

FACTSHEET ON WATER QUALITY PARAMETERS

E. coli (*Escherichia coli*)

E. coli (*Escherichia coli*) is a type of bacteria that lives in the intestines of people and animals. *E. coli* is commonly found in human and animal feces. Most strains of *E. coli* are harmless, but some can make people sick.

Why do we measure *E. coli*?

Water samples are collected to measure *E. coli* (Figure 1) to make sure water is safe for public recreation, such as swimming, fishing or canoeing. *E. coli* is considered an indicator organism, used to identify fecal contamination in freshwater and indicate the possible presence of disease-causing bacteria and viruses (pathogens). Individuals who swim or come in contact with water with elevated levels of *E. coli* and other fecal indicator organisms are at an increased risk of getting sick because of potential exposure to fecal pathogens. Common symptoms of ingesting a pathogenic strain of *E. coli* include vomiting and diarrhea. High numbers of *E. coli* (and other) bacteria may contribute to cloudy water, unpleasant odors, and increased oxygen demand (which may reduce levels of dissolved oxygen in the water).

E. coli concentrations may be linked with other parameters such as high total suspended solids (TSS) and turbidity concentrations because the bacteria tend to



Figure 1. *E. coli* under a microscope. Credit: Photo courtesy of National Institute of Allergy and Infectious Diseases

be found with particles. *E. coli* concentrations may also be linked with high phosphorus, nitrate, and biological oxygen demand (BOD) concentrations.

What affects *E. coli* levels?

E. coli is found in the feces of warm-blooded animals. *E. coli* from humans can reach surface water via wastewater treatment plant effluent, broken or leaky sewer pipes, and failing or poorly sited septic systems. *E. coli* from animals can enter waterbodies in stormwater

runoff from feedlots, manure storage areas, or areas where there is wildlife. Livestock that are allowed to get into or near streams can introduce *E. coli* directly into surface water.

For factsheets on other water quality parameters, visit: epa.gov/awma/factsheets-water-quality-parameters.

For more information about the Clean Water Act Section 106 Grants Program, visit: epa.gov/water-pollution-control-section-106-grants.

What are EPA’s recommended criteria for E. coli?

E. coli criteria are expressed as the number of colony-forming units (cfu) per 100 mL. The two sets of criteria shown in Table 1 were developed using different methods for calculating illness rates from scientific data. They are based on studies that show a link between illness and fecal contamination in recreational waters. Both are considered protective of human health, and either can be used to assess recreational water quality.

Recommendation 1. A geometric mean (GM) of 126 cfu per 100 mL and a statistical threshold value (STV) of 410 cfu per 100 mL measured.

Recommendation 2. A GM of 100 cfu per 100 mL and an STV of 320 cfu per 100 mL measured.

The GM is a statistic often used for bacterial counts in federal and state water quality standards. The GM of the monitoring samples should not exceed whichever criterion is selected from the two recommendations in any 30-day interval. The STV is similar to a 90th percentile, meaning that no more than 10% of samples should exceed it.

EPA recommends weekly sampling to evaluate the GM and STV over a 30-day period and encourages more frequent sampling at more densely populated beaches.

Table 1. Two sets of E. coli criteria based on two different estimated illness rates.

	Recommendation 1	
	Estimated Illness Rate: 36 per 1,000	
Indicator Organism	Geometric Mean (cfu/100 mL)	Statistical Threshold Value (STV- 90 th percentile) (cfu/100 mL)
E. coli (freshwater)	126	410

	Recommendation 2	
	Estimated Illness Rate: 32 per 1,000	
Indicator Organism	Geometric Mean (cfu/100 mL)	Statistical Threshold Value (STV- 90 th percentile) (cfu/100 mL)
E. coli (freshwater)	100	320

Source: Anderson and Rounds (2003)

How do we measure E. coli?

E. coli levels are measured by analyzing bacterial growth in laboratory analyses. This is commonly done by the membrane filter procedure, although color test kits have also been EPA-approved. Care must be taken when

collecting water samples because all of the sampling containers must be sterile. More information on measuring E. coli can be found in EPA’s *Volunteer Stream Monitoring: A Methods Manual* (1997).

What are the challenges of using E. coli as a water quality parameter?

Bacteria levels in waterbodies can be highly variable. In streams, natural bacteria levels vary and change with

rainfall. This can make it challenging to pinpoint sources of elevated E. coli concentrations.

What if there is an exceedance of the water quality criteria?



Figure 2. Public advisory warns of high bacteria levels in water. Public advisories can include additional information such as the date of the posting and contact information to check on the status of the posting. Credit: Photo courtesy of USEPA

When elevated *E. coli* concentrations are observed, it is important to respond in a timely manner by collecting additional data, posting a public notice (Figure 2), and/or closing the waterbody to recreational activities. Figure 3 summarizes general actions to take when responding to elevated concentrations.

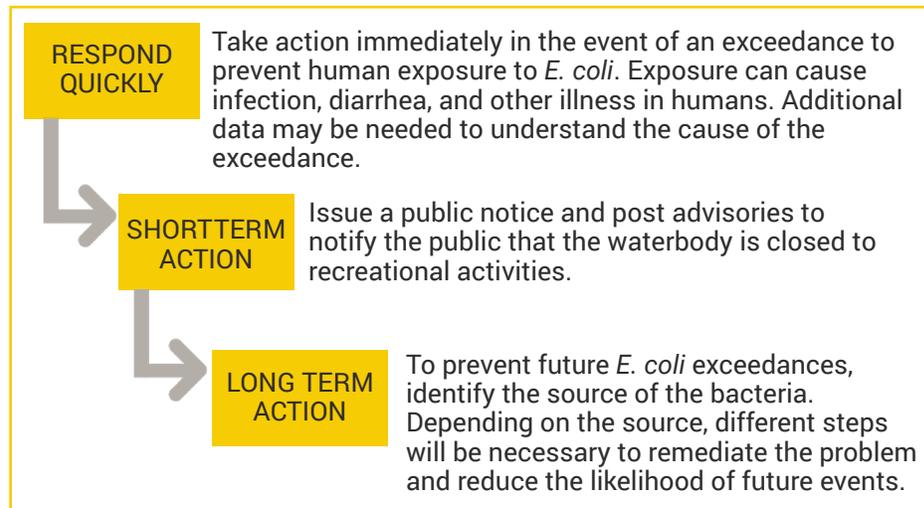


Figure 3. General actions to take when a sampling result shows an elevated concentration of *E. coli*.