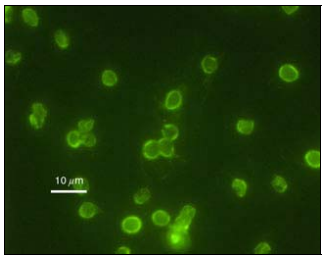
PRIVATE DRINKING WATER IN CONNECTICUT

Publication Date: November 2009

Publication No. 38: Sampling Private Wells for Bacteria

Sampling Technique



Nothing is more frustrating than to investigate a water quality complaint, take some samples, wait a week or more for the results ands when they finally come in, realize that should have asked for other parameters and possibly should have been more careful when you took the samples. Therefore take your time in sampling, sample preservation and deciding what definitive parameters you need to solve the problem you are addressing.

When sampling for bacterial populations aseptic (pathogen free) sampling technique *must* be followed and any and all variables that would affect water quality must be eliminated where possible. Any well that requires sampling, if buried, must be found and uncovered so that sanitary construction of the well can be checked. If the well is in a pit, check to see if the pit is flooded with rainwater and if the water is running into the well casing via the vent or electric conduit? Perhaps the well doesn't even have a sanitary seal. If the well has obvious flaws such as these the well should be brought up to present code standards and disinfected before any water sampling is done. Allowing these conditions to exist, even with good bacteriological results, allows for future problems to develop and reoccur. The sample must be representative of untreated or raw well water only. Do the following:

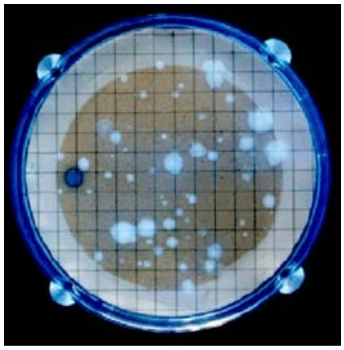
- After sampling and if practical, remove the well bonnet to inspect the sanitary seal, pitless adapter, if present, and upper terminus of well casing for watertight integrity
- Flush out storage tank until water runs clear
- Remove any aerators or similar devices from the sample tap/faucet
- Sample ahead/upstream of any and all point of entry (POE)/point of use (POU) water treatment devices, or the first downstream faucet after the pressure storage tank.
- Sample as close to the well as possible, at the well head if practical
- Thoroughly flush the cold water tap before sampling
- For sampling, only use an outside hose-bib as a last resort, and after thorough disinfection of the faucet (flame, alcohol, bleach)
- *Nota Bene*-any repair or replacement of the well and its pump, tank, etc. will always require disinfection of the well and the home's plumbing

What To Ask For

Bacteriologic Tests-Coliform [P-A (presence-absence) vs. MF (membrane filter)] and Heterotrophic Plate Count (HPC)

Produced by The State of Connecticut Department of Public Health
Environmental Health Section, Private Well Program
450 Capitol Avenue, MS#51REC, PO Box 340308, Hartford, CT 06134
Phone: 860-509-7296 Fax: 860-509-7295

P-A vs. MF Coliform Methods



The writer feels that to properly evaluate the extent of well contamination a more quantitative analytical method for coliform analysis must be used, i.e. the membrane filter technique (especially for the follow-up resamples). The CT Public Health Code, section 19-13-B102 provides the requirements, methodologies and maximum contaminant level (MCL) for our public water systems to comply with the Federal Safe Drinking Water Act. The private well regulations, section 19-13-B101, refers to parts of this section for coliform compliance. Section B102 acknowledges, per EPA requirements, 4 analytical methods for coliform detection:

- membrane filter (MF) technique
- multiple tube fermentation technique (an old & time consuming test, based on a statistical result)
- the P-A coliform test and
- the Colilert Test (a more sensitive P-A test that does an E. coli test simultaneously)

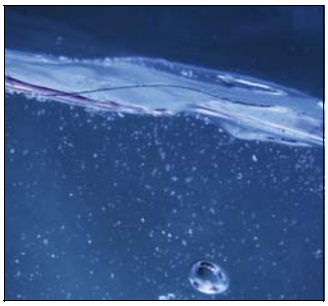
NOTE: When sampling for coliforms it is advisable to do a physical test (pH, color, turbidity) as well.

Section 19-13-B102 also states "The maximum contaminant level (MCL), *for total coliforms*, is based on the presence or absence of total coliforms in a sample, rather than coliform density". To reiterate this point, B101c states "The MCL for total coliform bacteria in a private water system is exceeded if the analytical result of the water sample is positive for total coliform bacteria". The writer feels that this method should be used, for the resamples, to accurately determine the extent and gravity of contaminated well(s). When one gets a numerical count back from the test results, if it is one or more, the sample is coliform "present", and the sample has exceeded the coliform MCL for private wells. The letter of the CT Public Health Code has been met and at least one is getting a result that tells you something! If the count is 1, 10, 100 or to numerous to count (TNTC), one can certainly assess, along with some specific sanitary chemical results, (elevated detergent, chloride, ammonia, nitrite, nitrate nitrogen, iron, manganese & sulfates), along with the standard physical parameters, the extent of contamination in that individual private well! This issue would be of primary concern if a house closing is dependent on a coliform result of "present" only and the magnitude of the coliform contamination is not really known.

The P-A method is best for public water systems doing multiple daily samplings and needing a quick turn around time in the interest of public health and welfare, but the writer personally does not think it is the best method for private wells. To quote from the AWWA/APHA 19th Edition of Standard Methods, Method 9221 D " The P-A test is intended for use on routine samples collected from distribution systems or water treatment plants. When sample locations produce a positive P-A result from coliforms, it may be advisable to determine coliform densities (MF) in repeat samples. Quantitative information may indicate the magnitude of a contaminating event". If one wants a rapid turnaround for a large number of samples, e.g. a public water system, the Colilert test is the option of choice because it is the *most sensitive* (according to The Standard Methods and current laboratory consensus) of the 4 methodologies. For private wells, in my opinion, the MF test is best. The CT Public Health Code does allow this test (MF) for coliform bacteria but when it is done, it should be done in conjunction with other water quality tests if one is trying to confirm a well contamination event.

HPC Test (formally known as Standard Plate Count)

- The MF test is susceptible to HPC bacterial interference, but one may want to sample for HPCs anyway when investigating a suspected well contamination. It is the nature of HPC method to measure all bacteriological activity, pathogens and non-pathogens. A large density of organisms, greater than 500 colonies, may also be indicative of a breached well or unsatisfactory well construction.



To emphasize the value of the HPC test (Standard Method # 9215), AWWA Standard C651-92 (sec. 7.1) refers to the use of this quality control method and our own CT Public Health Code states that an HPC result of over 200 colonies per milliliter negates a negative coliform count when using the MF method. Further justification of this test is in EPA's implementation of the Surface Water Treatment Rule (as part of the SDWA) that uses HPCs as a surrogate for free chlorine residuals [refer to the Codified Federal Register (CFR) 141.72]. When a sample has 500 or less colonies, the sample is deemed to have a "detectable disinfectant residual" when disinfection is being implemented in the system. CFR section 141.74 mandates that all public water systems, to comply with this rule, must sample for turbidity, coliforms, fecal coliforms AND heterotrophic bacteria. The writer has seen bacteriological analyses that have a total coliform count of zero with HPC bacteria count of greater than 5700 cfu/ml (or TNTC) which means the P-A coliform method of "absent" does not always guarantee potable water!

- Granular Activated Carbon (GAC) beds are notorious for harboring large populations of heterotrophic bacteria that could interfere with proper coliform detection by shielding the coliforms in its biomass. This is why one should thoroughly flush GAC filters before consuming the treated water and change the filters on a frequent basis.

- The HPC test will also confirm surface/rain water intrusion into the well because properly constructed bedrock wells will not yield significant numbers of coliforms *or* heterotrophs as there are no nutrients in deep bedrock aquifers to support these organisms where surface water and water table wells have the nutrients available. Overall the HPC test is an excellent indicator of general bacteriological background quality of the subject water and of proper disinfection procedures. If the well is rarely used the water will exhibit elevated HPCs, color, turbidity and iron (from the well casing). Wells that are rarely run end up with stagnant and aesthetically unappealing water in the borehole. Remember the result of 200/ colonies negates a negative coliform results and requires resampling at that sample site.

Should further questions arise contact your local health department/district or call the State Private Well Program in Hartford at 860-509-7296.

For more information please click on the following links:
EPA Office of Groundwater and Drinking Water
http://www.epa.gov/ogwdw/
EPA New England
http://www.epa.gov/region01/

Adapted from *Healthy Drinking Waters for Rhode Islanders*, University of Rhode Island Cooperative Extension, *April 2003*.