

Interpreting The Presence Of Coliform Bacteria In Drinking Water,

Determining the bacterial quality of drinking water is the single most important water quality test. Why? Because one glass of water containing just a few disease organisms can cause illness. When minimal exposure creates an immediate health risk that factor is known as an acute health risk. In contrast, a meaningful health risk from chemical contaminants such as arsenic, radon, or benzene, to name only a few, requires a long period of exposure, typically over many years.

The total coliform test is the basic yardstick for determining a water supply's biological quality. This test is performed frequently because of the risk that disease-causing organisms pose to health. The test is easy to perform, inexpensive, and errs on the side of caution.

Total Coliform As An Indicator Organism

Coliform bacteria are a large assemblage of various species of bacteria. Some of the members of this group of microbes are found in natural environments – soils, plants, and surface water. Other types of coliform bacteria exist in the intestines of humans and other warm-blooded animals and are typically present in the fecal material from the host organism.

It is this group of bacteria that is of significance during the water analysis because it is used as an indicator of bacterial contamination in drinking water. Any food or water sample in which this group of bacteria is found has potentially come in contact with domestic sewage, animal manure, or contaminated soil, plant, or animal material. Outside the host, bacteria die off quickly, typically within 30 days. Therefore, if coliform bacteria are seen in a well over a long period of time, it may be assumed that new bacteria are entering the well or aquifer (a natural underground water supply). It follows that such a water supply may contain pathogenic bacteria and viruses, which cause such serious human illnesses as typhoid fever, dysentery, hepatitis, etc. When present, coliform bacteria indicate the possibility, but not a certainty, that disease organisms may also be present in the water. When absent there is a very low possibility of disease from the water.

The ability of the total coliform test to reliably predict the bacterial safety of water relative to the hundreds of possible diseases that might be present is critical since it is impossible to check separately for every disease organism directly on a monthly or quarterly basis.

Recently however, public health experts have recognized that certain protozoa, which cause disease, such as giardia and cryptosporidium, can be present in surface water even when the total coliform test shows absence. Although an important exception, the total coliform test remains the standard for determining the bacterial quality of drinking water in the US and the world.

THE TOTAL COLIFORM TEST

The standard method for judging the bacterial quality of water for domestic use is the coliform test. This method of analysis detects the presence of coliform bacteria, sometimes collectively referred to as Total Coliform.

The recommended standard for the potability of water is less than one total coliform colony per 100 milliliters of water. If the presence of total coliform bacteria has been detected, it is recommended that the source be immediately resampled for verification, an effort be made to identify possible sources of contamination, and the well be disinfected upon verification. Neither one good nor one bad sample can be considered sufficient testing to judge the long-term consistency of a well's water quality. If the bacterial record, over many samples, alternates between acceptable and unacceptable, it implies that the aquifer is subject to recurring contamination or the well is not properly constructed.

The fact that a water supply has been used for a long time without any adverse effects is no guarantee of its safety. Individuals may develop a tolerance for certain bacteria to which they are regularly exposed, while others may become ill from drinking the same water. For this reason it is important that the bacterial quality of all drinking water be tested regularly.

Members of the Total Coliform Family

There are a number of subgroups within the overall coliform family as shown in the diagram on the right. The presence of bacteria from each progressively smaller subgroup heightens the concern that disease-causing organisms may be present in the water. These groups and their relative risk implications are discussed below.

Total Coliform. These organisms are very prolific in the soil and their presence does not necessarily imply poor wastewater disposal or other sanitation based health risks. The presence of only total coliform generally does not imply an imminent health risk but does require an analysis of all water systems facilities and their operation to determine how these organisms entered the water system. "Public notice" to public water system users is required since a properly constructed and properly maintained water system should not have total coliform present.

Fecal Coliform. This is a much smaller group within the total coliform family. Fecal coliform generally originate in the intestines of mammals. They have a relatively short life span compared to more general coliforms. Their presence could be related to improper disposal of sanitary waste. Immediate "public notice" to public water system users is required due to the higher perceived risk of disease organisms also being presence in water.

Escherichia Coli (e-coli). This is a specific species (subgroup) within the coliform family. They originate only in the intestines of animals and humans. Like fecal coliform they have a relatively short life span compared to more general coliform. Their presence indicates a strong likelihood that human or animal wastes are entering the water system. Immediate "public notice" is required due to higher perceived risk of disease organism **also** being presence in the water.

Non-Coliform.

Multiple tests can be used to determine the presence of coliforms. The membrane filtration test can produce results for non-coliform organisms in the water. This value has importance in the two areas:

Invalidation of The Total Coliform Test

When the number of non-coliform organisms is high, their presence may inhibit the growth of other more important organisms in the total coliform family. That action will invalidate that total coliform test.

Non-coliform As Indicator of Adequate Filtration

It is believed that the number of non-coliform organisms in a well should be small. Thus when numbers are high, there is concern that the water in the well is not being sufficiently filtered. Reasons for a lack of adequate filtration include:

- a. The well is not properly constructed; or
- b. The soil / rock is not properly filtering the rainfall water that is percolating down from above.

TESTING YOUR WATER

EAI Analytical Labs will provide you with your free water testing kit containing: sample bottles, detailed sampling instructions and a tracking form. Bacteria samples bottles are distributed pre-sterilized and all sample bottles contain their necessary preservatives. Kits are available for pickup or they can be mailed to you. If you are interested or have any questions regarding the analysis of your water, please give us a call.