

## 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* O157:H7) that can cause serious illnesses.

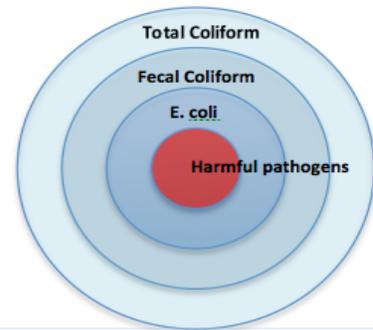


Figure 1. Coliform bacteria  
The smaller the subset of coliform, the more accurate as an indicator for the presence of pathogens.

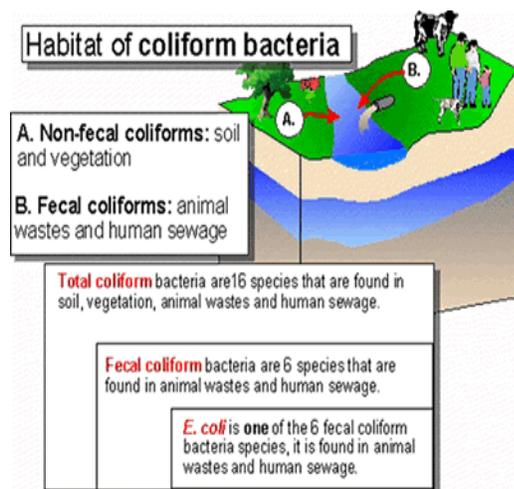


Figure 2. Fecal matter entering a waterbody

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.

## S1.2 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 cases 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.

### **S1.3 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 utilize the industry wide accepted 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.

## **Environmental Protection Agency BEACH Act**

To protect beachgoers, on October 10, 2000, the Beaches Environmental Assessment and Coastal Health Act (BEACH Act) was signed into law, amending the Clean Water Act (CWA). The BEACH Act required the Environmental Protection Agency (EPA) to develop performance criteria for testing, monitoring, and notifying public users of possible coastal recreation water problems.<sup>1</sup>

The BEACH Act was then amended to require states, territories, and tribes that have coastal recreation waters to adopt new or revised water quality standards by April 10, 2004, for pathogens and pathogen indicators for which EPA has published criteria under CWA section 304(a). An additional amendment authorized EPA to award grants to states, territories, tribes, or local governments to develop and implement beach monitoring and assessment programs.

## **Monitoring of Beach Waters in Virginia**

In Virginia, from May through September local branches of the Virginia Department of Health (VDH) perform weekly testing for levels of *E. coli* bacteria at forty-six at public beach areas on the Chesapeake Bay and the Atlantic Ocean. When bacteria levels exceed Virginia's Water Quality Standard for saltwater and transition zones a swimming advisory is issued.<sup>2</sup> VDH swimming advisories remain in effect until results from additional testing are below the State Standards.

VDH utilizes several public notification methods to inform the public when a swimming advisory has been issued, including:



Figure 4. Image of warning sign posted by VDH

- Posting an advisory sign in plain view at the swimming location;
- Issuing a local press release;
- Publishing swimming advisories at public coastal beaches on the VDH website:  
(<http://www.vdh.virginia.gov/environmental-epidemiology/beach-monitoring/>);
- Informing local businesses (e.g., rafting companies) and local government officials
- Providing additional information as requested.

**Despite the recognition of the responsibility to inform the public of potential health risks when engaging in water contact recreational activities at Virginia beaches, no such programs exist for the freshwater rivers and tributaries of Virginia even at state recognized public access and recreational use areas.**

<sup>1</sup> <https://www.epa.gov/beaches/learn-epas-role-protecting-beaches>

<sup>2</sup> <http://www.vdh.virginia.gov/environmental-epidemiology/beach-monitoring/>