



## **Advice of the shipping company occupational physician Drinking water analysis on Cargo Ships in international waters**

As described by [www.who.int](http://www.who.int)

- WHO Guidelines for Drinking-water Quality 2011, 4<sup>th</sup> ed
- WHO Handbook for the inspection of ships and the issuance of ship sanitation certificates
- WHO Guide to Ship Sanitation 2011 3<sup>rd</sup> ed.
- DIN EN ISO 15748-1 (Trinkwasser-Versorgungsanlagen auf Schiffen und Seebauwerken)
- ISO 19458:2006 –Water Quality Sampling for microbiological analysis
- ISO Technical standard for laboratories: ISO/IEC 17025

Helpful link: [www.seahealth.dk](http://www.seahealth.dk)

### **Drinking Water Analysis**

Frequency: *Annual analysis of drinking water.* Increase frequency for a period if it is necessary to determine appropriate corrective action.

Sampling methods: Sampling only by trained professionals who are authorized by a certified laboratory.

Laboratories engaged for potable water analysis should refer to international quality standards (ISO/IEC 17025) for comparability of results. Laboratory must follow defined sampling procedures (ISO 19458:2006).

Special sampling containers must be used:

- sterile glass bottles that contain sodium thiosulfate for microbiological samples
- special polyethylene bottles for chemical samples

Standard Sampling Scheme (depends on size and complexity of the potable water system on board), at a minimum:

- if possible: sample directly from tanks (sampling taps are necessary) and farthest point of the distribution system (e.g. bridge)

- **alternatively: sampling from galley and bridge**

Sampling method as recommended by WHO

- Microbiological sampling at farthest tap (e.g. bridge) ISO 19458: Remove aerator, clean the tap, disinfect or sterilize the tap by using disinfection liquid or gas burner, let some water flow out (2-3 liters) and fill the sterile sampling bottles
- Microbiological sampling at tank (sampling tap) ISO 19458: Disinfect or sterilize the sampling tap with a gas burner or with suitable disinfection liquid (Ethanol

70%, let water flow out until the temperature is constant (or at least 10 liters) and fill the sterile sampling bottles.

- Chemical analysis: Bottle 1: Take one sample directly from tap without any other measures in advance. Use a polyethylene bottle (1 litre). Bottle 2: let 2-3 l of water flow and fill second bottle. Bottle 3: Let water flow 15-20 min and fill third bottle.

## Minimum set of parameters for annual analysis (if production from seawater)

according to WHO guidelines, national standards may differ

Drinking water should have no detectable odour or flavor

Parameter	Typical Value/Unit	Remark
Escheria coli	0 cfu/100 ml	Index of fecal pollution
Enterococci	0 cfu/100 ml	Index of fecal pollution, survive longer in water as Escheria coli
Total coliforme bacteria	0 cfu/100 ml	Indicator of treatment effectiveness, assess the cleanliness of distribution system, and the potential presence of biofilms
HPC (at 20°C or 22°C)	1000 cfu/100 ml	Heterotrophic platelet count is an indicator of general water quality. The actual numbers from HPC are not as important as changes in numbers at particular locations. Increase in HPC can indicate deterioration of cleanliness, possible stagnation and development of biofilms.
HPC (at 36°C or 37°C)	100 cfu/100 ml	
ph	6,5-9,5	A ph above 8.0 does not allow effective water disinfection with chlorine and gives evidence that self-produced water may not be remineralized. Check rehardener or mineralizer functions properly.
Temperature cold water	5-25°C	Ideally cold water below 20° C to avoid growth of Legionella spp. If cold water above 25° C or hot water below 55° Ca high risk of Legionella spp. contamination exists. Violation should trigger testing for contamination with Legionella spp.
Temperature hot water	50-90°C	
Conductivity	Typical values Untreated distillate 50 uS/cm Water from shore source 500 uS/cm Seawater 50.000 uS/cm	Indirect measure of total dissolved solids. Too low conductivity should trigger evaluation of corrosive process in the piping and existence of heavy metals due to corrosion.

### Additional analysis if needed (examples only):

- When taking potable water from shore and chlorine is added, the concentration of **free and total chlorine** must be tested in multiple locations: For effective disinfection, there should be a residual concentration of free chlorine of at least 0,5 mg/l at least 30 minutes contact time at ph below 8.
- If temperature of cold water is above 25°C or hot water below 55°C or other technical /operational problems with the piping exists: check for **Legionella spp.** (Typical value < 100 cfu/100 ml, refer also to national guidelines)
- **If Conductivity is too low:** Test water to assess corrosion: **Pb, Fe, Zn, Cu, Cd, Ni**
- **In new vessels:** products from coating and metals (organic, e.g. pesticides and inorganic contaminants)
- **In bunkering from sources of questionable quality:** frequent control of microbiological parameters, chlorine, organic and inorganic contaminants