Interpreting Drinking Water Quality Results

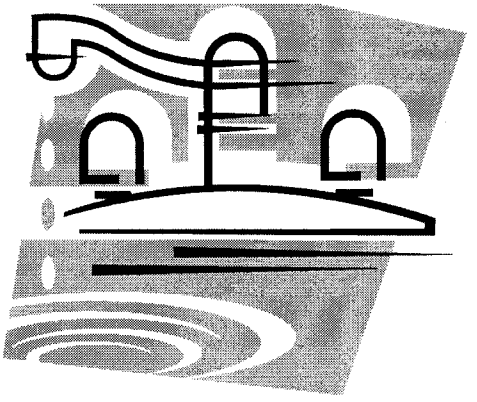
Identifying Problems and Solutions

INDIVIDUAL TESTS:

Using this fact sheet

This fact sheet is intended to help you interpret the results of commonly recommended analyses for drinking water from private wells in Wisconsin.

Some of these tests are important because they deal with health related contaminants; the other tests will tell you about important characteristics of your well water, such as how hard or corrosive it is.



Bacteria - Coliform

Coliform bacteria are microorganisms that are found in surface water and soil. This test is used as an indicator of the sanitary condition of your well. It is the most important test to perform on a well. A sanitary well should not contain any coliform bacteria.

Your result is either:

ABSENT = No coliform bacteria are present. Your water supply is bacteriologically safe. No further action is needed at this time. Consider testing your well again in a year for bacteria or sooner if you notice a sudden change in taste, color or odor.

or

PRESENT = Coliform bacteria are present; water supply is considered bacteriologically **unsafe**. *Until the source of the problem is identified and corrected, we recommend using an alternative source of drinking water or boiling water for 5 minutes before using for drinking or cooking*

While coliform bacteria do not usually cause disease, their presence in a water sample indicates a potential pathway for fecal wastes and other disease causing organisms to enter your well. If human or animal wastes are contaminating the water, gastrointestinal diseases, hepatitis, or other diseases may result. If coliform bacteria is present, many laboratories will also test for *E.coli,* a type of fecal coliform. The presence of *E. coli* in a water sample is more conclusive evidence of fecal contamination which represents an even greater health risk than the presence of coliform bacteria.

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Additional information about bacteria in wells:

In areas where fractured bedrock aquifers are overlain by thin soils, bacteria in a well may be the result of geologic conditions which do not allow for adequate filtration of water before reaching a well. You may suspect this if water suddenly changes color or odor following large rain events. For wells that are consistently contaminated with bacteria, disinfection may not solve the problem. In this case the best solution may be to drill a new well.

Bacteria – Coliform continued...

What should you do if coliform bacteria are present?

If coliform bacteria are present in a water sample we recommend carefully resampling to rule out sampling error.

If a second test confirms the original test, take corrective action outlined here:

1. Check well for sanitary defects. Some common examples include:
   - Well cap is loose or missing (well cap should be a vermin proof cap).
   - Casing is cracked or rusted through, or casing does not extend 12 inches above grade.
   - Inadequate grout (seal or fill around well casing).

2. After correcting any visible defects, disinfect with a dilute bleach solution using the procedure outlined by the Department of Natural Resources brochure entitled "Bacteriological Contamination of Drinking Water Wells".

3. Test again after bleach dissipates to ensure that the procedure was effective.

Hardness - Total

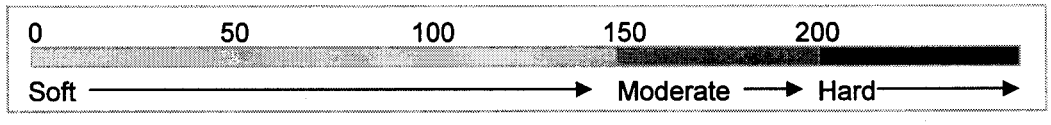
Hardness measures the amount of calcium and magnesium in water. Hardness is primarily caused by water slowly dissolving rocks that contain calcium and magnesium.

There are no health concerns associated with drinking hard water, however it is often undesirable because it can cause lime buildup (scaling) in pipes and water heaters. Hard water reacts with soap which can decrease its cleaning ability and hard water also causes build up of soap scum and/or graying of white laundry over time. Some people that use hard water for showering may notice problems with dry skin.

Calcium and magnesium are essential nutrients, however drinking hard water is generally not a significant source of calcium and magnesium dietary needs.

Water that is naturally low in total hardness (referred to as soft water) may be corrosive.

Note the water softening industry measures hardness in grains per gallon. 1 grain per gallon = 17.1 mg/L $CaCO_3$.



Acceptable Results:

Total hardness is a test for overall water quality; there are no health concerns related to total hardness. Values near 150 mg/L are generally ideal from an aesthetic viewpoint.

Water less than 150 mg/L are considered soft water while values greater than 200 mg/L are considered hard water.

Sources:

Primarily dissolved carbonate minerals from soil and rock materials. When carbonate minerals dissolve they increase the amount of calcium and magnesium ions in water.

Alkalinity

Alkalinity is a measure of water's ability to neutralize acids. It results primarily from dissolving limestone or dolomite minerals in the aquifer.

Alkalinity and total hardness are usually nearly equal in concentration (when they are both reported in mg/L $CaCO_3$ (calcium carbonate) because they form from the same minerals.

If alkalinity is much greater than total hardness, it may indicate that your water has passed through a water softener.

If alkalinity is much less than total hardness, it may signify elevated levels of chloride, nitrate or sulfate.

Water with low levels of alkalinity (less than 150 mg/L) is more likely to be corrosive. High alkalinity water (greater than 150 mg/L) may contribute to scaling.

Acceptable results:

This is a test for overall water quality. There are no health concerns related to alkalinity. The value should be roughly 75% to 100% of the total hardness value.

Sources:

Primarily dissolved carbonate from soil or rock materials.

Conductivity

Conductivity is a measure of the ability of water to conduct an electrical current. It is related to the amount of dissolved substances (or ions) in water, but does not give an indication of which minerals are present.

Conductivity (measured in µmhos/cm at 25° C) is about twice the total hardness value (mg/L $CaCO_3$) in most uncontaminated waters.

Changes in conductivity over time may indicate changes in your overall water quality.

Acceptable results:

This is a test for overall water quality, there is no health standard associated with conductivity.

A normal conductivity value is roughly twice the total hardness in unsoftened water samples. If conductivity is much greater than two times the hardness, it may indicate the presence of other ions such as chloride, nitrate, or sulfate which may be human-influenced or naturally occurring.

Sources:

Natural or human-related dissolved substances in water.

Corrective Action for Hard or Corrosive Water

If you are experiencing problems with hard water:

- Consider softening water using a water softener. Softened water removes calcium and magnesium and replaces it with another cation (usually sodium). Many people choose not to soften the cold water tap used for drinking and cooking.

If you are experiencing problems with corrosion of household plumbing:

- Install a water treatment device (neutralizer) designed to make water less corrosive.
- Install plastic plumbing which will not develop pinhole leaks or leach metals.
- If you have a shallow well, drilling deeper may produce less corrosive water.
- Water allowed to contact unprotected metal plumbing for extended periods can dissolve unsafe levels of copper and/or lead. If levels of copper or lead in drinking water are a concern, run water for a few minutes before using for drinking or cooking.

Did you know that your well water is actually groundwater?

Groundwater is water that occupies void spaces between soil particles or cracks in rock below the land surface. It is a local resource that originates as precipitation which infiltrates into the ground. The type of soil and bedrock that a well is drilled into often determines water's pH, saturation index, or the amount of hardness or alkalinity in water. The type of soil and bedrock in a region also determines how quickly contaminants can reach groundwater. Human activities are often responsible for elevated levels of contaminants such as nitrate and chloride.

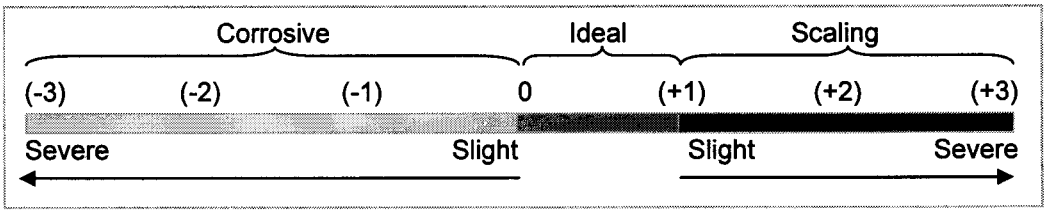
Saturation Index

The saturation index is a measure of water's ability to corrode or form scale. It is calculated using values from pH, alkalinity, total hardness and conductivity tests.

A negative value indicates that water is likely to be corrosive, while a positive value indicates a tendency for scale (calcium carbonate) to precipitate (form a solid and settle out) from water.

Water is a good solvent and will attack unprotected metal plumbing. Corrosive water can sometimes have health implications if it causes elements like lead and copper from pipes and solder to dissolve into drinking water. Symptoms of corrosive water may include pinhole leaks in pipes or green stains in sinks.

Lime precipitate (scale) is a natural protection against corrosion. Too much scale, however, will plug pipes and water heaters thereby decreasing their efficiency. Water softeners are an effective form of treatment to prevent scale buildup but may also decrease protection from corrosion that natural water may have provided.



Acceptable results:

This is a test for overall water quality, there is no health standard associated with the saturation index.

Values between 0 and 1 are considered desirable. However the relationship between saturation index and corrosivity/scaling is imperfect.

Because copper and lead are health related concerns you may still need to test your water to determine whether corrosion of these metals is occurring.

Sources:

Low values may be caused by lack of natural carbonate minerals in the aquifer. Low values also occur when hardness is removed with a water softener. High values relate to high water hardness and alkalinity.

Nitrogen-Nitrate

Nutrient management is an important strategy to minimize nitrogen losses in areas where fertilizer use is the primary source of nitrate in groundwater.

Not only does it help keep nitrate levels in groundwater low, it also helps farmers save money on fertilizer costs.

Nitrate is a chemical commonly found in agricultural and lawn fertilizer. It is also formed when waste materials such as manure or septic effluent decompose.

Infants less than 6 months of age should not drink water (or formula made with water) that contains more than 10 mg/L of nitrate-nitrogen. This is because of concerns related to methemoglobinemia (also called blue-baby disease), a condition in infants which inhibits the bloods ability to carry oxygen. If not caught early and treated, this condition can be fatal.

Some studies suggest that high nitrate water may be linked to birth defects and miscarriages, so pregnant women should also avoid drinking water over 10 mg/L.

The natural level of nitrate in Wisconsin's groundwater is less than 1 mg/L. Elevated nitrate levels can be an indicator of other

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Nitrogen-Nitrate continued...

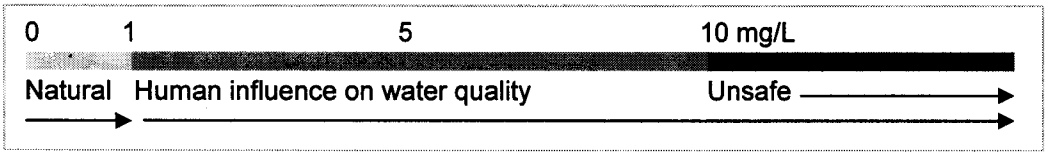
potential contaminants. If nitrate levels are elevated you may want to consider testing for pesticides if you know that they are used nearby.

Acceptable results:

The drinking water standard for nitrate-nitrogen is 10 mg/L. Above 10 mg/L is considered unsafe for infants less than 6 months of age and women who are pregnant. Less than 2 mg/L is preferred. If feed is also high in nitrate, problems for livestock may begin to occur if the concentration of nitrate in well water is between 20-40 mg/L.

Sources:

Fertilizers, septic systems, animal wastes, land spreading of bio-solids.



Corrective Action for Nitrate

If possible, eliminate the contamination source. Unfortunately it may take years to observe any reduction in nitrate levels. As a result an alternative solution is usually necessary. Below are some actions that may reduce nitrate levels.

- Extending the casing depth, lowering the depth of the existing well, or drilling a new well *may* result in water with lower nitrate concentrations.
- Use bottled water for drinking and cooking.
- Connect to a public water supply if possible.
- Use a water treatment device designed to reduce nitrate levels.*
  ***Only** reverse osmosis (RO), distillation and anion exchange are treatment methods capable of reducing nitrate levels. When purchasing a water treatment device, only purchase those that have been approved by the WI Dept. of Commerce. Ask them to provide a copy of the product approval letter if you are unsure.*

Chloride

In most areas of Wisconsin, chloride concentrations are naturally low. Higher concentrations usually indicate contamination from septic systems, road salt, fertilizer, animal waste or other wastes.

Chloride is not toxic, but some people can detect a salty taste when high levels of chloride are present. Water with high chloride may also have elevated sodium content. High chloride may also speed up corrosion in plumbing (just as road salt does to your car).

Acceptable results:

Chloride has no health standard. Levels less than 10 mg/L are desirable. Levels more than 250 mg/L may cause a salty taste or corrosion of some metals. Sodium (which is sometimes found with chloride) may be a concern for individuals on physician prescribed "no salt diets".

Sources:

Septic systems, road salt, fertilizer, animal waste, landfills, or naturally occurring mineral deposits.

Water testing and units of measure:

Many minerals and contaminants in water are reported as a concentration. When comparing test results to water quality standards it is important to check that you are comparing values with the same unit of measure. Some labs report nitrate concentrations as parts per million (ppm) while some use the term milligram per liter (mg/L).

1 mg/L = 1 ppm

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www.uwsp.edu/cnr/watersheds

Additional Information

The following websites contain more information on private wells and water testing:

Central Wisconsin Groundwater Center
www.uwsp.edu/cnr/gndwater/privatewells/index.htm

Wisconsin Department of Natural Resources
http://dnr.wi.gov/org/water/dwg/prih2o.htm

Other Useful Publications

Answers to Your Questions about Groundwater. DNR. PUB DG-049 2003

Bacteriological Contamination of Private Wells. DNR. PUB DG-003-2005

Better Homes and Groundwater. DNR. PUB-DG-070 2004

Choosing a Water Treatment Device. UWEX. G3558-5

Do Deeper Wells Mean Better Water? UWEX. G3652

Improving Your Private Well Water Quality. UWEX. G3826

Tests for Drinking Water from Private Wells. DNR. PUB DG-023-2007

You and Your Well. DNR. PUB-DG-002 2007

For copies of **WI Department of Natural Resources (DNR)** publications please call (608)266-0821 or visit http://www.dnr.state.wi.us/org/water/dwg/pubbro.htm

For copies of **UW-Extension (UWEX)** publications visit http://learningstore.uwex.edu or call (877)947-7827.

The Wisconsin Geological and Natural History Survey has many excellent geology and groundwater resources including maps available from their office. If interested in what resources are available call (608)263-7389 or for a complete listing visit their website at: http://www.uwex.edu/wgnhs/pubs.htm