Heterotrophic Plate Counts and Drinking-water Safety

The Significance of HPCs for Water Quality and Human Health

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Edited by J. Bartram, J. Cotruvo, M. Exner, C. Fricker, A. Glasmacher

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Foreword

This monograph examines the appropriate role of the heterotrophic plate count (HPC) measurement in drinking-water quality management. It was developed from a two-day workshop attended by a group of microbiology and public health experts, including those with regulatory and medical expertise, convened by the World Health Organization and NSF International (WHO Collaborating Centre for Drinking Water Safety and Treatment) in Geneva, Switzerland, on 25–26 April 2002. The workshop followed immediately after the International Symposium on HPC Bacteria in Drinking Water — Public Health Implications?, developed by the same organizations. The Session Chairs and other selected participants in the symposium assembled in the workshop to address the issues that led to the formulation of the symposium and to provide a consensus report and conclusions to assist public health officials to interpret the information provided by HPC measurements.

The issues that were addressed include:

- the relationship between HPC in drinking-water systems (including those derived from in-line treatment systems, dispensers and bottled water) and health risks for the general public;

- the role of HPC as an indirect indicator or index for pathogens of concern in drinking-water;
- the role of HPC in assessing the efficacy and proper functioning of water treatment and supply/distribution processes; and
- the relationship between HPC and the aesthetic acceptability of drinking-water.

This report deals with safe water supply extending from source to consumer, including plumbed-in devices, domestic and building environments, and water supplied in bottles or packages. The different ways in which drinking-water may be used in the home are considered, and specific concerns in higher-risk settings and populations at increased risk are addressed.

The Expert Meeting, supported by the papers in this monograph, addressed that debate as to the need, utility or quantitative basis for health-based standards or guidelines relating to HPC-measured growth in drinking-water and provided their consensus conclusions in the Meeting Report (chapter 1). Each chapter was originally the lead presentation in each session of the symposium. Each was revised in light of the other presented papers, the debates and discussions, and the Expert Meeting deliberations to reflect the scientific information that was presented and the collective experiences of the members. This report is the product of the Expert Meeting; its chapters were peer reviewed by members of the expert group and the editors.

We hope this document provides useful information and perspective on the utility and the limitations of HPC data in the management and operation of piped water systems, as well as other means of providing drinking-water to the public.

J. Bartram
J.A. Cotruvo
M. Exner
C.R. Fricker
A. Glasmacher

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List of acronyms and abbreviations

AFLP	amplified fragment length polymorphism
AIDS	acquired immunodeficiency syndrome
ANSI	American National Standards Institute
AOC	assimilable organic carbon
AP-PCR	arbitrarily primed polymerase chain reaction
ARDRA	amplified ribosomal DNA restriction analysis
ATP	adenosine triphosphate
BDOC	biodegradable dissolved organic carbon
BFR	biofilm formation rate
BOM	biodegradable organic matter
BOX-PCR	high-stringency PCR assay targeting regions within various bacterial genomes and bordered by invertedly repeated elements
bp	base pair
BPP	biomass production potential
cDNA	complementary or copy DNA
cfu	colony-forming units
CI	confidence interval
CTC	cyanoditolyl tetrazolium chloride

DGGE	denaturing gradient gel electrophoresis
DNA	deoxyribonucleic acid
DOC	dissolved organic carbon
EC	European Community
EEC	European Economic Community
EPA	Environmental Protection Agency
EU	European Union
FISH	fluorescence *in situ* hybridization
GAC	granular activated carbon
HIV	human immunodeficiency virus
HPC	heterotrophic plate count
ICU	intensive care unit
IF	immunofluorescence
Ig	immunoglobulin
IMS	immunomagnetic separation
INT	iodonitrotetrazolium
ISO	International Organization for Standardization
LMW	low molecular weight
MAC	*Mycobacterium avium* complex
MDOD	mean dissolved oxygen difference
MLEE	multilocus enzyme electrophoresis
MLST	multilocus sequence typing
MRD	Modified Robbins Device
mRNA	messenger RNA
OR	odds ratio
PAI	pathogenicity island
PCR	polymerase chain reaction
PET	polyethylene terephthalate
PFGE	pulsed field gel electrophoresis
PNA	peptide nucleic acid
POE	point-of-entry
POU	point-of-use
PVC	polyvinyl chloride
QMRA	quantitative microbial risk assessment
RAPD	random amplified polymorphic DNA
rDNA	ribosomal DNA
RFLP	restriction fragment length polymorphism
RNA	ribonucleic acid
rRNA	ribosomal RNA
SIV	simian immunodeficiency virus
SPC	standard plate count

SSCP	single-strand conformation polymorphism
TDC	total direct count
TGGE	temperature gradient gel electrophoresis
THM	trihalomethane
tRNA	transfer RNA
VBNC	viable but non-culturable
VTEC	verocytotoxigenic *Escherichia coli*
WHO	World Health Organization
WSP	water safety plan

Robert Koch

In 1883 Robert Koch published an article entitled: *About Detection Methods for Microorganisms in Water*. In that historic paper that marked the introduction of the application of microbial indicators for surveillance of water hygiene, Koch described for the first time the methodology for HPC measurement in water, and showed its value as a measure of water treatment technology performance. The editors of this state-of-the-art review of the role and health significance of HPC wish to recognize the contributions of Robert Koch to water microbiology on this 120th anniversary of his original publication on the topic.