



Interpreting Groundwater Results – Information for Dairy Producers in California’s North Coast Region

Deanne Meyer, Livestock Waste Management Specialist, Patricia L. Price, Staff Research Associate,
Department of Animal Science, University of California, Davis
dmeyer@ucdavis.edu

In fall, 2012, the first of four groundwater sampling events was required to meet the conditions of the North Coast Regional Water Board’s Waiver of Waste Discharge Requirements for Dairies. By now, most producers have received results from this first sampling event. Sample results should be available for both nitrate and fecal coliform.

This document provides helpful information about interpreting results from groundwater monitoring.

What do the results mean?

Nitrate results should be reported as either nitrate (NO_3) or nitrate-nitrogen ($\text{NO}_3\text{-N}$) in units of mg/l or ppm (parts per million). The US Environmental Protection Agency (USEPA) has a maximum contaminant level (MCL) for this compound in drinking water. Elevated nitrate concentrations have been associated with compromise of the blood’s ability to carry oxygen resulting in blue baby syndrome in infants under 6 months of age. **Values above 45 ppm nitrate (NO_3) or 10 ppm $\text{NO}_3\text{-N}$ exceed the MCL and are indicative of contamination of the water supply.** If nitrate results are higher than these levels, use an alternate water source to mix infant formula.

Laboratory results for **fecal coliform** should be reported in units of most probable number (MPN). The lab sheet may show the results from each of 10 tubes (1 x 10) as positive (+) or negative (-) for the presence of fecal coliform bacteria. The results observed in each of the 10 tubes at 96 hours are used to estimate MPN. Caution should be used when determining the sanitary significance of any single coliform result. The laboratory method precision for the estimation of MPN is greatly improved when several samples from a given sampling point are estimated separately and then the results combined to obtain an average.

An MPN greater than 1 means there may be fecal contamination of the water supply.

The 95% confidence limits are one-third to three times the reported estimate. This means that if the reported value is less than 5.1, the actual estimate is within the range 0 to 9.7 MPN (see table on page 2). If this water supply is a drinking water supply, you may choose to resample. For MPN values 5.1 or larger, the table below suggests it may be wise to chlorinate the well and resample after chlorination to be sure fecal coliforms are not present.

What should I do about positive results?

For positive results you should evaluate practices at or near the wellhead to identify if contamination is occurring in that immediate area. Manure applications near the wellhead or even in the vicinity could flow to the wellhead. Document any management modifications you make so you have it available when you prepare your Annual Report.

Samples should be collected as close to the wellhead as possible to reduce the possibility of obtaining false results from contamination in a storage tank or pipeline. Resample the water supply if there is a location closer to the wellhead than the site of the original sample.

MPN Index and 95% confidence Limits for all combinations of positive and negative results when ten 10-ml portions are used (Source: APHA AWWA WEF)

Positives*	MPN Index/100 mL	95% Confidence Limit (Exact)	
		Lower	Upper
0	< 1.1	--	3.4
1	1.1	0.051	5.9
2	2.2	0.37	8.2
3	3.6	0.91	9.7
4	5.1	1.6	13
5	6.9	2.5	15
6	9.2	3.3	19
7	12	4.8	24
8	16	5.8	34
9	23	8.1	53
10	>23	13	--

* Number of tubes giving positive reaction (10 mL each)

Can I decontaminate my water supply?

If well results show elevated nitrate (above the drinking water standard) or the presence of fecal coliforms, you should take action. Your County Environmental Health Service may have additional brochures or handouts with information on well results and decontamination procedures, but here are some steps you should consider.

Elevated nitrate: Elevated nitrate concentrations may result from a poorly collected sample or from actual nitrate contamination. Nitrate is mobile in the soil, so it is important to review applications of manure, fertilizers, and other soil amendments and to evaluate total nitrogen applied to fields and total nitrogen removed. In standard agricultural settings water is seldom treated to remove nitrate.

Presence of fecal coliforms: The presence of **fecal coliforms** may indicate contamination of the well by feces. Chlorination should take care of this if it is not a recurrent problem. However, a thorough analysis of the source of feces and potential pathways into the water supply should be conducted to identify if modification of existing management practices could be beneficial to address direct contamination of wells through the well head may occur.

Documents from Humboldt County Environmental Health were used to prepare the following list regarding well contamination.

“Wells of insufficient depth or substandard construction are more susceptible to bacteriological contamination. This is particularly true of “dug wells” that are walled up with boards, brick, stone, or tile sections. These linings let unfiltered surface water and near-surface water seep in through cracks. Properly constructed wells (drilled wells) are usually free from bacteriological contamination because they seal off near-surface and surface waters from the well. However, if drilled wells are contaminated, one of the following reasons is likely the cause:

- Lack of or inadequate annular seal around well casing causing surface water intrusion.
- The casing is not terminated far enough above the ground.
- Well is too close to sources of contamination (sewage disposal system, corrals, etc.).

- Well head is subject to flooding, or slab does not drain away from casing, or is missing.
- Inadequate sanitary seal at well head.
- Cross connections in plumbing system.
- In old wells, the casing may have rusted through, leaving holes near the ground surface through which polluted surface water can enter.
- New wells often show contamination because the drill hole becomes contaminated through dirty tools, pipe and drilling water.
- New piping, pump or pressure system components may also contaminate a well if they are dirty and not disinfected prior to use, assembly or installation. Therefore, new wells, pumping equipment and water systems should be disinfected prior to use. The state code requires such disinfection.
- Storage tank in poor condition, or allows intrusion of water, dirt, insects, animals, etc.”

What will the North Coast Regional Water Board do if my Nitrogen or Fecal Coliform results are high as reported in my Annual Report?

Each Fall, the Regional Board will review the dairy groundwater data as reported in the dairy Annual Reports, which are due by November 30 of each year. If sampling results show elevated levels of nitrate or fecal coliforms, they may contact you regarding re-sampling or arranging an onsite inspection. If ongoing contamination is found to be a problem, measures will be taken to find the source of groundwater contamination (it may be offsite) and steps may be recommended to increase protection.

For additional information:

<http://co.humboldt.ca.us/hhs/phb/environmentalhealth/documents.asp> (scroll down to Wells and Water, click on links for Interpretation of water sample & procedure for disinfection wells)

APHA AWWA WEF. 2005. 21st Edition Standard Methods for the Examination of water and wastewater. Method 9221. Ed. A.D. Eaton, L.S. Clesceri, E.W. Rice, A.E. Greenberg. American Public Health Association. Washington, DC.

Information in this document was compiled by CDQAP to assist dairy producers in understanding and complying with the three North Coast Region General WDR or Waiver of WDR for dairies. Effort has been made to ensure accuracy, but these summaries are not official regulatory guidance and are not legal advice. Producers are advised that these summaries are not intended to be a substitute for reading the complete order and consulting their own legal counsel to ensure compliance with the waste discharge requirements. Should any information here conflict with the Orders and/or official information provided by the Regional Board, Board-provided information takes precedence. Staff at the Regional Board reviewed this document for completeness.