Distribution System Water Quality
Protecting Water Quality with HPC Monitoring

Heterotrophic microorganisms are a broad, diverse group, including bacteria, yeasts, and molds, that require organic carbon for growth. Heterotrophic plate count (HPC) is a procedure for estimating the number of live, culturable heterotrophs in a water sample. HPC monitoring can give an indication of the general quality of water in the distribution system; a significant increase in HPC numbers can indicate a potential water quality problem. This fact sheet is part of EPA's Distribution System Toolbox and its purpose is to summarize a best management practice that public water systems (PWSs), particularly small systems, can use to maintain distribution system water quality and protect public health.

Examples of Utility Actions

A PWS serving approximately 100,000 people in the northwestern U.S. found that the HPCs in stored water rapidly increased after two standpipes were painted. The new tank coatings had been air cured and the standpipes were disinfected before being returned to service. The PWS applied shock chlorination to the standpipes five times, but each time the HPC levels increased within one month from 0 to up to 4,300 CFU/mL. The PWS drained the tanks and found that biofilm had formed on wall surfaces. The PWS pressure washed the tanks with highly chlorinated water to remove the biofilm and then the paint was given additional curing time. Additional monitoring after pressure washing showed that HPC had decreased to normal levels.

A PWS serving 8,500 people in the western U.S. experienced discolored water complaints in 2007 and 2010 in two areas of the distribution system. In response, the PWS improved their low velocity unidirectional flushing program and conducted HPC monitoring to help characterize microbiological water quality before and after flushing. Low HPC results at all flushing sites indicated either low biological growth in the pipes or lack of biofilm disturbance by flushing.

Use of HPC Monitoring Data in the Surface Water Treatment Rule (SWTR)

- For regulatory purposes, a drinking water sample with an HPC concentration of less than or equal to 500 colony forming units per milliliter (CFU/mL) is considered equivalent to having a detectable disinfectant residual under the disinfection requirements of the SWTR (40 CFR 141.72).
- Higher levels of HPC bacteria (>500 CFU/mL) can cause interference in the detection of other microorganisms that could be present in a water matrix, including indicator organisms (e.g., coliform bacteria).

How HPC Monitoring Data Can Be Used to Assess Water Quality

- Elevated HPC concentrations may be a sign of more biologically active water. Biologically active water can be caused by many factors, including low disinfectant residual and/or high nutrient concentrations. These are the types of conditions that allow opportunistic pathogens, such as *Legionella*, to grow and flourish.
- HPC data can be useful when assessing the effectiveness of treatment processes and distribution system conditions and integrity. HPC data can serve as an indicator of bacterial growth in the distribution system, which can arise from ineffective treatment, deteriorating water quality throughout the distribution system, or contaminant intrusion into the distribution system.

Colonies of HPC bacteria on R2A Medium
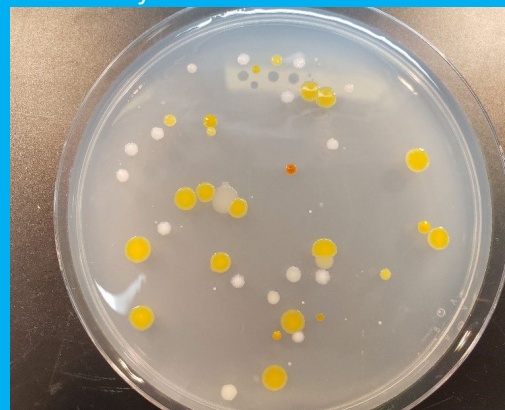
Photo Credit: Philadelphia Water Department, Bureau of Laboratory Services

Table 1: Resources and Guidelines for HPC Monitoring

Resource Title and URL	Relevance to HPC Monitoring
AWWA. 2017. M68 Manual of Water Supply Practices. Water Quality in Distribution Systems. www.awwa.org/. Note: There may be a fee associated with obtaining this resource.	Chapter 3 discusses microbiological water quality in the water distribution system, including occurrence and regrowth of heterotrophic bacteria and applications for HPC monitoring.
American Public Health Association. 2012. Method 9215B, Heterotrophic Plate Count. In *Standard Methods for the Examination of Water and Wastewater*. 22nd Edition. www.apha.org. Note: There may be a fee associated with obtaining this resource.	Describes the laboratory analytical method 9215B used for measuring HPC. Note that the similar IDEXX SimPlate method is not discussed in this resource.
Chowdhury, S. 2011. Heterotrophic Bacteria in Drinking Water Distribution System: A Review. https://www.researchgate.net/publication/51791899_Heterotrophic_bacteria_in_drinking_water_distribution_system_A_review. Note: There may be a fee associated with obtaining this resource.	Describes the occurrence of heterotrophic bacteria in water distribution systems, factors affecting bacteria regrowth in bulk water and biofilms, and bacteria control strategies.
World Health Organization (WHO). 2003. *Heterotrophic Plate Counts and Drinking-water Safety. The Significance of HPCs for Water Quality and Human Health*. www.who.int	Examines the role of HPC monitoring in drinking water quality management, based on an expert workshop.