



STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL HEALTH SECTION
PRIVATE WELL PROGRAM

Recommendations for 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 and, 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. This is the one of two articles covering well sampling. This article focuses on sampling for bacteria.

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 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. We recommend the following:

- Sample as close to the well as possible, at the well head if practical
- 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.
- Remove any aerators or similar devices from the sample tap/faucet
- 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)
- Flush out storage tank until water runs clear
- 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
- *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



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Recommended Bacteriologic Tests

The standard bacteria test for determining the sanitary quality of a well is total coliforms with simultaneous determination of either fecal coliforms or e. coli. Currently there are several approved methods laboratories can use and results can be qualitative (e.g. presence/ absence) or quantitative (the number of colony forming units are reported). The maximum contaminant level (MCL) for total coliforms is 0 colony forming unit (cfu) per 100 mls. Therefore if any coliforms are found, the water is considered not safe for drinking. The writer feels that to properly evaluate the extent of well contamination, a quantitative method for coliforms analysis should be used. Some tests will yield final results in 24-hours, while others may take 3-4 days. We recommend you specify to the laboratory that you need to enumerate the number of colonies, not just presence/ absence, and ask when results will be available.

We also strongly recommend that when sampling for coliforms to also do a suite of physical tests (at least pH, color, and turbidity) and some specific sanitary chemical tests (detergents, chloride, ammonia, nitrite-nitrogen, nitrate-nitrogen, iron, manganese & sulfates). If the coliform count is 1, 10, 100 or to numerous to count (TNTC), the chemical and physical results will allow a better assessment of the extent of contamination in the well and possible cause.

Heterotrophic Plate Count or HPC (*formally know as Standard Plate Count*)

Some coliform tests are susceptible to interferences if the HPC bacterial counts are high. One may want to sample for HPCs when investigating a suspected well contamination. It is the nature of HPC methods to measure all bacteriological activity, pathogens and non-pathogens alike. A large density of organisms, greater than 500 colonies/ml, may also be indicative of a breached well or unsatisfactory well construction.

To emphasize the value of the HPC test AWWA Standard C651-92 (sec. 7.1) refers to the use of this as a quality control method. The Connecticut Public Health Code also states that an HPC result of over 200 cfu/ml negates a negative coliform count, when using a membrane filter method. Further justification of this test is in EPA's implementation of the Surface Water Treatment Rule (as part of the SDWA) that uses HPC as a surrogate for free chlorine residuals [refer 40 CFR Part 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!

The HPC test will also confirm surface/rain water intrusion into the well. 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. Surface water and water table wells have the nutrients available, therefore a high HPC would be an indication of contamination. 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 may exhibit elevated HPCs, color, turbidity and iron (from the well casing). Wells that are rarely utilized end up with stagnant and aesthetically unappealing water in the

borehole. Remember the result of 200/colonies negates a negative membrane filter coliform result and requires resampling at that sample site.

*Note: Granular Activated Carbon (GAC) beds are notorious for harboring large populations of heterotrophic bacteria that could interfere with membrane filter 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.

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

CAMJ
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