What is Coliform Bacteria?

There are different types of bacteria; *coliforms* are a family of a strain of bacteria. The most common is the rod-shaped microorganism total coliform that is naturally found throughout the environment. Fecal coliforms are a group of coliform bacteria that are found in the intestines of warm-blooded animals, including people, where they live and reproduce. *Escherichia coli,* commonly referred to as *E. coli,* is a single species of fecal coliform bacteria. Most strains of the *E. coli* bacterium are harmless. However there are strains of *E. coli* (i.e. *E. coli* 0157:H7) that can cause serious illnesses.

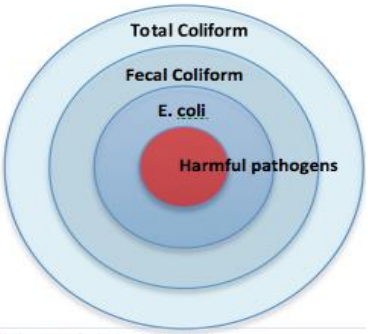

Figure 1. **Coliform bacteria**
The smaller the subset of coliform, the more accurate as an indicator for the presence of pathogens.

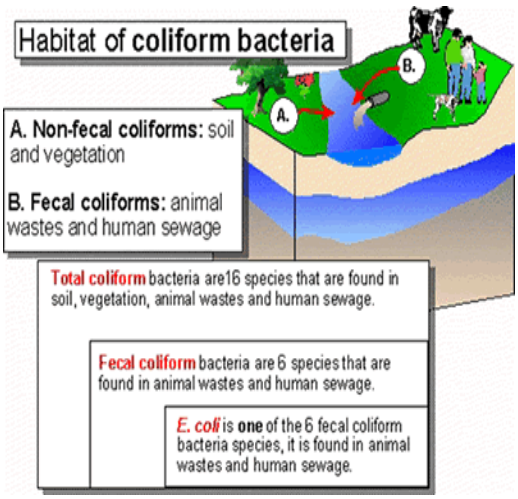

Figure 2. Fecal matter entering a waterbody

If fecal coliform is detected in the water, it indicates that there was recent fecal contamination in the water systems. Detection of *E. coli* bacteria in the water indicates recent fecal contamination as well as a possible presence of other disease-causing microorganisms or pathogens. As the level of *E. coli* bacterium increases the potential health risk from exposure to pathogenic organisms also increases.

Potential sources of contamination from fecal matter include sewers, septic systems, wastewater treatment facilities, wildlife, pets, fertilizer such as manure, and livestock.

Health Effects from Exposure to Waterborne Pathogens

Signs and symptoms of exposure to waterborne diseases may include:

- Gastrointestinal illnesses such as
  - gas
  - abdominal cramping
  - diarrhea
  - nausea, which may result in vomiting
  - loss of appetite
- Urinary tract infections
- Respiratory infections
- Conjunctivitis (pink eye)
- Exposure to open wounds by the waterborne pathogens can cause infections of the wound that may result in extended, and sometimes painful, healing time.

- In rare causes developing a life-threatening form of kidney failure called hemolytic uremic syndrome

In mild to moderate cases, one may not associate their symptoms with recent water related recreational activities especially if the symptoms do not manifest until three or four days later. Also, not all people will be affected to the same degree; young children, the elderly, and those with weakened immune systems are at a higher risk of experiencing illness and more serious complications caused by harmful *E. coli* bacteria and associated pathogens. In extreme circumstances, even in otherwise healthy persons, exposure to harmful strains of *E. coli* and other pathogens can and do result in death either from the organism itself or complications from the exposure.

Role of coliforms in detecting contamination in water

Testing water for specific harmful bacteria and pathogens is complex, time consuming and expensive. For this reason, coliform bacteria are used as water quality indicators, or "indicator organisms," for these main reasons:

- Coliforms respond to environmental conditions similarly to many pathogens.
- The presence of coliforms, more specifically *E. coli*, in water may be associated with and an indicator of the presence of pathogenic bacteria contaminating the water.
- The analysis of water samples for coliforms, including *E. coli*, is relatively simple, economical and efficient.
- The Friends of the Shenandoah River will analyze all samples for this project using the IDEXX Colilert-18® method for the determination of the E. coli concentrations.
- By using this method the results for *E. coli* levels can be read after an incubation period of 18 – 22 hours. The *E. coli* level of a water sample is measured as the Most Probable Number (MPN) of Colony Forming Units (CFUs) per 100 ml of water sample.

Figure 3. IDEXX Quanti-Tray under 365nm UV light, the presence of *E. coli* indicated by fluorescing wells.

E. coli **Level Standards**

E. coli level standards vary depending on the use of the water being sampled. Drinking water should contain 0 MPN of E. coli CFUs per 100 ml of water sample according to the Environmental Protection Agency. For stream water used for recreational activities, such as swimming or kayaking, we are using Virginia's previous water quality standard threshold for freshwater primary recreational use, which was a single sample maximum of 235 MPN of E. coli CFUs per 100 mL of water sample. Each wastewater treatment facility in Virginia has a permit limit established by the Virginia Department of Environmental Quality for the level of E. coli that is allowed to be discharged in the treated wastewater released from the facility into a receiving stream. The two facilities in this project have permit limits of 126 MPN of E. coli CFUs per 100 mL of water sample. This permit limit is calculated not from a single sample, but rather from the geometric mean of a series of four consecutive weekly samples.