Well Educated

Understanding Your Test Results

Example Test Result

LABORATORY ANALYTICAL REPORT

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Alkalinity, Total as CaCO3	254	mg/L		1		A2320 B	03/21/06 17:40 / qed
Chloride	27	mg/L		1		E300.0	03/22/06 19:13 / qed
Sulfate	318	mg/L		1		E300.0	03/22/06 19:13 / qed
Fluoride	1.0	mg/L		0.1		E300.0	03/22/06 19:13 / qed
Nitrogen, Nitrate+Nitrite as N	0.24	mg/L		0.05		E300.0	03/22/06 19:13 / qed

The following interpretation is based on public drinking water system standards. These standards only apply to public water systems but the health implications are the same for private well water users.

Definitions:
ND stands for no detection meaning the parameter was not detected in the sample
ppm (parts per million) is often used interchangeably with **mg/L** (milligrams per liter)
RL (reporting limit) is basically the smallest concentration a test can detect
MCL (maximum contaminant level) is a USEPA drinking water standard

Parameter Name	Possible Results	Quick Interp.	Warnings and Suggestions
Alkalinity (Total as $CaCO_3$) The ability of water to compensate for changes in pH. Higher alkalinity means water is less likely to experience big changes in acidity.	**ND or less than 100 (mg/L)**	**Corrosion Potential**	As alkalinity decreases below 100, if pH is lower than 6.5 there is increased potential for corrosion of pipes releasing metals into the water .
	100 to 200 (mg/L)	**Satisfactory**	Sufficient buffer potential to resist changes in pH and generally not significant scaling in pipes.
	200 or more (mg/L)	**Scaling Potential**	Possible scaling in pipes and water heaters.
Aluminum A naturally occurring metal generally found in concentrations between 0.01 and 0.3 mg/L in groundwater. The EPA secondary standard for aluminum is 0.050 to 0.2 mg/L because high concentrations can cause coloring of water.	**ND or less than 0.05 (mg/L)**	**Satisfactory**	No action necessary.
	0.05 or more (mg/L)	**Objectionable**	Standard based on aesthetics not health; if water discoloration is troublesome, consider treatment.
Antimony Antimony is not commonly found in nature; sources of contamination include petroleum refinery discharge, fire retardants, ceramics, electronics and solder.	**ND or less than 0.006 (mg/L)**	**Satisfactory**	Result generally shouldn't change dramatically through time, consider retesting next year if result is 0.005 or more.
	0.006 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative sources; see fact sheet for more information
Arsenic Groundwater contamination can happen from mining, pesticides and wood preservatives; contamination can also occur naturally.	**ND**	**Satisfactory**	Retesting not necessary unless a change is suspected.
	0 to 0.010 (mg/L)	**Satisfactory**	Ideally, drinking water should contain no detectable arsenic; consider retesting next year if result is 0.008 mg/L or more.
	0.010 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative drinking water sources; see fact sheet for more information.

Parameter Name	Possible Results	Quick Interp.	Warnings and Suggestions
Barium Found abundantly in nature and is used in the production of many household items; it can enter drinking water through industrial discharge and natural erosion.	**ND or less than 2 (mg/L)**	**Satisfactory**	Result generally shouldn't change dramatically through time, consider retesting next year if result is 1.6 mg/L or more.
	2 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative drinking water sources; see fact sheet for more information.
Beryllium A naturally occurring metal used in metal refining; coal combustion; and electrical, aerospace and defense industries.	**ND or less than 0.004 (mg/L)**	**Satisfactory**	Result generally shouldn't change dramatically through time, consider retesting next year if result is 0.003 mg/L or more.
	0.004 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative sources; see fact sheet for more information.
Bicarbonate as HCO_3 Bicarbonate is the principle alkaline constituent in drinking water. See alkalinity.	**Any Value**	**Satisfactory (depending on alkalinity)**	Bicarbonate does not pose a health risk; bicarbonate and carbonate are closely related to alkalinity.
Cadmium A metallic element that can enter drinking water through corrosion of pipes, erosion of natural deposits, metal refining and runoff from waste batteries and paints.	**ND or less than 0.005 (mg/L)**	**Satisfactory**	Result generally shouldn't change dramatically through time, consider retesting next year if result is 0.004 mg/L or more.
	0.005 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative sources; see fact sheet for more information.
Calcium A naturally occurring metal essential in the human diet and common in groundwater with concentrations ranging from zero up to several hundred mg/L. A major contributor to the hardness of water which can cause scaling problems in pipes and hot water heaters.	**Any Value**	**Satisfactory (depending on hardness)**	Calcium does not pose a health risk; calcium and magnesium together make up the hardness; see hardness.
Carbonate as CO_3 Mineral found in groundwater. See alkalinity.	**Any Value**	**Satisfactory (depending on alkalinity)**	Carbonate does not pose a health risk; carbonate and bicarbonate are closely related to alkalinity; see alkalinity.
Chloride A common natural salt in groundwater. The EPA secondary standard for chloride is 250 mg/L; higher concentrations can cause a salty taste.	**ND or less than 250 (mg/L)**	**Satisfactory**	No action necessary.
	250 or more (mg/L)	**Objectionable**	Standard based on aesthetics not health; if salty taste is troublesome, consider treatment.

Parameter Name	Possible Results	Quick Interp.	Warnings and Suggestions
Chromium A metallic element commonly found in nature; contamination of groundwater can happen through discharge from leather tanning, steel and pulp mills or erosion of natural deposits.	**ND or less than 0.10 (mg/L)**	**Satisfactory**	Result generally shouldn't change dramatically through time, consider retesting next year if result is 0.08 mg/L or more.
	0.10 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative sources; see fact sheet for more information.
Coliform Bacteria (Total) A type of bacteria which should not be present in groundwater; indicates potential contamination.	**Absent**	**Satisfactory**	Continue testing annually to monitor for contamination.
	Present	**Objectionable**	No direct health threat, but coliforms should not be present in groundwater; see fact sheet for more information.
Coliform Bacteria (*E. coli*) A type of bacteria found in feces of warm blooded animals which indicates fecal pollution. If *E. coli* is present in a sample, the water is unsafe to drink without treatment.	**Absent**	**Satisfactory**	Continue testing annually to monitor for contamination.
	Present	**Unsatisfactory**	Direct health threat; treat water for drinking and cooking; see fact sheet for more information.
Conductivity A measure of how easily electric current will pass through a water sample. This measurement is related to and often used to estimate total dissolved solids. Also used to estimate the tendency of water to corrode metal.	**Any Value**	**Satisfactory**	Conductivity does not pose a health risk; it is related to total dissolved solids and is used in calculating the corrosivity.
Corrosivity (Langelier Index) Corrosive water can mobilize metals (especially lead and copper) from pipes into drinking water and can eventually cause leaks in plumbing. While not a perfect tool, the Langelier Index is a useful guide for assessing the corrosive ability of water.	**Less than -2.5**	**High Corrosion Potential**	Corrosive water can leach metals from minerals in the earth or from pipes and fixtures; treatment and/or testing for metals is recommended.
	-2.5 to -0.5	**Moderate Corrosion Potential**	Corrosive water can leach metals from minerals in the earth or from pipes and fixtures; Consider treatment and/or testing for metals.
	-0.5 to 0.5	**Satisfactory**	Ideal range to minimize corrosion and scaling.
	0.5 to 2.5	**Moderate Scaling Potential**	Moderate potential for scaling in pipes and hot water heaters; consider treatment.
	More than 2.5	**High Scaling Potential**	High potential for scaling in pipes and hot water heaters; consider treatment.
Copper Potential health risks; copper is a metallic element that is rarely found in groundwater, but can be introduced into drinking water by corrosion of pipes.	**ND or less than 1.3 (mg/L)**	**Satisfactory**	Pipe corrosion is a common copper source; if water is corrosive, copper concentration could change through time; consider retesting next year if result is 1.0 mg/L or more. See fact sheet for more information.
	1.3 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative drinking water sources; see fact sheet for more information.

Parameter Name	Possible Results	Quick Interp.	Warnings and Suggestions
Fluoride A naturally occurring nonmetal which promotes dental health at concentrations between 0.7 and 1.5 mg/L, but can cause health problems at high concentrations.	**ND or less than 0.7 (mg/L)**	**Satisfactory**	Concentrations below 0.7 mg/L are out of the ideal range for protection of tooth enamel.
	0.7 to 1.5 (mg/L)	**Satisfactory**	Ideal range for development and protection of tooth enamel.
	1.5 to 2.0 (mg/L)	**Satisfactory**	Concentrations above 1.5 mg/L are out of the ideal range for protection of tooth enamel.
	2.0 to 4.0 (mg/L)	**Objectionable**	Dental fluorosis or brownish discoloration of teeth can occur; a report by the National Research Council suggests possible health effects at concentrations in this range.
	4.0 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative sources; see fact sheet for more information.
Hardness (as $CaCO_3$) Primarily caused by compounds of calcium and magnesium in water and can result in scaling in pipes/ water heaters; it also decreases the lather and effectiveness of soaps and detergents.	**ND or less than 60 (mg/L)**	**Corrosion Potential**	Softer water can be more corrosive; see corrosivity.
	61 to 120 (mg/L)	**Satisfactory**	Generally a satisfactory intermediate between corrosion and scaling; see corrosivity.
	121 or more (mg/L)	**Scaling Potential**	Harder water can cause scaling in pipes and hot water heaters; if scaling is troublesome, consider softening.
Iron (Total) Iron is a metallic element found in nature. Aesthetic problems such as staining of clothes and pipes, as well as sediment problems in plumbing are associated with iron.	**ND or less than 0.3 (mg/L)**	**Satisfactory**	No action is necessary
	0.3 or more (mg/L)	**Objectionable**	High iron can cause discoloration of fixtures and/or clothing and can support iron bacteria growth leading to taste and odor problems; if troublesome, consider treatment.
Lead A metallic element that often enters drinking water through corrosion of pipes.	**ND**	**Satisfactory**	If water is corrosive, lead concentration could change through time; see corrosivity.
	0 to 0.015 (mg/L)	**Satisfactory**	Pipe corrosion is a common lead source; if water is corrosive, lead concentration could increase; consider retesting next year if result is 0.012 mg/L or more; see fact sheet for more information.
	0.015 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative drinking water sources; see fact sheet for more information.
Magnesium A naturally occurring metal important in human diet and common in groundwater; with calcium, magnesium is a major contributor to the hardness of water.	**Any Value**	**Satisfactory (depending on hardness)**	Magnesium does not pose a health risk; calcium and magnesium together make up the hardness; hard water can cause scaling in pipes; see hardness.
Manganese A naturally occurring metal important in the human diet; the EPA secondary standard for manganese is 0.05 mg/L; high concentrations can cause black to brown color, black staining, and a bitter taste.	**ND or less than 0.05 (mg/L)**	**Satisfactory**	No action necessary.
	0.010 or more (mg/L)	**Objectionable**	Standard based on aesthetics not health; if black/brown staining or bitter taste is troublesome, consider treatment.

Parameter Name	Possible Results	Quick Interp.	Warnings and Suggestions
Mercury A metallic element; sources of contamination of drinking water include erosion of natural deposits, discharge from refineries and factories and runoff from landfills and croplands.	**ND or less than 0.002 (mg/L)**	**Satisfactory**	Result generally shouldn't change dramatically through time, consider retesting next year if result is 0.0016 mg/L or more.
	0.002 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative sources; see fact sheet for more information.
Nitrate + Nitrite as N or Nitrate as N Can occur naturally, from septic tanks/wastewater treatment, or from agricultural practices and causes oxygen deficiency in infants under 6 months of age; nitrate moves easily in groundwater so increasing nitrate levels can be an early warning that other contaminants are moving toward a well.	**ND or less than 1 (mg/L)**	**Satisfactory**	Continue testing annually to monitor for contamination.
	1 to 4 (mg/L)	**Possible Impairment**	Potential pollution exists; continue testing annually to monitor for changes.
	4 to 10 (mg/L)	**Above Normal Natural Levels**	Above normal levels; possible contamination; continue monitoring annually for changes; Monitor more regularly if infants under the age of 1 year are consuming the water.
	10 or more (mg/L)	**Unsatisfactory**	Health risk exists, discontinue use of water for infants under 1 year of age and persons with cardiovascular conditions; see fact sheet for more information.
pH The measure of acidity of water; pH is related to the ability of water to corrode pipes and release metals into water.	**6.5 to 8.5**	**Satisfactory**	pH of groundwater does not generally change rapidly so retesting is not necessary unless a change is suspected.
	Less than 6.5 or More than 8.5	**Objectionable**	pH slightly out of the ideal range is not a direct health threat but can affect corrosivity which can leach metals from minerals in the earth or from pipes; consider a corrosivity test.
Potassium A common salt in groundwater-essential in the human diet; concentrations are typically less than 10 mg/L.	**Any Value**	**Satisfactory**	Tap water concentrations generally range from 0.5 to 8 mg/l; no action is necessary .
Selenium A non-metallic element found in sedimentary rocks; sources of contamination include: discharge from petroleum refineries, erosion of natural deposits, and discharge from mines.	**ND or less than 0.05 (mg/L)**	**Satisfactory**	Result generally shouldn't change dramatically through time, consider retesting next year if result is 0.04 mg/L or more.
	0.05 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative sources; see fact sheet for more information.
Sodium A common salt in groundwater which can impart a salty taste at concentrations over 250 mg/L; sodium can contribute to hypertension and high levels in drinking water should be noted by people on low sodium diets.	**Any Value**	**Satisfactory**	Sodium in drinking water supplies can range from 0.4 to 1,900 mg/l; sodium intake in drinking water should be considered by people on low sodium diets in association with reducing risk of cardiovascular disease.

Parameter Name	Possible Results	Quick Interp.	Warnings and Suggestions
Sodium Adsorption Ratio (SAR) SAR is the amount of sodium relative to calcium and magnesium in the water; high SAR can damage soil and reduce crop productivity.	**Any Value**	**Depends on conductivity and soil type**	SAR is not relevant for drinking water, but irrigation water with an SAR value above 6 can pose a risk to physical soil characteristics; SAR risk is evaluated based on its relationship to conductivity and the texture of the soil being irrigated; see fact sheet for more information.
Sulfate A common salt in groundwater which can impart a salty taste; high quantities can cause gastrointestinal distress in people unaccustomed to the water.	**ND or less than 250 (mg/L)**	**Satisfactory**	No action necessary.
	250 or more (mg/L)	**Objectionable**	Standard based on aesthetics not health; if salty taste is troublesome, consider treatment.
Thallium A metallic element; sources of contamination include: leaching from ore-processing sites, discharge from electronics, glass and drug factories.	**ND (mg/L)**	**Satisfactory**	No action necessary.
	0.001 to 0.002 (mg/L)	**Satisfactory**	Ideally, drinking water should contain less than 0.001 mg/l of thallium; consider retesting next year if result is 0.001 mg/L.
	0.002 or more (mg/L)	**Unsatisfactory**	Health risk exists; consider water treatment and/or alternative sources; see fact sheet for more information.
Total Dissolved Solids TDS is the sum of all minerals, metals and salts dissolved in water; high quantities can cause gastrointestinal distress in people unaccustomed to the water.	**ND or less than 500 (mg/L)**	**Satisfactory**	Total Dissolved Solids should not change significantly through time; retest if a change is suspected.
	500 or more (mg/L)	**Objectionable**	High total dissolved solids do not generally pose a serious health risk but can cause water to be colored, taste poor, stain, and cause diarrhea in people not accustomed to the water.
Uranium A naturally occurring metal that can be ingested through the air, water and plants. The EPA primary standard is 30 µg/L. Water can be contaminated from natural processes, mining, coal combustion, nuclear power plants and phosphate fertilizers.	**ND or less than 30 (µg/L)**	**Satisfactory**	Ideally, drinking water should not contain any uranium.; consider retesting next year if value is greater than 24 µg/L.
	30 or more (µg/L)	**Unsatisfactory**	Health risk exists; consider water treatment or alternative drinking water sources; see fact sheet for more information.
Zinc A naturally occurring metal essential to the human diet; the EPA secondary standard for zinc is 5 mg/L; high concentrations can cause a metallic taste.	**ND or less than 5 (mg/L)**	**Satisfactory**	No action necessary.
	5 or more (mg/L)	**Objectionable**	Standard based on aesthetics not health; if metallic taste is troublesome; consider treatment.

Well Educated

Applying knowledge to improve water quality
Northern Plains & Mountains Regional Water Program
A Partnership of USDA NIFA & Land Grant Colleges and Universities

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Corrosivity

What is Corrosivity?

Corrosivity is a measure of how aggressive water is at corroding pipes and fixtures. Corrosive water can mobilize lead and copper from pipes into drinking water and can eventually cause leaks in plumbing.

Corrosive potential of water is increased by:

- → **pH** (lower than 6.5 or higher than 8.5)
- → **water flow rate** (faster flow)
- → **water temperature** (higher temp)
- → **dissolved gases** (more dissolved gas)
- → **conductivity** (higher conductivity)
- → **dissolved solids** (high dissolved solids)
- → **certain bacteria** (more bacteria)
- → **suspended solids** (more sediment)
- → **chlorine** (more chlorine)

Determining Corrosivity

One common index of corrosivity is the Langelier Index (LI). The LI is calculated using pH, temperature, total dissolved solids, alkalinity, and total hardness. The LI is a measure of the balance between pH and calcium carbonate ($CaCO_3$). As the LI value becomes more negative, the water is increasingly under-saturated with $CaCO_3$ and therefore has increased corrosion potential. As the LI value becomes more positive, the water is increasingly over-saturated with $CaCO_3$. Over-saturation results in $CaCO_3$ precipitation which can coat and protect pipes from corrosion but can cause scaling in pipes, hot water heaters, and fixtures. While not a perfect analytical tool, the LI serves as a useful guide for assessing corrosive ability of well water.

Langelier Index	Description	General Recommendation
-4	Severe Corrosion	Treatment Recommended/Consider Lead/Copper Test
-3	Moderate Corrosion	Treatment Recommended/Consider Lead/Copper Test
-2	Moderate Corrosion	Treatment May Be Needed/Consider Lead/Copper Test
-1	Mild Corrosion	Treatment May Be Needed/Consider Lead/Copper Test
-0.5	None-Mild Corrosion	Probably No Treatment
0	Near Balanced	No Treatment
0.5	Some Faint Coating	Probably No Treatment
1	Mild Scale Coating	Treatment May Be Needed
2	Mild to Moderate Coating	Treatment May Be Needed
3	Moderate Scale Forming	Treatment Advisable
4	Severe Scale Forming	Treatment Advisable

Adapted from Wilkes University Center For Environmental Quality;
Corrosion, Saturation Index, Balanced Water in Drinking Water Systems

Controlling Corrosion

Corrosiveness may be increased by installing water softeners, aeration devices, increasing hot water temperatures, chlorinating water or improper matching of metal pipes. Corrosion control options include pretreatment systems, installation of non-conductive unions, reducing hot water temperature, and replacing metal piping with CPVC. Pretreatment systems include neutralizing tank filters and caustic liquid treatment. These systems change the pH, hardness, and/or alkalinity to achieve a less corrosive water chemistry.

Additional Resources:

Corrosion ... in Drinking Water Systems; Wilkes University Center for Environmental Quality
http://www.water-research.net/corrosion.htm

Lead and Copper Fact Sheet; MSU Extension Water Quality
http://waterquality.montana.edu/docs/homeowners.shtml (listed under “Drinking Water”)

Household Drinking Water Protection and Treatment; MSU Extension Service
http://waterquality.montana.edu/docs/homeowners.shtml (listed under “Drinking Water”)

Northern Plains and Mountains Regional Water Program– Drinking Water Initiative
http://region8water.colostate.edu/regional/DrinkingWater/slideshow/projects.shtml