AGRI-FACTS
Practical Information for Alberta's Agriculture Industry

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Chemical Analysis Interpretation of Rural Household Water Supplies

A routine chemical analysis tests the water for about 15 chemical parameters. Levels for common problems such as hardness, sodium, sulphates, nitrates and nitrites can be determined.

Chemicals, other than those discussed below, can be tested, but arrangements to analyze them should be made with the laboratory before the sample is collected and submitted. These special requests must be arranged before collecting or submitting the sample and should be clearly specified on the request form. Special water sample collection procedures may need to be observed.

Your farm water supply should be analyzed regularly. Testing frequency depends on the type of water source. When a new water source is constructed, or a change in water quality is noticed, or other special circumstances arise, the water should be tested.

To test water for human consumption, your Regional Health Authority can provide the necessary water sample containers and arrange for laboratory testing. Water samples for livestock, irrigation, mortgage approvals and other non-household water usage must be sent to a private lab. Check the Yellow Pages telephone book for major cities under "laboratories" for lab contacts.

The water sample you take should be representative of the household supply. Choose a water outlet you regularly use for household usage. If you want to determine if the water quality of the source itself is an issue, then take a sample as close to the source as possible from an uncontaminated outlet. For most household samples, allow the water to run through the faucet for about five minutes and then fill the sample container. Send the sample to the lab right after collection.

Your rural household water supply should be analyzed regularly

To help you interpret the results after the laboratory analysis is complete, you can use factsheets such as this one, or contact a health inspector or agricultural water specialist. The Rural Water Quality Information Tool on Alberta Agriculture's website (at www.agric.gov.ab.ca/app84/rwqit) can also assess water quality suitability for human drinking water, livestock, irrigation and spray water.

The comments on water quality below, which refer to particular minerals and other chemicals, pertain to household usage.

Water quality criteria

It is not legally required for private supplies to meet federal guidelines. People have different reactions and tolerances to different water quality constituents.

The two major types of guidelines are **"aesthetic objectives" (AO)** and **"maximum acceptable concentrations" (MAC)**. Aesthetic objectives (AO) relate to effects like taste, odour, staining, etc. MAC levels are assigned when there are known health effects. If a chemical in your water exceeds MAC human drinking water limits, consult your family doctor or local health inspector.

All levels listed below (except pH and conductivity) are listed in milligrams/litre (mg/L), which is practically equivalent to parts per million (ppm) for drinking water.

Sodium

The AO for sodium is less than 200 mg/L. Sodium is not considered a toxic metal, and normal adults may consume 5,000 to 10,000 milligrams per

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day without adverse effects. The average intake of sodium from water is only a small fraction of that consumed in a normal diet.

The recommended maximum level for people suffering from certain medical conditions such as hypertension, congestive heart failure or heart disease is 20 mg/L. If in doubt, consult a physician.

Sodium is a significant factor in assessing water for irrigation and plant watering. High levels affect soil structure and a plant's ability to take up water.

Potassium

There is no guideline or recommended limit for potassium in water. Alberta water supplies rarely contain more than 20 mg/L.

Water softeners that regenerate using potassium chloride can significantly raise the level of potassium in water. It is recommended that people with kidney disease or other conditions such as heart disease, coronary artery disease, hypertension, diabetes and those who take medication that interferes with how the body handles potassium do not drink water from a water softener that uses potassium chloride.

Calcium

The recommended limit for calcium is 200 mg/L; however, there is no federal or provincial guideline. Calcium is one constituent of "hardness" in water and is not a hazard to health. Calcium is undesirable because it may be detrimental for household uses such as washing, bathing and laundering. It also tends to cause encrustations in kettles, coffee makers and water heaters and may impair treatment processes.

Magnesium

Magnesium is another constituent causing "hardness" in water. There is no federal or provincial guideline for magnesium, but a recommended limit of 150 mg/L is suggested because of taste. Higher levels of magnesium may produce a bitter taste but are not normally a health hazard.

Iron

The AO for iron is less than 0.3 mg/L. Levels as low as 0.2 to 0.3 mg/L will usually cause staining of laundry and plumbing fixtures. Iron gives water a metallic taste that may be objectionable to some at 1 to 2 mg/L. Most water sources contain less than 5 mg/L iron, but occasionally, levels over 30 mg/L are found. The presence of iron bacteria in water supplies will often cause staining even at levels near 0.1 mg/L. Iron and iron bacteria are not normally a health concern.

Iron bacteria cause a slime that can reduce well flow, cause staining, clog up piping and pumps, and impair treatment processes.

A routine chemical test does not always provide a dependable measurement of the iron concentration. To determine an accurate level of iron, a trace metals analysis should be conducted.

Sulphate (SO_4)

The AO for sulphate is less than 500 mg/L. Sulphate concentrations over 500 mg/L can cause a laxative effect, especially for new users, as well as an objectionable taste. People may become accustomed to higher sulphate levels. If your water contains high levels of sulfate and you suspect that it is causing health problems, you should contact a physician.

Chloride

The AO for chloride is less than 250 mg/L. At levels above 500 mg/L, a salty taste is usually noticeable. Most water in Alberta contains less than 20 mg/L, although chloride in the 2,000 mg/L range can be found in some areas.

NO_3 Nitrogen (Nitrate)

The MAC is **10 mg/L when reported as the nitrogen component of nitrate (NO_3-N) or 45 mg/L when reported as nitrate (NO_3)**.

Nitrates may be an indicator of contamination by human or livestock wastes, excessive fertilization or seepage from dump sites. Nitrates can also occur naturally in some geological formations. The MAC level is largely based on the potential for nitrate poisoning of infants called methemoglobinemia (blue baby syndrome).

NO_2 Nitrogen (Nitrite)

Due to its toxicity, the MAC for nitrite in drinking water is **1 mg/L when reported as NO_2-N** (the nitrogen component of nitrite) or approximately **3.28 mg/L when reported as nitrite (NO_2)**. Nitrite is often an indicator of direct contamination by sewage or manure because nitrites are unstable and quickly converted into nitrates.

Fluoride

The MAC for fluoride is 1.5 mg/L. Levels above this limit may cause dental fluorosis in children 13 years old and younger including infants.

Total Dissolved Solids Inorganic (TDS Inorganic)

The AO for TDS is 500 mg/L. “Dissolved solids” are small enough to pass through a very fine filter (2.0 microns), and they can come from natural or man-made sources.

The TDS value that usually appears in a lab analysis is calculated from adding the measured mass of all inorganic elements dissolved in water. Alternatively, TDS can be derived from another measurement called “conductivity” and is most accurate when organic content in the sample is low.

Ground water sources often contain higher TDS concentrations than surface water. Average Alberta well water has a TDS level closer to 1,000 mg/L. Levels higher than 1,000 mg/L are not necessarily a health problem depending on the specific minerals present; however, they may be somewhat unpalatable. High TDS may be associated with excessive hardness, taste, mineral deposition or corrosion.

Conductivity

Conductivity can be used to estimate the total dissolved solids (inorganic) in the water. Multiplying the conductivity in microSiemens per centimetre by 0.65 will give an approximation of the total dissolved solids in mg/L. Conductivity tests are often used to assess water suitability for irrigation, for which the units used are usually deciSiemens per metre.

1 deciSiemen/metre = 1,000 microSiemens/centimetre

pH

The AO for pH is 6.5 to 8.5. pH is a measure of the concentration of the hydrogen ion, which determines how acidic or basic the water is. The pH scale goes from 0 to 14, with pH less than 7 being acidic and pH greater than 7 being basic. pH below 6.5 may be corrosive whereas pH above 8.5 may cause encrustation, scaling and a bitter taste.

The measurement of pH varies with temperature and is usually reported to what it would be at 25 degrees C. pH will affect many water treatment processes and needs to be considered when assessing treatment options.

Hardness

Hardness is caused primarily by calcium and magnesium salts in water. It is expressed as a mg/L equivalent of calcium carbonate. Hard water causes soap curd, which makes bathroom fixtures difficult to keep clean and causes graying of laundry. Increased levels above 100 mg/L will require more soap to be used when washing or bathing.

Hard water will also tend to form scale in hot water tanks, kettles, piping systems, etc.

Most labs will report hardness in mg/L. Many water treatment companies will use field test kits that report hardness in grains per gallon.

one grain per gallon (US) = 17.1 mg/L

Type of water	Amount of hardness	
	mg/L	Grains per gallon
Soft	0 - 50	0 - 3
Moderately soft	50 - 100	3 - 6
Moderately hard	100 - 200	6 - 12
Hard	200 - 400	12 - 23
Very hard	400 - 600	23 - 35
Extremely hard	over 600	over 35

Alkalinity

Alkalinity is not a specific substance but rather a combined effect of several substances, most importantly carbonates, bicarbonates and hydroxides. It is expressed in units of mg/L of $CaCO_3$. It is a gauge of the ability of water to neutralize acidity.

The alkalinity of most Alberta waters is in the range of 100 to 500 mg/L, which is considered acceptable. Water with higher levels is often used. Alkalinity is a factor in corrosion (from low levels) or scale deposition (from high levels) and may also impair treatment processes.

Water treatment

Water treatment equipment can often improve water quality significantly. Each type of water treatment equipment has its limitations and therefore should be selected carefully.

For more information on water treatment please refer to the Agdex 716 D series of factsheets and the Rural Water Quality Information Tool on Alberta Agriculture's internet site: http://www.agric.gov.ab.ca/app84/rwqit

Helpful conversions

1 mg/L (milligram per litre) = approx. 1 ppm (part per million)
1 gpg (grain per gallon) = 17.1 mg/L (milligram/litre)

References

Guidelines for Canadian Drinking Water Quality – Summary Table (March 2007)

Canadian Environmental Quality Guidelines at http://www.ccme.ca/publications/ceqg_rcqe.html

Alberta Environmental Public Health Field Manual http://www.health.alberta.ca/documents/Drinking-Water-Systems-2004.pdf

Other information sources

Alberta Agriculture factsheet regarding livestock water quality *Water Analysis Interpretation*, Agdex 400/716-2

Health Canada website (use the search pane) http://www.hc-sc.gc.ca/index-eng.php

Rural Water Quality Information Tool link at http://www.agric.gov.ab.ca/app84/rwqit

Alberta Agriculture and Rural Development Agricultural Water Specialists at: Alberta Ag-Info Centre; call toll-free 310-FARM (3276)

Prepared by

Farm Water Supply Branch
Alberta Agriculture and Rural Development

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