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INFO

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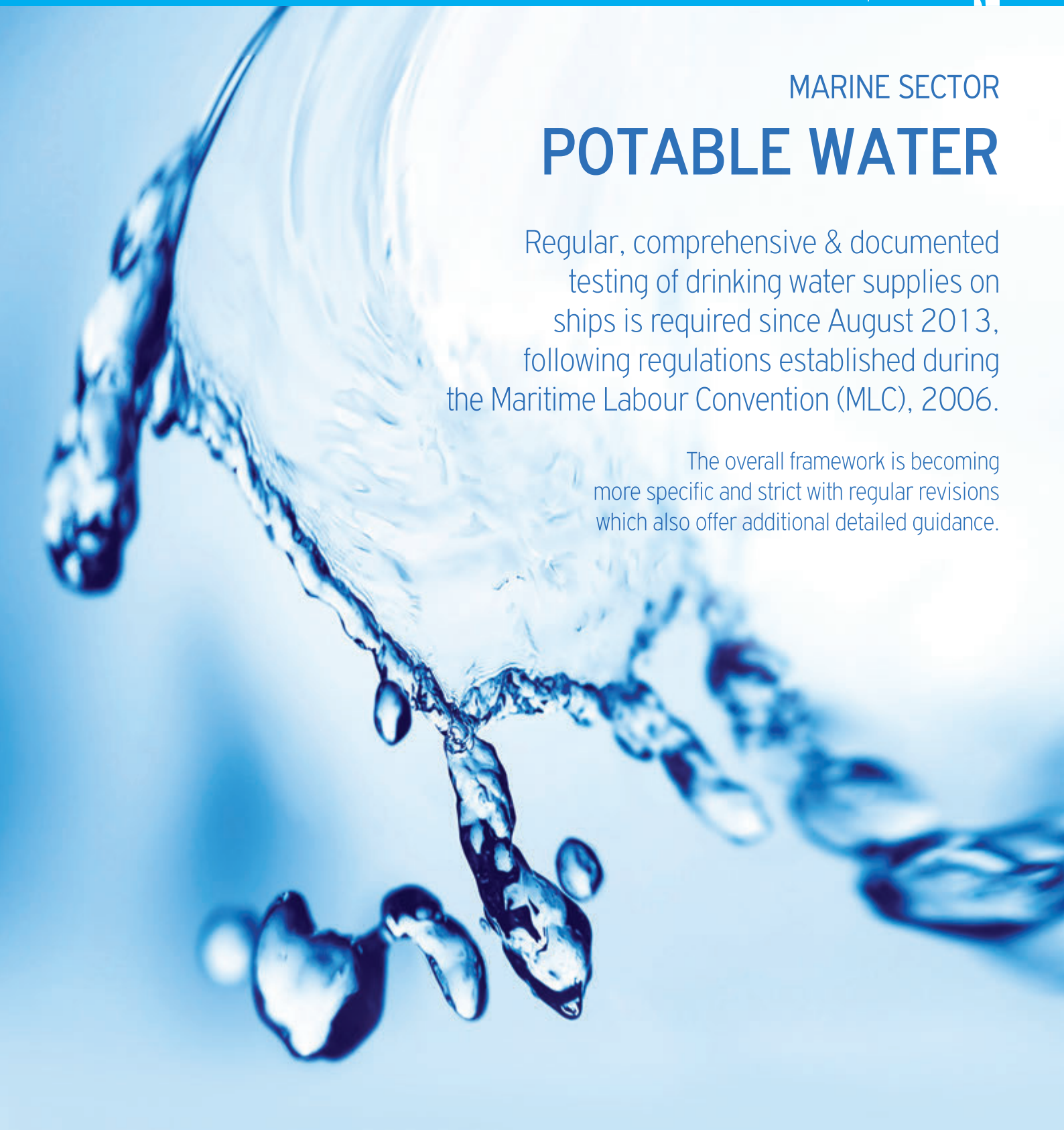


MARINE SECTOR

POTABLE WATER

Regular, comprehensive & documented testing of drinking water supplies on ships is required since August 2013, following regulations established during the Maritime Labour Convention (MLC), 2006.

The overall framework is becoming more specific and strict with regular revisions which also offer additional detailed guidance.


MOKING

POTABLE WATER IN SHIPS

"Water to be used for potable water purposes aboard ships must be provided with sanitary safeguards from the shore source, through the shore water distribution system, including connections to the ship system, and through the potable water system at each outlet in order to prevent contamination or pollution of the water during ship operation."
WHO, Guide to ship sanitation, 2011, pg. 8

Over one hundred outbreaks of infectious diseases due to water mismanagement, have been recorded between 1970 and 2000 in ships affecting marine vessels with serious operational and financial consequences (WHO 2001). Legionnaires' disease, typhoid fever, salmonella, viral gastroenteritis, enterotoxigenic, E-coli infections, shigellosis, cryptosporidiosis and trichinosis are some of the diseases that have been reported. Ships are considered one of the highest risk areas, especially for Legionnaires' disease.

First of all, potable water for ships must be obtained only from those water sources and water supplies that provide potable water of a quality in line with the standards recommended in Guidelines for drinking-water quality, especially as concerns bacteriological requirements and chemical and physical requirements. Potable water must be obtained from those watering points approved by the health administration or health authority. The ship's master or officer responsible for the loading of water must ascertain whether or not the source of water is safe for potable use.

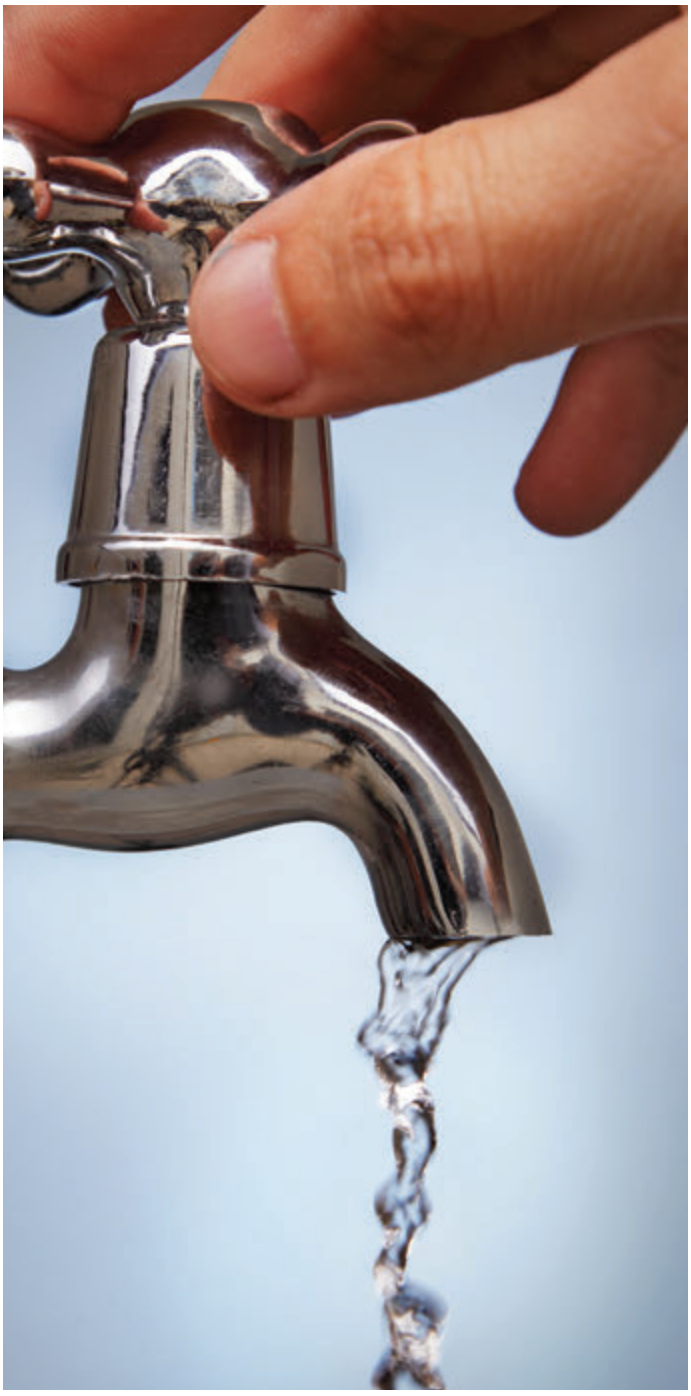
In addition, concerning to storage and distribution system of potable water on ships, health risks are usually caused by:

- Limited space on ships means that potable water systems are likely to be close to hazardous substances such as sewage or waste streams, and sources of heat. Evidence from disease outbreaks indicates that contamination from sewage is one of the most common causes of waterborne outbreaks on ships.
- Water production on board through Desalination, Reverse Osmosis or Evaporation can be associated with its own potential health problems.
- Corrosion in plumbing may lead to metals leaching into water. Desalinated water produced on board may be corrosive while saline atmospheres may also have additional corrosive effects.

Current regulations on potable water in ships

The regulatory framework for Potable Water Quality Monitoring and Control was initiated by the:

- **World Health Organization (WHO)** via its **International Health Regulations (IHR)**, providing reviewed and updated Editions of Drinking Water Quality (latest 4th Edition). These editions describe minimum requirements for the protection of health and give numerical values and indicators for water constituents and water quality.
- **European Union (EU)**, which proposes the **Drinking-Water Directive (DWD) 98/83/EC**, setting quality standards for most common substances (48 microbiological & chemical, so-called, parameters) that can be found in drinking water, based on WHO standards.



Based on the regulatory framework about potable water, regulations associated with potable water in ships are:

- **Maritime Labour Convention (MLC) 2006, (Standard A3.2-Food & Catering)**

  "...drinking water supplies shall be suitable in respect of quality..." (para 2a, pg. 52)

  "...the competent authority shall require that frequent documented inspections be carried out on board ships, by or under the authority of the master, with respect to supplies of drinking water" (para 7a, pg. 52-53)

  A ship, regardless of flag, in the port of a State which has ratified the Convention may be subject to a Port State Control inspection for the purpose of reviewing compliance with the requirements of the Convention.

  The International Chamber of Shipping (ICS) issued advice to ship-owners, prior to MLC coming into force to help them preempt port state control problems saying: *"regardless of the progress which may or may not have been made by a vessel's flag state; ships are required to meet the standards in the Convention. ICS recommends you prepare a **Declaration of Maritime Labour Compliance (DMLC)** for all your ships, which will serve as evidence that your ship meets **MLC standards**."*

  It is therefore advisable that ships have documentation on board as evidence of compliance with the requirements of the Convention even if the ship's flag Administration has not ratified the Convention. Contravening the MLC 2006 regulations, with non-compliance or failed inspections, may result in vessel detention and black listing.

- **World Health Organisation (WHO), (Guide to Ship Sanitation, 3rd Edition, 2011 & Guidelines for Drinking Water Quality, 2008)**

  "Source water is monitored at the port to ensure that water is safe. The ship's master is responsible for operational monitoring: quality of source water: disinfectant residuals and pH (e.g., daily); microbial quality of treated water, particularly after maintenance or repairs."

  The guide, as a global reference on health requirements for ship construction and operation, is primarily aimed to be used as a basis for the development of national approaches to controlling the hazards that may be encountered on ships as well as to provide a framework for policy-making and local decision-making. Monitoring and control compliance procedures are laid out in the WHO guidance for Ship Sanitation Certificates (SSC).

  A number of international regulatory bodies cascade their guidance adopting the fundamental principles defined by WHO.

  Thus among others, ILO, MCA, MGN's & HPA are outlining the imperatives on monitoring and control of Potable Water quality on ship with strong reference to WHO detailed guidance on Ship Sanitation.

POTABLE WATER QUALITY CONTROL BY SPECTRUMLABS

"Regular water quality monitoring must be performed to demonstrate that source water been supplied to the port and potable water on board are not contaminated with fresh faecal material or other microbial and chemical hazards."

WHO, Guide to ship sanitation, 2011, pg. 42

SpectrumLabs, quality control laboratories, provides potable water analysis according to **MLC 2006** requirements, in terms of monitoring potable water quality in marine vessels.

Our detailed analysis report includes physicochemical & microbiological analysis results, evaluation of the findings and recommendations for corrective action (if needed).

Analysis reports are sent within **48hrs** via e-mail followed by a hard copy, upon request.

Recommended physicochemical parameters

Appearance, color and odor
of potable water should be acceptable to the consumer. Ideally, it should have no visible color and no detectable odor.

pH
is important when checking water treatment efficiency and corrosive potential of mains and pipes in the potable water distribution system.
LIMITS RANGE 6.5–9.5

Conductivity
is used to assess the efficacy of the desalinated water remineralisation process.
UPPER LIMIT 2500 µS/cm

Total residual chlorine
is tested to assess the efficacy of disinfection treatment. It should be measured during or after the disinfection treatment, or as often as required.
UPPER LIMIT 5 mg/L

Chloride
is tested to assess the efficacy of disinfection treatment. It should be measured during or after the disinfection treatment, or as often as required.
UPPER LIMIT 250 mg/L

Metals
Potable water may contain metals which cause chronic or acute poisoning. Most of metals can leach from water pipes and soldered joints.

UPPER LIMITS	Iron (Fe)	200 µg/L
	Copper (Cu)	2 mg/L
	Lead (Pb)	10 µg/L
	Cadmium (Cd)	3 µg/L
	Nickel (Ni)	20 µg/L
	Zinc (Zn)	Recommended limit by WHO less than 3 mg/L

Total Hardness
is measured in concentration of calcium carbonate ($CaCO_3$), to avoid corrosion and scaling.

Turbidity
is a measure of the relative clarity or cloudiness of water and is an indicator of the effectiveness of potable water treatment processes, particularly filtration, in the removal of potential microbial pathogens. The high turbidity indicates that the treatment system is not working properly.
RECOMMENDED LIMIT by WHO less than 5 NTU

Chloride & Total Hardness tests

Recommended microbial parameters

Total coliforms
are a broad class of bacteria and include those that can survive and grow in water. Even though they are not useful as an indicator of specific faecal pathogens, they can be used to assess effectiveness of the treatment in the cleanliness and integrity of distribution systems by showing the presence of biofilms. UPPER LIMIT 0 cfus/100mL

Escherichia coli (E. coli)
is a type of coliform that is considered the most suitable indicator of faecal contamination monitoring including surveillance of potable water quality.
UPPER LIMIT 0 cfus/100mL

Intestinal enterococci
can be used as an indicator of faecal contamination since they survive longer in water environments than E. coli or thermotolerant coliforms and are more resistant to drying and chlorination. UPPER LIMITS 0 cfus/100mL

Heterotrophic plate count (HPC)
detects a wide spectrum of heterotrophic microorganisms including bacteria and fungi. The test is based on the ability of the organisms to grow on rich growth media without inhibitory or selective agents, over a specified incubation period and at defined temperatures.
UPPER LIMITS HPC at 22°C 100 cfus/mL
HPC at 37°C 20 cfus/mL

Chlostridium perfingens
is ever present in nature and can be found as a normal component of decaying vegetation, marine sediment, soil and insects. It is one of the most common causes of food poisoning.
UPPER LIMIT 0 cfus/100mL

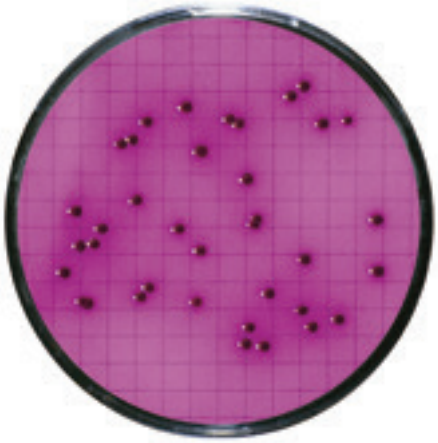
Pseudomonas aeroginosa
is a bacterium that can cause disease in plant, animals and humans. It is found in soil, water skin flora and most man made environments. UPPER LIMITS 0 cfus/100mL

Legionella
is a common bacterium in many environments, including soil and aquatic systems. The bacterium is not transmissible from person to person.UPPER LIMITS 0 cfus/100mL

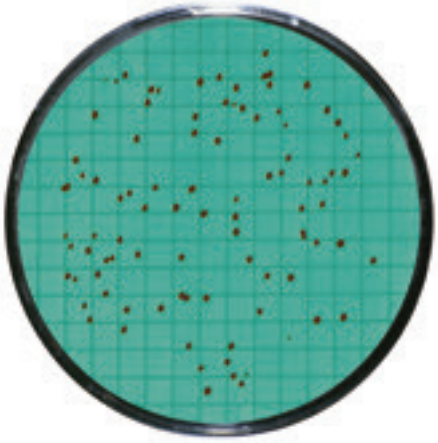
NOTE
Drinking Water Directive 98/83/EC requires total absence of microbial indicators E-Coli, Total Coliforms, Enterococci, Pseudomonas Aeroginosa, Legionella and Chlostridium perfingens.

ATTENTION

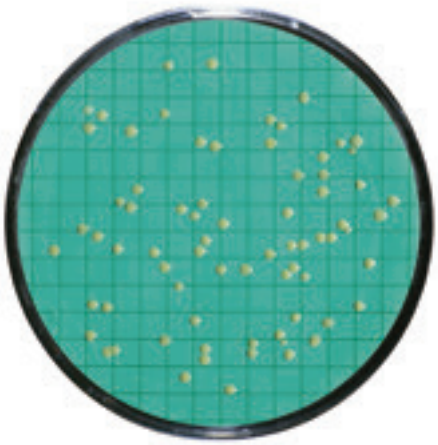
IN ORDER TO PERFORM MICROBIOLOGICAL ANALYSIS SAMPLES MUST BE COLLECTED IN STERILIZED BOTTLES.



Escherichia coli (E. coli)



Intestinal enterococci



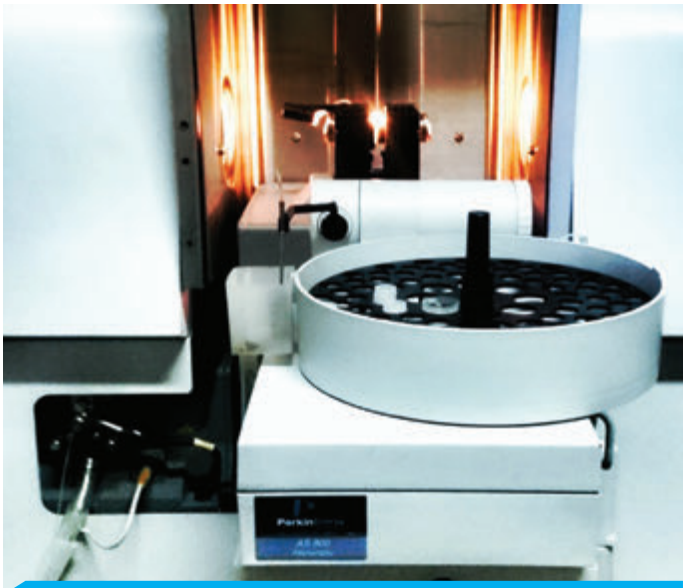
Heterotrophic plate count (HPC)

Methods

- ✓ SENSORY: Color, Appearance and Odor Tests
- ✓ ISO 10523: Determination of pH
- ✓ ISO 7888: Determination of Electrical Conductivity
- ✓ APHA 4500 CL G: Determination of Total Residual Chlorine
- ✓ ISO 9297: Determination of Chloride
- ✓ ISO 15586: Determination of trace elements using atomic absorption spectrometry (GFFA)
- ✓ ISO 6059: (Total Hardness) Determination of the sum of calcium and magnesium
- ✓ ISO 7027-1: Determination of turbidity
- ✓ ISO 9308: Enumeration of Escherichia Coli & Coliform Bacteria
- ✓ ISO 7899-2: Detection & Enumeration of Intestinal Enterococci
- ✓ ISO 6222: Enumeration of Heterotrophic Plate Count
- ✓ ISO 11731-2: Detection and enumeration of legionella
- ✓ ISO 16266: Detection and enumeration of pseudomonas aeruginosa
- ✓ ISO 14189: Detection and enumeration of chlostridium perfigens

Equipment

- ▶ Atomic Absorption Spectrometer PERKIN ELMER Aanalyst 700
- ▶ Photometer Dr Lange LASA 100
- ▶ Sartorius Stedium Filtration System
- ▶ pH & Conductivity meter Hanna Edge
- ▶ Turbidimeter, Lovibond Water Testing



Atomic Absorption Spectrometer PERKIN ELMER Aanalyst 700

Photometer Dr Lange LASA 100

Sartorius Stedium Filtration System

AUDIT MONITORING

The purpose of audit monitoring is to provide the information necessary to determine whether or not all of the regulatory imposed parametric values are being complied with.

Testing & frequency

According to **MLC 2006** *"frequent documented inspections"* of drinking water supplies should be carried out. This ensures that ship-owners are acting responsibly with a clear trail for port state control officers to inspect.

The International Labour Organisation (ILO) Convention 78 requires ship-owners to *"physically check quality of water at random, using different outlets"* and the **World Health Organisation (WHO)** has issued guidelines that state: *"The frequency of monitoring should reflect the probable rate of change in water quality. For example, monitoring of drinking-water on ships may be more frequent when the ship is new or recently commissioned, with frequencies decreasing in the light of review of results. Similarly, if the ship's water system has been outof control, monitoring following restoration of the system would be more frequent until it is verified that the system is clearly under control."*

To ensure water quality stability it is recommended that examination be carried out at least twice a year. The frequency of the tests will be determined based on the following criteria:

- frequency of ship drinking water supply,
- refreshing of water through the desalination process,
- visual observation,
- monitoring the treatment procedure (check & optimize the treatment system according to manufacturer's instructions, re-hardening system, UV sterilization system, etc.).

Sampling

Sampling should be performed after an inspection of the whole system and especially for microbiological analysis according to **ISO 19458:2006** (Water quality-sampling for microbiological analysis).

A standard of the sampling scheme needs to be defined and monitored in order to ensure its reliability. For this purpose, it should be taken into consideration:

- a standard surveillance so as to verify of good management performance,
- a more detailed inspection in case of suspected problems.

Sampling points

Sampling should be performed from locations considered as highly hazardous. Specific sampling points should be taken into account, such as:

- potable water supply lines,
- freshwater tank systems,
- toilets & showers,
- galleys,
- crew or passengers cabins,
- any other connection or tank for potable water that there is loaded on board.

To obtain reliable and comparable information of the sanitary status of the potable water installation, it is recommended to take more than one sample in the system. At a minimum, one sample should be taken from the tank (by use of an installed sampling tap) and another sample should be taken at the tap farthest away from the tank -usually at the bridge deck). Comparison of all samples allows interpretation of biological processes inside the distribution system and gives information on treatment efficacy. In order to be able to survey development of microbial growth in a particular system, it is imperative to always take the samples from the same sampling points.

SpectrumLabs have the framework, methology & expertise which ensure services that meet requirements and satisfy monitoring controls.

We are always happy to assist you with any queries you may have or any information you may require.

We offer

as part of our service, free-of-charge, especially designed sampling kits which contain:

- sterilized bottles,
  (Sodium Thiosulfate as a preservative is included in the bottles)
- materials & supplies needed for proper sampling and global shipment,
- step-by-step sampling instructions.

We undertake

- ✓ pickup & shipment of samples from ports wordlwide to our labs within 48hrs,
- ✓ on-board water sampling, upon request. Just call and request for one of our technicians at the next port you anchor.

REFERENCES

EU DIRECTIVE 98/83/EC
www.fsai.ie/uploadedFiles/Legislation/Food_Legisation_Links/General_Principles_of_Food_Law/Dir%2098.83.EC.pdf
WHO Guidelines for Drinking Water Quality, 4th Edition 2011
whqlibdoc.who.int/publications/2011/9789241548151_eng.pdf
Handbook for inspection of ships and issuance of ship sanitation certificates, WHO, 2011
whqlibdoc.who.int/publications/2011/9789241548199_eng.pdf
Guide to ship sanitation, WHO, 2011
whqlibdoc.who.int/publications/2011/9789241546690_eng.pdf
MLC 2006
www.ilo.org/wcmsp5/groups/public/---ed_norm/---normes/documents/normativeinstrument/wcms_090250.pdf
IHR 2005, WHO
www.ilo.org/wcmsp5/groups/public/---ed_norm/---normes/documents/normativeinstrument/wcms_090250.pdf

Also available

WASTEWATER ANALYSIS

✓ BILGEWATER/OILY WATER SEPARATOR EFFLUENT ANALYSIS
✓ GRAYWATER ANALYSIS
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Where Quality Comes First

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