

Total, Fecal & E. coli Bacteria in Groundwater¹

February 2007

What are Total, Fecal and *E. coli* bacteria?

Coliform bacteria are described and grouped, based on their common origin or characteristics, as either Total or Fecal Coliform. The Total group includes Fecal Coliform bacteria such as *Escherichia coli* (*E. coli*), as well as other types of Coliform bacteria that are naturally found in the soil. Fecal Coliform bacteria exist in the intestines of warm blooded animals and humans, and are found in bodily waste, animal droppings, and naturally in soil. Most of the Fecal Coliform in fecal material (feces) is comprised of *E. coli*, and the serotype *E. coli* 0157:H7 is known to cause serious human illness.

Total Coliform do not necessarily indicate recent water contamination by fecal waste, however the presence or absence of these bacteria in treated water is often used to determine whether water disinfection is working properly.

The presence of Fecal Coliform in well water may indicate recent contamination of the groundwater by human sewage or animal droppings which could contain other bacteria, viruses, or disease causing organisms. This is why Coliform bacteria are considered “indicator organisms”; their presence warns of the potential presence of disease causing organisms and should alert the person responsible for the water to take precautionary action.

A basic laboratory test is the best way to tell if Coliform organisms are present, as they can be there with no appearance or taste difference. When water is tested for Fecal or Total Coliform, the results are usually given as the number of colony forming units per 100 millilitres (CFU/100ml) of water sampled. No sample should contain Fecal Coliform or *E. coli*, and ideally there should be no Total Coliform, however a single sample may contain up to 10 Total Coliform CFU/100 ml. Refer to the Guidelines for Canadian Drinking Water Quality for details. If any Coliform bacteria are detected in drinking water, the source should be immediately investigated. If known or suspected to be Fecal Coliform or *E. coli*, the water should not be consumed without treatment such as boiling for one minute.

What are the known sources of Coliform bacteria?

Sources of Total and Fecal Coliform in groundwater can include:

- Agricultural runoff
- Effluent from septic systems or sewage discharges
- Infiltration of domestic or wild animal fecal matter

Poor well maintenance and construction (particularly shallow dug wells) can also increase the risk of bacteria and other harmful organisms getting into a well water supply.

¹ Information in this fact sheet is generally intended for private wells. Please note that any water supply system or well serving anything other than one single family dwelling is defined as a water supply system under the *Drinking Water Protection Act* and Regulations and must be sampled according to the Act and Regulations. The person operating such a system is defined as a water supplier.

Other information sources:

Health Canada, Guidelines for Canadian Drinking Water Quality Supporting Documents. http://www.hc-sc.gc.ca/ewh-semr/pubs/water-eau/doc_sup-appui/index_e.html

Health Canada, *It's Your Health*. http://www.hc-sc.gc.ca/iyh-vsv/environ/index_e.html

B.C.'s Ground Water Protection Regulation: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/index.html

B.C. Ministry of Health, “Safe Water Supply Vital to Your Health.” (1999) <http://www.healthservices.gov.bc.ca/protect/pdf/PHI052.pdf>

B.C. Ministry of Health, Health Files. <http://www.bchealthguide.org/healthfiles/index.stm>

Type “water” in the search section and look for various articles including:

- #45 “Should I Get My Well Water Tested?”
- #49a “Water-borne Diseases in British Columbia.”
- #49b “How to Disinfect Drinking Water.”



The Best Place on Earth



Where are the environmental health concerns?

The presence of Fecal Coliform bacteria or *E. coli* indicates contamination of water with fecal waste that may contain other harmful or disease causing organisms, including bacteria, viruses, or parasites such as *Giardia*, the cause of beaver fever. Drinking water contaminated with these organisms can cause stomach and intestinal illness including diarrhea and nausea, and even lead to death. These effects may be more severe and possibly life threatening for babies, children, the elderly or people with immune deficiencies or other illnesses.

Where have high Coliform levels been found in B.C. well water?

The Ministry of Environment evaluated the results of groundwater samples obtained through the *Water Quality Check Program* carried out between 1977 and 1993. Of nearly 12,000 samples analysed for Total Coliform bacteria, 15% had concentrations greater than the drinking water guideline of 10 CFU per 100 ml water, 80% of samples had between 1 and 10 CFU/100 ml and 5% of samples had less than or equal to 1 CFU/100 ml. The study found no geographic pattern of occurrence of Total Coliform organisms above the guideline. The results for Fecal Coliform samples were not included within the *Water Quality Check Program* study.

What can well owners and water suppliers do about contamination of well water with fecal waste?

For private wells, it is recommended that water be tested a minimum of once per year for Total and Fecal Coliform bacteria or Total Coliforms and *E. coli*. Water containing Total or Fecal Coliform above the drinking water guidelines should not be used for drinking or food preparation (including making ice cubes or brushing teeth) without disinfection. Boil water for one minute or use bottled water or obtain water from an alternate source, such as a municipal system, or a nearby well that has been tested and found to be safe. The best long term solution is to fix the well to prevent on-going contamination, if possible, or to install a permanent water treatment device. Pitcher-type carbon filters will not disinfect water. Treatment methods such as chlorination, distillation, disinfection by ultraviolet light (UV), or reverse osmosis can be used to destroy or remove bacteria, viruses or other organisms in water. Parasites such as *Cryptosporidium* or *Giardia* are best destroyed by boiling (including distillation) but are also effectively inactivated by UV treatment, but water flow must be limited and the unit must be properly maintained. When purchasing a treatment device, you should consider one that has been certified by an organization accredited by the Standards Council of Canada (SCC). The treatment device should meet the following standards: NSF/ANSI Standard 62 on drinking water distillation systems, or Standard 58 on reverse osmosis drinking water treatment systems, or Standards 53 on drinking water treatment units — with specific designation for the water quality parameters you are trying to remove (e.g. bacteria or cyst removal). Certification assures that a device works as the manufacturer or distributor claims. Devices can be certified for treating a range of water quality concerns, so make sure that the device you purchase is explicitly certified for bacterial removal. Find an up-to-date list of accredited organizations at www.scc.ca.

Wells contaminated with feces should be disinfected with liquid bleach, thoroughly flushed to remove bleach residue and retested. Due to potential for re-growth of bacteria in distribution lines, these should also be disinfected and cleared prior to retesting. Details on disinfecting wells can be found in the Ministry of Health publication “Safe Water Supply Vital to Your Health.” The original source of contamination should be determined so changes can be made to prevent future contamination from backflow, flooding, poor well construction or other causes.

Well water testing and source protection

Well owners are encouraged to test their water periodically to make sure it is safe to drink; a water supplier must sample to the frequency established in Schedule B of the Drinking Water Protection Regulation or as specified by the Health Authority. Consult Public Health at your local Health Authority for advice regarding the specific parameters to test for and how often testing should be done. If you are on a community well water system, contact your water system owner for information about water quality testing. Preventive methods such as proper well site selection and construction are the best way to safeguard water supplies against contamination by fecal material. Shallow wells in intensive agricultural areas serviced by septic field are at the greatest risk of contamination. For more information on protecting your well water source, a *Well Protection Toolkit* is available from the Ministry of Environment on the internet: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/well_protection/wellprotect.html to help suppliers and communities develop a well protection plan to minimize the threat of land use activities on groundwater quality.
