

Discussion with Blue Flag  
August 6, 2021

Testing for Fecal Indicator Bacteria (FIB)

There is no one method that is perfect for all waters. The site conditions will affect the results. Check with local managers and permits to see what methods they use. EPA's approved methods for FIB in ambient waters are found at 40 *Code of Federal Register* Part 136.3 Table IH and the sampling and holding time requirements in Table II. The methods in 136.3 IH are not required by EPA for your program – however, a state may require a particular method for compliance. See <https://www.epa.gov/cwa-methods/approved-cwa-microbiological-test-methods>

There are additional methods for molecular testing and microbial source tracking can be found at <https://www.epa.gov/cwa-methods/other-clean-water-act-test-methods-microbiological>

In general, there are 4 types of methods used in testing recreational waters:

**Multiple tube**

**Membrane Filtration**

**Enzymatic or Colorimetric**

**Molecular or PCR**

All must be performed in a lab. There is no approved “at home” method even though you can find them on the internet.

Most Probable Number vs. Colony Forming Unit

That is the unit used depending on the method chosen and statistics. Multiple Tube and Colorimetric methods are based on MPN which is a statistical tool used to estimate the concentration of the FIB – not an actual count. You can not convert between methods or microbes.

Molecular methods are measured in either calibrator cell equivalent (CCE) or gene copies (gc or just c).

For questions on EPA Clean Water Act methods go to <https://www.epa.gov/cwa-methods> and the “Contact Us” link at the bottom of the page.

How many samples?

See Chapter 4.3.2 of the 2014 Beach Guidance

<https://www.epa.gov/beach-tech/national-beach-guidance-and-required-performance-criteria-grants>

*Effect of Sampling Frequency on Shoreline Microbiology Assessments*, Molly K Lecaster, Stephen Weisberg Marine Pollution Bulletin 2001

*Day at the Beach: Enabling Coastal Water Quality Prediction with High-Frequency Sampling and Data-Driven Models* Ryan T. Searcy and Alexandria B. Boehm, Environ. Sci. Technol. 2021, 55, 1908–1918

## Actions after high FIB results

After a high result, you will want to consider site specific factors such as: the long term trends in FIB results, weather, season, wildlife population (especially birds) and new construction.

<https://www.epa.gov/beach-tech/national-beach-guidance-and-required-performance-criteria-grants>

Beach Guidance: Section 3.4 Step 3: Characterize the Beach to Determine Risk and Use; Beach Guidance, Chapter 5 Public Notification and risk Communication; 3.4 Sanitary Surveys

<https://www.epa.gov/beach-tech/tools-evaluate-and-manage-beach-health>

*Restoration Utilization of multiple microbial tools to evaluate efficacy of restoration strategies to improve recreational water quality at a Lake Michigan Beach*  
(Racine, WI) Julie Kinzelman Journal of Microbiological Methods, August 2020

### Microbial Source Tracking (MST)

In addition, you may want to consider using molecular methods to track and identify sources of FIB – MST methods 1696 and 1697. <https://www.epa.gov/cwa-methods/other-clean-water-act-test-methods-microbiological>

*A novel droplet digital PCR human mtDNA assay for fecal source Tracking* Kevin Zhu, 2020 Water Research 183 (2020) 116085

*Investigation of relationships between fecal contamination, cattle grazing, human recreation, and microbial source tracking markers in a mixed-land-use rangeland watershed* Naveen Joseph, February 2021 Water Research 194 (2021) 116921

*Data Acceptance Criteria for Standardized Human-Associated Fecal Source Identification Quantitative Real-Time PCR Methods* Orin C. Shanks, Applied and Environmental Microbiology May 2016 Volume 82 Number 9