



What are my cows really drinking?

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You may have answered, “It’s just H₂O”.

Saying “It’s just water” is like saying “Hay is just hay.” Rarely do we give much thought to where it really comes from and what is in it.

Water is an absolutely vital part of keeping cows healthy and productive. Let’s take a few minutes to step back and look at where water comes from, what water analysis can tell you and how it might be affecting the nutrition and health of your cows. Accounting for total mineral intake including the mineral content of water can help us avoid over-feeding minerals, reduce excessive excretion of minerals in urine and manure, adjust diets to avoid competition or antagonism for trace mineral absorption, and potentially keep pre-fresh and lactating cows in optimum DCAD status.

How Geology Affects Mineral Content of Water

Due to water vapor mixing with nitric oxide and sulfur dioxide in the atmosphere, most of the precipitation falling on the northeastern United States has a pH of around 4.2. This moderately acidic solution (a.k.a. acid rain) then dissolves minerals out of the soil and bedrock on its way to the underlying aquifer. So the geology of your particular neighborhood will have a significant effect on the minerals found in your water supply. If that bedrock is mostly sedimentary, water will leach much more mineral out of it. As it moves through metamorphic bedrock, it will dissolve less and through igneous (volcanic) rock, almost none at all. Additionally, deeper wells will generally have higher mineral content than shallow ones, simply because the water has spent more time working its way through bedrock to those deeper levels.

When water is pulled from shallower, gravelly aquifers (known as unconsolidated aquifers) it is much more susceptible to surface influences such as large rain events, snow melt, drought or agricultural practices such as manure or fertilizer applications, etc. Knowing something about the character of your water source will help you figure out how often you need to sample and analyze your water supply.

General Guidelines for Water Sampling Frequency

- To get started, sample each of your wells 4 times per year.
- Take these samples to capture the extremes of potential variation in the water supply, including events such as spring thaw, the hottest, driest part of summer, late fall, and mid-winter.
- If there is much variation in mineral levels from season to season, continue sampling 4 times per year for a couple of years to see if the pattern of change is consistent.
- If there is very little variation in mineral levels across the seasons, it is reasonable to drop back to sampling every other year or so.
- If water use patterns change in your neighborhood, for example new irrigation wells are put in, or hydro-fracking activity starts up, go back to the 4 times per year sampling so that you can adapt to changes in water quality.

What Should I Test For?

Unless you are suspicious about a specific contaminant in your water supply, such as a leaky fuel tank, a nearby industrial dump, or other source, the Complete Water Analysis offered by Dairy One is the place to start (<http://dairyone.com/analytical-services/water/>). This analysis will give you a comprehensive mineral analysis in addition to bacterial coliforms, pH, hardness and total dissolved solids. If you have reason to suspect a toxic contamination of your water source, National Testing Labs (www.watercheck.com/products.html) has analysis options that include volatile organic compounds (such as fuel constituents) and twenty different pesticide and herbicide compounds. Both labs will send complete kits containing sample bottles and detailed instructions for sample collection and submission.

How Do I Analyze the Results, and What Does This Mean for My Cows?

When you get the results back, one way to evaluate their potential contribution to mineral nutrition, or any other issues, is to use the evaluator at www.waterforcows.com. There, you can sign up for a free subscription and, after entering some basic information (milk production, dry matter intake, temperature and sodium intake) calculate the water intake and potential mineral intake from your cows’ water supply. In most cases, the intake will be small, from nothing up to a few grams of mineral. However, for about 12% of water supplies, the intake of minerals from water can range from tens to hundreds of grams of mineral. This represents an opportunity to adjust mineral levels in the diet so that the overall mineral balance is kept in line.

Over the last eight years, Dairy One and Dairyland Laboratories have gener-

ously provided me with their water analysis databases to compile summaries of results. These summaries include about 12,000 sample results and, it should be noted, are not necessarily from dairies. In the table below, you can see that the average level of most minerals is fairly low, but at the upper end of the samples are some with very high mineral levels.

	SO ₄ -S	Cl	Ca	P	Mg	K	Na	Fe
Average (ppm)	70.5	183.7	101.5	0.6	34.1	12.29	123.3	0.46
Maximum (ppm)	3003.0	18760	9320	124.5	1267	707.3	12260	40.9

Table 1. Average and maximum concentration (ppm) of minerals from 12,162 samples analyzed by DairyOne and Dairyland Laboratories, 2006 – 2013.

When we consider a cow that will drink about 30 gallons (115 liters) of water per day, some of these samples will translate into a significant mineral intake from the water supply. Again, most water supplies will have minimal impact on mineral intake. However, the average water supply in this dataset will provide 28%, 34% and 39% of a cow’s requirement for sodium, chloride or sulfur, respectively. This provides an opportunity to adjust dietary mineral supplementation.

The table below shows the grams of mineral consumed, just from water, in an “average” water sample, and at the upper end (90th percentile) of these water samples.

	SO ₄ -S	Cl	Ca	P	Mg	K	Na	Fe
Average (g)	25.4	21.1	11.7	<0.1	3.9	1.4	14.2	<0.1
90th Percentile (g)	73.6	23.5	21.1	0.1	7.5	1.8	23.4	0.1

Table 2. Mineral intake (grams) from 30 gallons of water intake with average mineral levels, or at the 90th percentile of the distribution; from 12,162 samples analyzed by Dairy One and Dairyland Laboratories, 2006 – 2013.

Throughout the Midwest, Northeast and Mid-Atlantic regions, the mineral that causes the greatest concern is sulfur. About 8.5% of the samples in this dataset contained enough sulfur (267 ppm of SO₄-S, equivalent to 800 ppm of SO₄) to antagonize the absorption of copper and selenium, 2 trace minerals that are essential for animal health. Because sulfur is quite often odorless and tasteless, we may not know there is a problem with elevated levels until we analyze the water. In some areas, iron can be a significant problem leading to palatability issues and reduced water consumption. Recent research from Michigan State University puts the level at which cows back off on water consumption somewhere between 4 and 8 ppm. Similarly, iron and manganese will support the growth of iron- or manganese-reducing bacteria. These will form black, slimy, growths inside water pipes and troughs and may also lead to reductions in water intake.

The last area I’ll touch on is that of DCAD balance. Just as we know that dietary sodium, potassium, magnesium, calcium, sulfur, chloride and phosphorous (the “strong ions”) will influence the acid/base status of cows, so will those same minerals found in water. Until recently, we have never considered these ions coming from water in our calculation of DCAD balance. If a water supply has a high level of the positively charged ions (Na, K, Mg, or Ca) it can drag your pre-fresh cows’ pH out of the optimal range to avoid milk fever and other metabolic complications. In lactation, and especially in summer, when we want the DCAD balance on the positive side, a high level of S or Cl can drag them down and disrupt rumen function, feed intake, and production. Knowing the contribution of ions from water is another step in avoiding potential issues in both pre-fresh and lactating cows. Once you know it, you can manage around it.

To follow up on this topic, you can:

- Contact Dairy One for a water sample kit.
- Collect a water sample from each source of water that your cows consume and send it in for a Complete water analysis.
- Sign up for a free subscription at www.waterforcows.com
- Evaluate the combination of water and dietary minerals for your cows using the WaterForCows® model.
- Work with your nutritionist to make necessary adjustments in the diet, or work with a water treatment company if serious water quality problems are detected.