Global Water CENTER



Priority Parameter Selection Guide

1

List mandatory parameters from national standards

Start with a clear understanding of what you must test by law.

2

Access the system

Walk the entire system from source to tap and document the source characteristics, potential contamination sources, treatment processes, storage conditions, distribution system conditions, and user practices (e.g. storage, handling, treatment).

- WHO sanitary inspections

3

Review available data

- Past water quality and quantity reports
- Regional studies (water management plans, environmental reports, climate assessments, pollution permits, geological surveys)
- Information from nearby water systems
- Local health records
- Stories and observations from community members, water users, and vulnerable groups
- Engagement and consultation with local stakeholders and experts.
- For further information to inform steps 2 and 3, see the following WHO guidance:
  - Guidelines for drinking-water quality, including small water supplies
  - Sanitary inspection packages
  - Chemical safety of drinking-water
  - Protecting surface water for health
  - Protecting groundwater for health
  - Water safety in distribution systems

4

Prioritize based on risk

Rank parameters based on:

- Likelihood of occurrence in your system
- Severity of health impact if present
- For basic guidance on conducting risk assessments in small community water supplies, and for examples of risk assessment matrices see:
  - Water safety planning for small community water supplies
  - WSP Manual supplementary tool: Module 4 – examples of risk assessment matrices

5

Create your monitoring plan

Document which parameters you will test, how frequently, at which locations, and how the data will be actioned. This plan should include:

- Mandatory parameters from standards
- Additional priority parameters identified through risk assessment
- Testing schedule for each parameter
- Sampling locations
- Decision rules for when to conduct investigative monitoring
- Communication plan to disseminate results
- Action plan for how to address results of concern

Drinking-water quality monitoring alone cannot ensure safety - it should always be complemented by risk-management measures, such as water safety planning and/or sanitary inspection.

Guiding Principles for Parameter Selection using national regulation requirements and contextual risk assessment:

- *Prioritize microbial safety – highest public health risk*
- *Consider priority chemical contaminants where relevant in the local context*
- *Include relevant acceptability parameters that affect user acceptance*
- *Reflect resource limitations – technical (equipment & analytics), financial and human*
- *Plan for progressive improvements with periodic review and expansion (e.g. the inclusion of additional parameters considered beyond the priority set presented in this section, based on risks and capacities).*



Health-Based Priority Parameters - Microbial

Primary Microbial Indicator

E. coli

E. coli bacteria causes diarrheal diseases. It is the preferred indicator organism for determining microbial safety since it is the most specific indicator of recent fecal contamination.

WHO Guideline	National Standard	Alternative
Not detectable in any 100 mL water sample.		Thermotolerant coliforms (less reliable but acceptable where national standards allow)

Note - for further important contextual information, refer to Chapter 3 (in particular tables 3.5 - 3.9) in WHO's Guidelines for drinking-water quality: small water supplies.

Indicators of Microbial Contamination

While *E. coli* testing directly measures fecal contamination, several operational parameters serve as indirect indicators of microbial water quality and treatment effectiveness. These parameters should be monitored frequently (often daily) because they can signal potential contamination risks or treatment failures before *E. coli* testing results are available.

Turbidity

Turbidity makes water look unsafe, may indicate treatment problems, may shield microorganisms from disinfection. Low turbidity is required for effective disinfection and consumer acceptability

WHO Target Value	National Standard
Less than 1 NTU (large suppliers) Less than 5 NTU (small suppliers)*	

*In these cases, higher disinfection doses and/or contact times will be required to ensure that adequate disinfection is achieved. Above 5 NTU, disinfection should still be practised.

Free Chlorine Residual
(if water is chlorinated)

Indicates disinfection efficacy and protective capacity against recontamination.

WHO Target Value	National Standard
Greater than or equal to 0.2 milligrams per liter (mg/L) at point of use *Should be higher (e.g. at least 0.5 mg/L) if users transport water to point of use	

Effective disinfection needs sufficient contact time between free chlorine and the drinking-water (e.g. 0.5 mg/L for at least 30 minutes at pH less than 8). User acceptability should also be considered when determining the optimal free chlorine residual.

pH
(if water is chlorinated)

Critical for effective chlorination (less than 8 for efficacy), pipe corrosion and water taste.

WHO Target Value	National Standard
6.5-8.5 (optimum varies by national context and local conditions)	

Health-Based Priority Parameters - Chemical Contaminants

Unlike microbial hazards that can cause immediate illness, most chemical contaminants only cause health effects after long-term exposure (years). Chemical parameters should be selected based on **both national standards and local risk assessment.**[1]

Priority Chemical Parameters - WHO Guidance with National Adaptations

Arsenic

Health effects: Multiple body systems, skin changes, cancer
Occurrence: Natural deposits, widespread in groundwater in many places globally

WHO Guideline Value	National Standard
0.01 mg/L*	

Fluoride

Health effects: Dental/skeletal fluorosis at high concentrations, but dental benefits at low levels
Occurrence: Natural deposits, widespread in groundwater in many places globally, human activity, e.g. industry

WHO Guideline Value	National Standard
1.5 mg/L	

Lead

Health effects: Multiple systems, neurological effects in children
Occurrence: Lead-containing materials in water systems including internal plumbing systems in buildings and households, may occur less commonly from human activity, e.g. mining, or natural occurrence

WHO Guideline Value	National Standard
0.01 mg/L*	

Manganese

Health effects: Neurological effects, especially in children
Occurrence: Naturally occurring, human activities, e.g. industry

WHO Guideline Value	National Standard
0.08 mg/L*	

Acceptability impact: Discoloration, staining at greater than 0.02 mg/L

Nitrate

Health effects: Methemoglobinemia (blue baby syndrome) in infants
Occurrence: Agricultural contamination, septic systems, distribution systems of piped supplies with high levels of free ammonia, natural occurrence also possible.

WHO Guideline Value	National Standard
50 mg/L as nitrate ion	

*Provisional

[1]A local risk assessment should be conducted to determine if these parameters are likely to occur at concentrations of concern and, therefore, should be prioritized for monitoring. This risk assessment should be revisited following any significant changes in circumstance that could affect the parameter's presence or concentration.

Acceptability Parameters

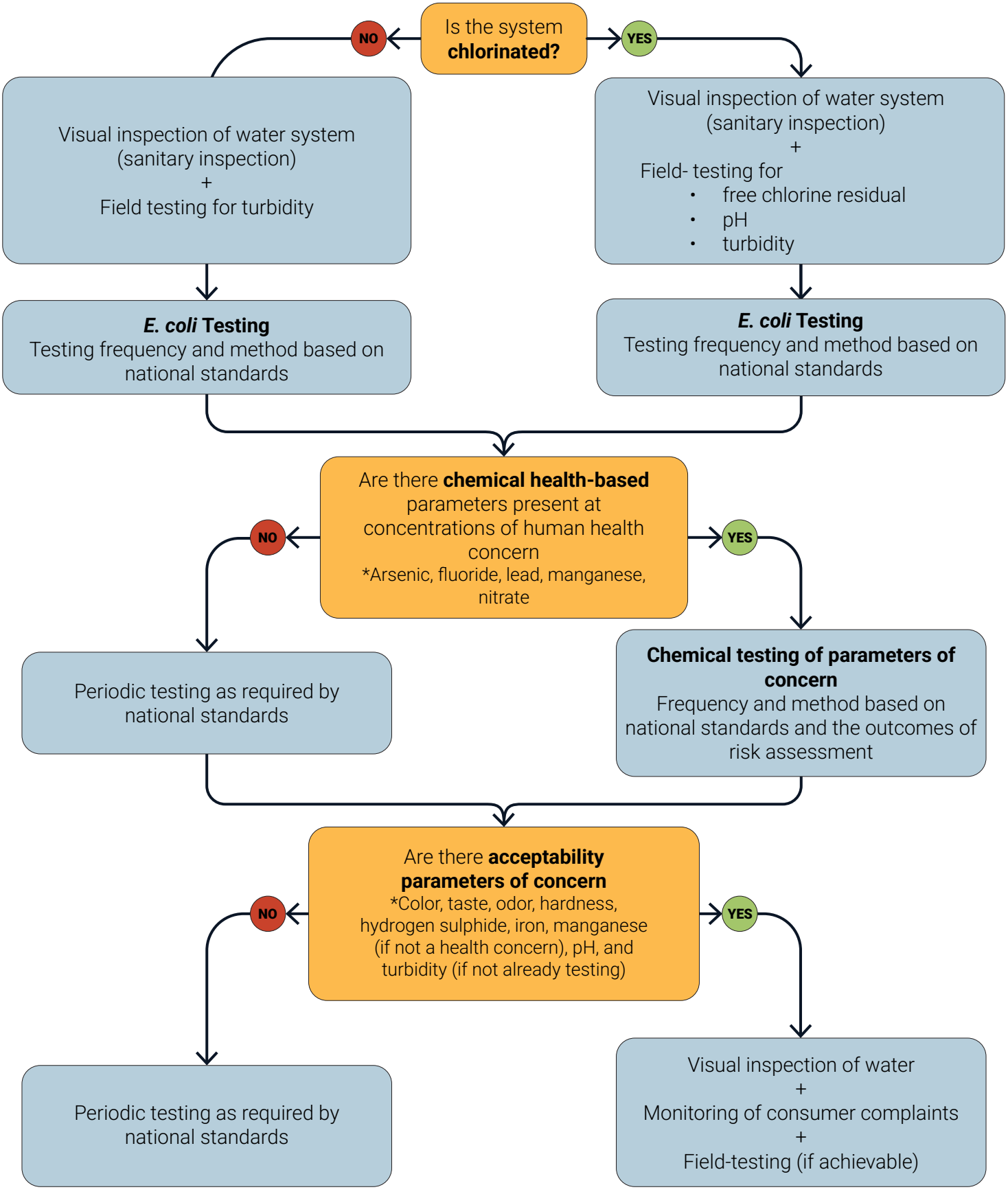


Acceptability parameter	Consumer acceptability*	Additional information
Turbidity	Causes murky or discolored appearance Visible cloudiness occurs at greater than 4 NTU	Critical for disinfection effectiveness and microbial safety
pH	Causes taste and operational issues outside of WHO range of 6.5-8.5	Critical for disinfection effectiveness and microbial safety Natural pH varies by geology and source type
Iron	Causes brown/red staining and metallic taste at greater than 0.3 mg/L	Natural levels vary by geology and source water
Manganese	Causes black staining and acceptability issues above 0.02 mg/L	Natural levels vary by geology and source water
Total dissolved solids (TDS)	Levels above 600 mg/L may cause water to become unpalatable	Natural levels vary by geology and source water Community tolerance varies by cultural context
Color	Water should be colorless. Most people can detect color about 15 TCU (true color units)	Community tolerance varies by cultural context
Taste and odor	Most common consumer complaints. Water should be odorless and not have any offensive tastes	Community tolerance varies by cultural context
Hardness	Causes noticeable scale formation and interferes with soap lathering at above 200 mg/L	Natural levels vary by geology and source water
Hydrogen sulfide	Distinctive rotten egg odor Often rejected by users even at levels as low as 0.05 mg/L	Acceptability varies significantly between communities Natural levels vary by geology and source water
Algae and Cyanobacteria	Causes earthy musty taste and odor	May be found in surface water. Presence of cyanobacteria may indicate potential for harmful cyanotoxins

*Consumer acceptability ranges can be found in the WHO Guidelines for drinking-water quality 2022 Chapter 10.

Water Quality Monitoring Decision Path

The greatest risk to human health is contamination from human and animal faeces. As such, monitoring for microbiological parameters is the greatest priority, followed by chemical health-based parameters, followed by acceptability parameters



Key points

Field testing should be conducted regularly by water suppliers for operational monitoring.
Compliance monitoring should be conducted at a frequency dependent on national standards and be in-line with analytical requirements set out in the regulations (e.g permissible field versus lab testing methods and can be conducted by the surveillance agency, or the water supplier (with results shared with the surveillance agency)