota Groundwater Provinces

Province 1. Sandstone and limestone aquifers yield large quantities of water. Aquifers in agricultural areas often have high concentrations of nitrate, and pesticides may be present in low concentration. Low concentrations of fuel oils and industrial chemicals are often found in shallow aquifers in urban areas.

Province 2. Small isolated sand and gravel aquifers occur more than 100 feet below the land surface. Deeper sedimentary rock aquifers provide moderate to good quantities of water. Aquifers generally remain uncontaminated, but may have high concentrations of dissolved chemicals, such as calcium.

Province 3. Sedimentary rock aquifers provide large quantities of water. When these aquifers are close to the land surface they are vulnerable to contamination. In these aquifers, nitrate is often present at high concentrations, and pesticides are often detected. Sand aquifers generally occur only along rivers.

Province 4. Sand aquifers are thick and yield large quantities of water. When these aquifers are near the land surface, they are vulnerable to contamination. In agricultural areas, shallow groundwater often has detectable concentrations of pesticides and high concentrations of nitrate. Bedrock aquifers may yield low to moderate quantities of water in areas where sand aquifers do not occur.

Province 5. Sand aquifers are isolated and occur more than 100 feet below the land surface. In areas where these are not present, bedrock aquifers may provide low to moderate quantities of water. Aquifers are generally not vulnerable to rapid contamination except sand aquifers located along rivers. Groundwater often contains high concentrations of dissolved chemicals, such as calcium and sulfate.

Province 6. Igneous and metamorphic rocks occur at or near the land surface. Groundwater occurs in fractures and faults in this rock. Quantities of available water are small. Water quality varies with type of rock. Concentrations of dissolved solids are usually low, but concentrations of iron, manganese and boron can be high.

• Chloride from road salt is increasingly being studied and recognized as a pollutant in both surface and groundwater in urban areas.

Who monitors groundwater quality in Minnesota?
Three state agencies share responsibility for groundwater quality: the Minnesota Pollution Control Agency, the Minnesota Department of Agriculture and the Minnesota Department of Health. The Pollution Control Agency and the Department of Agriculture monitor groundwater quality by testing wells throughout the state.

The Pollution Control Agency mostly tests for nonagricultural chemicals, but it is also responsible for sampling related to animal feedlots, manure storage facilities and agricultural...
industry sewage. The Department of Agriculture samples for chemicals originating from farm pesticides and the application of manure and chemical fertilizers. The Department of Health monitors drinking water for compliance with federal drinking water standards. The Department of Health also operates protection programs for municipal wells and regulates well construction and the sealing of old wells. It collects and interprets data from private wells in connection with specific cases of contamination where human health is a concern.

**How is groundwater quality being protected?**

The Department of Agriculture and other agencies, including the Pollution Control Agency, the University of Minnesota Extension Service, county soil and water conservation districts and the Board of Water and Soil Resources, develop and promote best management practices for home and business owners, farmers and others to minimize groundwater contamination.

The Department of Health has a number of programs aimed at protecting people from drinking contaminated water and preventing the spread of contamination within aquifers:

- The Department of Health has designated about 500 wellhead protection areas around the state, ranging in size from about 1 square mile to 20 square miles that are centered on wells for public water supply systems. It expects eventually to identify four times that many protection areas.

- Public water supply systems that have wellhead protection areas are required to develop management plans. The plans prescribe monitoring of known contaminants and planning for accidental spills. The plans may include special permitting requirements for underground storage tanks or farm feedlots within the protected areas, plus special plans for stormwater drainage.

- Fourteen areas across the state, covering about 87 square miles, have been designated as Special Well Construction Areas because of known contamination that has been proven to be, or may be, a health risk. In those areas, wells must be drilled in ways that avoid pumping or spreading the contaminated water.

In the Twin Cities, Special Well Construction Areas include parts of Minneapolis and several northern suburbs near the former Twin Cities Army Ammunition Plant in Arden Hills. On the east side of the metro area, large parts of Oakdale, Lake Elmo, Baytown Township and West Lakeland Township are similarly designated as Special Well Construction Areas. Five outstate counties—Beltrami, Blue Earth, Houston, Otter Tail and Todd—also have Special Well Construction Areas within their borders.

**How can I find out if my water is safe to drink?**

Most Minnesotans receive their water from public water systems. The Minnesota Health Department monitors and tests water distributed by those systems, both those that use groundwater and those that use water from rivers or lakes. Each year, the Health Department helps community water systems prepare Consumer Confidence Reports. The systems are required to publicize the reports and make them available to customers.

About 400,000 households across the state rely on private wells. The Department of Health recommends testing wells once a year for coliform bacteria, the most common type of contaminant. According to the Department of Health, at any given time, as many as one-fourth of the private wells in the state have detectable levels of coliform bacteria. From a health standpoint, any level of the bacteria is considered unacceptable.

The Health Department recommends a test for nitrate every two or three years, and more frequently if an infant under the age of 6 months old will be drinking the water. The Health Department also recommends testing for arsenic. Well testing costs from $10 to about $35, depending on the tests conducted. Some cities and counties have programs that provide free well testing or provide it at a reduced cost. See the Resource Materials page for more information.