NATO STANDARD

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FOOD AND WATER SAFETY, DEFENCE, AND PRODUCTION IN NATO NAVAL OPERATIONS

Edition A, version 1

JULY 2022

NORTH ATLANTIC TREATY ORGANIZATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

4 July 2022

1. The enclosed Allied Medical Publication AMedP-4.14, Edition A, version 1, FOOD AND WATER SAFETY, DEFENCE, AND PRODUCTION IN NATO NAVAL OPERATIONS, which has been approved by the nations in the Military Committee Medical Standardization Board, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 2556.

2. AMedP-4.14, Edition A, version 1, is effective upon receipt.

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4. This publication shall be handled in accordance with C-M(2002)60.

Dimitrios SIGOULAKIS
Major General, GRC (A)
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
BGR	1. The Bulgarian Armed Forces (BAF) will not implement AMedP-4.5 since the standard contradicts with the national legislation. Under the national Act on Food, the rights to control the organization and activities of manufacturers and suppliers of food, and food products have only the Bulgarian Food Safety Agency. Structures of the Ministry of Defence have no legal grounds and rights to supervise and inspect private suppliers. 2. BAF cannot fully implement Appendix B to AMedP-4.14, and the following points will be applied only: - Enterococcus, Escherichia coli (E. coli), Coliforms at 37°C, Number of revivable aerobic microorganisms at 22°C and 37°C, Sulfito-reducing bacteria, including spores (Clostridium spp). - Colour, Smell, Taste, Conductivity, Hardness, pH, Magnesium, Manganese, Nickel, Nitrates, Nitrites, Sulphates, Total Chlorine, Copper and Iron.
CAN	CAN does not routinely remineralise reverse osmosis permeate water. CAN does not routinely monitor for Enterococcus, Number of revivable aerobic microorganisms, nor Sulfito-reducing bacteria. CAN does not routinely monitor for the chemicals listed in Appendix B unless it is indicated to do so, following a risk assessment.
CZE	CZE obeys the principles of good manufacturing and hygiene practices, Codex Alimentarius, hazard analysis and critical control points and national legislation based on the EU legislation during the food distribution, stocking and processing. The requirements stated in these documents differ from the requirements stated in STANAG 2556 Edition 3 RD 1 in the following paragraphs: k) AMedP-4.14 (A) (1): CZE armed forces do not have NAVY. CZE can provide personnel to maritime MMU in accordance with AMedP-4.14 (A) (1).
DEU	Due to national regulations DEU will not necessarily fulfill the limits and referencelevels for drinking water set out in Appendix B in terms of conductivity, pH, free chlorine, chlorine dioxide. Limits and reference levels of free chlorine or chlorine dioxide will only be reached in case of usage in a sanitizing process (Appendix B). DEU will dispense the provision of reliable documents if water is taken off a EU or Nato country's official potable water network (3.3.2.3.). Due to national regulations DEU will not fulfill the limits of the final pH of water for human consumption (3.4.5). DEU reservations also affect the water supply from DEU logistic vessels (3.3.3). DEU mainly uses

	ultraviolet light as sanitization procedure; a chemical disinfectant shock treatment or sanitizing process is only used in case of microbiologic problems (3.5).
ESP	Regarding the Appendix B about Analytical frameworks for potable water on board military ships, Spain will apply limits under national and EU law.
GBR	The UK will not, or may not be able to, implement the following paragraphs: 1.2.4(5) – Given number of platforms and wide range of organisational structures the UK finds this requirement is unduly onerous. Roles and responsibilities clearly set out in policy and unit standing orders without the need to create and maintain organisational charts. 1.2.6(4) – Although consultation with FHP experts is desirable ahead of modification or renovation work, often not possible and/or practicable within operational and workforce constraints. 2.2.2(1) and (2) – Although desirable to have all food services on the same deck, this is not possible in some RN platforms. ? 2.2.7(1) – Not possible on some RN platforms to have galley located close to food storage rooms on the same deck. RN food storage compartments are often dislocated from food preparation areas / galleys in terms of compartments and decks. 2.2.12 (1) and (2) – Dedicated toilets, dedicated changing rooms, and hands-free lavatories and washbasins for catering staff immediately adjacent to the galley is not possible on RN platforms. 2.4.4 (1) – Requirement for food suppliers to be certified by the health authority of a NATO member state is not possible in all circumstances for operational reasons. Our contractual arrangements with Port Agents places responsibility on them to secure food from safe suppliers and experience indicates this adequately manages risk. 3.1(4) and Appendix B - UK has its own set of analytes developed through reference to national legislation and IHR/WHO/US/EU standards. In some cases, we do not analyse water for some of the chemical analytes in Appendix B, and analyse water for a wider range of other analytes. ?UK will follow national policy and approach. 3.3.2(3) and Para 3.3.4(1) - Not practicable or technically possible to purify and treat water being embarked in all circumstances. Units will undertake a risk assessment of water being embarked while alongside in a foreign port and implement control measures as required.

	3.5(1) – differs from national policy – including minimum and maximum concentrations of residual free chlorine - which will be followed instead. 3.5(4) – Requirement for sampling systems for each tank not possible on some RN platforms. Some Units have tanks without dedicated sampling outlets. 3.9(6) –. Although desirable, RN Med not in a position to constraint future ship design to ensure looped hot water distribution system.
SVK	The Armed Forces of the Slovak Republic reserves the right not to implement AMedP-4.14 because they have no military naval equipment available and there is no assumption to deploy any military medical/veterinary personnel to operations on ships in order to perform the tasks of food safety.
SVN	AMedP-4.14, Chapter 2, paragraph 2.2.3. – Surfaces, Item 5: It isn't feasible due to the constructional reasons.
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CHAPTER 1 – ROLES, RESPONSIBILITIES AND AUTHORITIES IN THE POLICY ON FOOD, WATER AND PESTS ON MILITARY SHIPS

1.1. INTRODUCTION

Under the “One Health” concept, the sanitary control of food and water is considered an essential condition of an operational mission. Pest control is also integral to managing health risks on board vessels.

AMedP-4.5, -4.6, -4.7, -4.12 of STANAG 2556 describe the requirements to be applied for food safety, defense and production during NATO operations. The AMedP-4.9 of STANAG 2136 describes the requirements for water potability during field operations and in emergency situations.
This document was created to complete these requirements for naval operations, in order to achieve a high level of control over health risks on board vessels.

This document identifies roles and responsibility regarding on-board food services, potable water services, pest control and defines the requirements to be met during the design and construction of a new vessel and throughout the vessel’s active duty cycle.
On-board food services include all the steps necessary for onboarding, storing and preparing food and serving meals, and managing food waste.

The potable water service includes all the steps necessary for onboarding, purifying, treating and storing water, and distributing water to users.

Pest control is recognized as essential to managing health risks. As a consequence, pest control is integral to managing health risks on board vessels.

1.2. ROLES AND RESPONSIBILITIES

1.2.1. Naval Staff and Engineering Services during a Naval Armament Program

1. Requirements and specifications for capacities, performance, autonomy and standards concerning the food supply chain and the potable water system has to be defined and communicated to the shipyard as part of the first step to build a new naval vessel.

2. The naval staff defines the requirements, and naval engineering services draft the technical specifications needed to produce the required performance.

1.2.2. Experts in Food and Water SerVICES

1. Force health protection experts (with naval competences) must be consulted and work closely with the naval staff and naval engineering services throughout the duration of a naval armament program.

2. Force health protection experts (food services and potable water) can be veterinarians, medical personnel, hygiene officers, environmental health officers, logistics officers, or any other qualified professional with experience in the fields of food services and potable water.

3. The role of force health protection experts is to ensure that:

- health regulations will be respected;
- the facilities constructed will be functional and workable;
- the equipment is of an appropriate size and suited to meet the requirements.

4. Force health protection experts must be involved in keeping the food service and potable water systems working. They must carry out expert assessments and inspections to define the corrective measures to be applied to restore proper management of health risks.

5. Force health protection experts also has to be involved in conducting health inspections to ensure that the crew is complying with all health requirements applicable to food and potable water.

6. Force health protection experts must advise the naval staff, the health service and vessel commanding officers about all matters relating to food or potable water on board military vessels.

1.2.3. Experts in Pest ConTROL

1. Pest control must be provided by military experts in pest control or by a private contractor.

2. Pest control experts should be consulted in the design of new ships.

3. Pest control should be overseen by the force health protection service onboard to ensure that operations are efficient, and accepted by base port authorities in order to deliver the Maritime Declaration of Health certificate (International Health Regulations).

1.2.4. Commanding Officers and Crews

1. The commanding officer is responsible for food and potable water quality, safety and defence on board the vessel. This fact has to be reminded before and during all naval operations.
2. The commanding officer is responsible for the decision of release for consumption, restrict or prohibit supplies on board the vessel.

3. On behalf of the commanding officer, the crew in charge of the food service and the crew in charge of potable water must comply with regulations and good practices.

4. The commanding officer is responsible for:

- making decisions to release water for consumption, restrict its use and interrupt water distribution on board the vessel;
- providing information and advice to personnel on the use of water.

The commanding officer's initial decision to release water for consumption must be based on the production facility operating parameters established through monitoring, on the recommendations in a report submitted by a medical branch inspector, and on the opinion of the commanding officer's technical advisor concerning water quality testing. Thus, any water for which the production, treatment, storage and distribution processes have been tested is presumed to be fit for human consumption.
Where specific local constraints make it impossible to guarantee compliance with the quality limits and references using standard technical means, the vessel's commanding officer, via the command of the force or the organizational authority, may request specialized technical advice from the stakeholders in the water supply chain to consider making an exception to the regulatory quality criteria.
Any such exception, issued on a temporary basis, may be accompanied by water use restrictions to minimize endangering the health of users.

5. Under the authority of the commanding officer, a functional organizational chart must be established to set out the responsibilities of each technical stakeholder involved in the production of potable water, including potential replacements. This personnel must provide the commanding officer with the results of water quality monitoring and with any other information related to water quality. When deficiencies are identified by monitoring personnel, they must apply the appropriate corrective measures as quickly as possible to restore water quality, and inform the commander and medical personnel onboard.

6. An action plan to manage malfunctions in the production of potable water shall be created. It is particularly important to have an emergency plan for supplying water under all circumstances.

1.2.5. Force Health Protection Services

1. The force health protection service (naval or joint) must be fully involved in the safety and defence of food and potable water on board military vessels.

2. The force health protection personnel on board vessels act as advisors to the commanding officer.

3. Force health protection management must support the on-board health personnel and the commanding officer in the event of any major difficulty or problem.

4. Health services conducts health inspections on board military vessels.

1.2.6. Maintenance Services

1. Maintenance operations on food service and potable water facilities must be performed to ensure the proper functioning and availability of the facilities.

2. The crew can provide the first level of maintenance.

3. Maintenance services are responsible for the other levels of maintenance and for the replacement of machinery and equipment.

4. Maintenance services must involve force health protection experts whenever modification or renovation work is planned on food service or potable water facilities.

CHAPTER 2 – FOOD SAFETY AND FOOD DEFENCE ON BOARD MILITARY VESSELS

2.1. INTRODUCTION

The control of health and tampering risks within on-board food services depends on several elements:

- The premises: organization, surfaces, material and equipment.
- The use by the crew: instruction, compliance with rules and sanitary principles.
- The quality of raw foodstuffs: supplied at base port or at foreign ports of call.

2.2. FOOD SERVICE FACILITIES: PREMISES, MATERIEL, EQUIPMENT

Some examples of technical solutions and equipment are described in detail in Appendix A. This appendix is a recommendation.

Complete general requirements are described in AMedP 4.6. The following points are specific to naval and maritime environment..

2.2.1. Surfaces dedicated to Food Service Activities

1. The total surface area of food service facilities often represents an architectural challenge for the vessel. The allocated surface area is a compromise between:

- materiel and equipment requirements;
- the distance between different food services functions (storage, production, distribution);
- the ability to clean large surfaces.

2.2.2. General Principles of Food Services

1. All food service facilities should be on the same deck. This principle makes it possible avoid cross contaminations and optimise work flow.

2. For older vessels, food service facilities can be spread over several decks, but should be located in the same section. Where this is the case, a dumbwaiter can be used to transport food from one deck to another.

3. Food service facilities must be designed to facilitate cleaning and sanitizing procedures, in accordance with the structure of the ship.

2.2.3. Surfaces

1. Surfaces must be able to withstand the naval environment (rust and fire risks for example) and be designed to facilitate cleaning and sanitizing procedures.

2. Floor surfaces must be able to withstand platform movements and deck deformations.

3. Floors must be equipped with an efficient wastewater drainage system designed for this specific application. The depth of the gutters must be sufficient to allow wastewater to drain without overflowing onto the floor.

4. The wall surfaces must be made of materials that facilitate easy cleaning. If there are junctions on the surfaces, they must be watertight and withstand platform movements and vibration.

5. Doors must be kept closed; therefore, they must be equipped with automatic return hinges to avoid unintentional opening or closing movements (when the ship is sailing on bad sea for example).

6. Pipes, sheaths or electric networks hung on ceilings must be covered with materials that facilitate easy maintenance, reduce condensation and limit the growth of microbes and moulds that can potentially contaminate food.

2.2.4. Ventilation

1. Smoke and vapour must be discharged by appropriately placed exhaust hoods, without any pollution of other decks. The remaining overhead clearance must be sufficient to accommodate personnel movement and performance of duties.

2. Fresh air intakes must not cause contamination. The air entering the galley must be filtered (at least against particles).

2.2.5. General Requirements for Equipment And Materiel

1. All equipment and material must be designed and installed to minimize health risks and facilitate cleaning procedures.

2. Food contact surfaces must be smooth, rot-proof, easily washable and non-toxic.

3. Equipment must be designed to withstand platform movements, shocks and vibration. It must not present a hazard to personnel (adequately secured in place).

2.2.6. Food Storage Facilities

1. Food storage facilities shall be adapted to the mission profile so that autonomy matches operational requirements concerning the number of days at sea without stopovers and the number of crew members.

2. Storage temperatures shall meet regulatory requirements. Redundancy should be ensured to continue operations during a potential breakdown while sailing.

3. There must be a refrigerated area for thawing food to ensure that cold chain integrity is preserved. If not, food should be thawed in an appropriate area and in accordance with a written procedure to ensure that the integrity of the cold chain is preserved.

4. Humidity levels in storage rooms for sensitive products, such as flour or refrigerated and frozen products should be controlled.
The air in the flour storage area must be dry enough to allow long-term storage without spoilage.

2.2.7. Food Preparation Areas

1. The galley should be located close to the storage rooms and on the same deck (“horizontal supply” concept). If this is not possible, the galley should be placed in the same section (“vertical supply” concept).

2. Food preparation areas shall be adapted to a vessel’s mission profile so that autonomy matches operational requirements, the number of crew members and meal preparation plan.

3. Food preparation areas shall be designed to meet food safety requirements and arranged to avoid cross-contamination. Clean and unclean operations must be segregated. If it is not possible to physically separate areas, then processes must be separated by time.
A specific area should be designated for activities to limit cross-contamination due to flour.

2.2.8. Dining Facilities

1. Self-service distribution equipment shall be located close to the galley. For table service, a pantry should be located near the mess rooms.
The mess rooms should be sufficiently large, properly equipped and user-friendly.

2.2.9. Cleaning and Sanitizing

1. A sufficient number of washing and sanitizing stations shall be provided in convenient locations in order to ensure effective cleaning and sanitation.

2. Cleaning products and chemicals shall be stored away from areas where food is handled or stored and shall be stored in such a way that they do not contaminate food or cause corrosion. Access to these products should be only available for authorized personnel.

3. Dishwashing activities shall be carried out in a dedicated area located near the mess rooms and the self-service station.
Dishes and kitchen utensils should be washed by a machine. Where it is not possible to wash dishes and utensils by a machine, a documented process shall be in place to ensure that the cleaning process, cleaning chemicals and water temperature will be adequate for hygiene purposes.

4. For hygiene purposes, the personnel in charge of dishwashing should belong to the food service.

2.2.10. Hand Hygiene

1. A sufficient number of hand free operated hand-washing facilities shall be made available within the food preparation area and at, or prior to, the point of entry to food service areas.
The facilities shall be equipped with hot and cold water, soap and towels.

2. Electric hand dryers are prohibited in the galley and food service areas. Single use paper towels is recommended.

3. Hand sanitization shall be provided before entering the food line.

2.2.11. Toilet Facilities for the Crew

The number of toilets shall be in correspondence with the capacity of the mess rooms. The toilets shall not connect directly to mess rooms or meal preparation areas.

2.2.12. Changing Rooms and Toilet Facilities for Catering Staff

1. Dedicated toilets and hands-free washbasins for catering staff shall be located close to the galley.

2. Dedicated change rooms equipped with hands-free lavatories and washbasins should be available and located immediately adjacent to the galley. This requirement may not be applied on small ships.

2.2.13. Treatment of Waste from the Food Service

1. The recommendations of the Maritime Pollution Convention (MARPOL) should be met.
Food service activities generally generate five categories of waste:

- organic food waste (from the preparation of meals, leftovers);
- plastics (from packaging and meals);
- metals (from beverages and meals);
- cellulose materials (wood, cardboard) from packaging;
- glass.

2. Food waste shredders should be installed in the galley for immediate treatment of waste during meal prep and in dishwashing stations to treat leftovers on site.

3. Contaminated non-organic waste must be stored under hygienic conditions (refrigerated if not neutralized). If necessary, a grinding and compacting system must be installed.

2.3. FOOD SAFETY DURING OPERATION AND TRAINING

Food services personnel must comply with hygiene rules described in AMedP-4.6, but special attention should be paid to the following points:

1 Food services personnel must wear clean clothing and appropriate footwear and keep unauthorized personnel from entering the food services areas.

2. Technical work (repairs, maintenance of equipment) must be carried out outside of galley operating hours. If immediate action is required, technical personnel must wear disposable protective clothing.

3. Secondary tasks of the food service personnel should not lead to food contamination or other hygiene issue.

4. Exercises or training activities should not compromise food safety or food defence principles. For example, food services personnel should ensure that basic sanitary arrangements (hot chain, cold chain) are made before leaving the galley to go to their assigned position during the exercise.

5. The marine environment is detrimental to metal surfaces on kitchen equipment and machinery, even those made of stainless steel, therefore cleaning and maintenance operations are very important and must be scrupulously followed.

6. In combat or intensive training situations, it may be necessary to prepare and serve a meal in a very short period of time. The menu, processes and activities must be adapted to the situation in order to limit health risks.

2.4. FOOD SUPPLIES

The food supply principles are defined in AMedP-4.5 and AMedP-4.12 of STANAG 2556.

The use of approved suppliers is required in order to control health and tampering risks.

2.4.1. Food Provisioning at Base Port

1. Only approved sources are authorized, in accordance with national regulations or, at minimum, in accordance with STANAG 2556.
2. The transportation and delivery of food must comply with national health regulations or, at minimum, with STANAG 2556.

2.4.2. Food Provisioning from a Logistics Vessel

Vessels must procure food supplies during missions in order to maintain their operational autonomy. Vessels can resupply at sea from NATO Member Nations' logistics vessels.

1. Only certified supplies from approved sources are authorized (in accordance with Stanag 2556 AMedP 4.5 or national certification).

2. The food storage conditions in the logistics vessel must, at a minimum, meet the requirements described in section 2.2.5.

3. The conditions for delivery from the logistics vessel to the recipient vessel must comply with health regulations regarding temperature and hygiene. Particular attention should be paid to the staging areas on the logistics vessel where food is stored before being sent to the recipient vessel.

4. If necessary, crew members other than food services personnel may assist with food deliveries in order to control the movement of food supplies from the deck to the vessel's refrigerated storage, only handling packaging and avoiding direct contact with raw foodstuff in order to limit contaminations.

2.4.3. Food Provisioning from a Base Port exported to a Foreign Port of Call

1. The resupply of food needed to restore the vessel's autonomy can be achieved by shipping pallets of food supplies from the base port to the port of call.

2. Transport conditions between the base port and the port of call, storage conditions at the port of call pending delivery, and delivery conditions must be verified by the food services personnel of the recipient vessel.

3. Particular attention must be paid to temperature control throughout the supply chain. Extra caution is advised if the delivery is made by subcontractors (local trucks for example).

4. If necessary, crew members other than food services personnel may assist with food deliveries in order to control the movement of food supplies from the deck of the recipient vessel to its refrigerated storage.

2.4.4. Food Provisioning at a Foreign Port of Call from Approved Local Suppliers

1. At foreign ports of call, the use of food suppliers is permissible if they are certified by the health authority of a NATO Member State in accordance with the audit principles of AMedP-4.5 in STANAG 2556.

2. The crew must take notice of the number of subcontractors in the supply chain implemented by the ship chandler. The provisioning company must demonstrate that the supply chain is short and under control.

3. The conditions of issuance and delivery must comply with health and safety requirements regarding food tampering. Extra vigilance is advised in ensuring that delivery trucks comply with conditions pertaining to hygiene and temperature.

4. At some ports of call, there are no certified suppliers available. In this case, no food supplies should be taken on. If a vessel must take on food supplies to continue operations, the commander of the ship is held liable, considering the hygiene level of the supplying country.

2.4.5. Food Import

When a ship is returning to base, national regulations about food import and STANAG 2557 must be followed.

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CHAPTER 3 – SAFETY AND DEFENCE OF POTABLE WATER ON BOARD MILITARY VESSELS

3.1. INTRODUCTION

1. This chapter outlines the terms and conditions to which the supply, production, storage and distribution of potable water on board military vessels are subject, including water quality monitoring and sanitary testing.

2. In order to ensure water safety and defence, appropriate technical means must be developed and installed on the vessel at the design and construction stage.

3. The control of water safety and defense is based on several elements:

- the facilities: equipment and machinery;
- the use of the facilities by the crew: training of personnel, compliance with operating rules;
- the source of the water: supplied at the base port, from a logistics vessel or at a foreign port.

4. Potable water must not contain a number or concentration of microorganisms, parasites or any other substance that constitutes a potential hazard to human health. In all circumstances, potable water must comply with the limits and reference levels for drinking water standards set out in Appendix B.

3.2. TRAINING OF PERSONNEL

1. Personnel responsible for operating the water production, storage and distribution systems on board military vessels must receive specific initial and ongoing training. In particular, the operators in charge of monitoring the system must be trained in risk assessment and in the use of portable analysis equipment available on board.
The operating personnel must also receive training on the risks associated with potential tampering, whether during water onboarding, production, storage or distribution on the vessel.
At each work station, documents specifying the guidelines of good hygiene practice and the specific operating procedures for each basic activity must made available to the personnel.

2. Medical branch personnel needs appropriate training in order to perform sanitary inspections.

3.3. SOURCE AND CHARACTERISTICS OF THE WATER

3.3.1. Water Supply from the Base PORT

1. The entity in charge of producing and distributing water to supply systems at naval bases is responsible for its quality. This entity shall give all relevant information concerning the delivered water to naval authorities and commanders of the vessels being supplied.

2. The crew must take every precaution to protect shore-based water systems from backflow from the vessel.

3.3.2. Onboarding of Potable Water

1. Only potable water of known and guaranteed quality may be taken directly into the vessel's tanks. Onboarding of raw water or technical water into potable water tanks is prohibited.

2. At the base port, the quality of potable water must be certified by the competent national health authorities.

3. At foreign ports of call, water delivered to the dock must be considered as raw water of unknown quality and purified and treated before being stored in the vessel's tanks. Exceptions can be made if appropriate and reliable documents are provided.

4. The vessel must be equipped with water hoses fitted with connections compliant with NATO standards (ATP 16 of STANAG 1065).
5. The crew must take every precaution to prevent contamination of the water during onboarding (type of hoses, purging of collectors, etc.).

3.3.3. Water Supply from a Logistics Vessel

The water stored and delivered by logistics vessels to other vessels during resupply at sea must comply with all aspects of the requirements set out in this AMedP.

3.3.4 Water Supply at Foreign Ports of CALL

1. Except in cases where the supply is sufficiently guaranteed, onboarded water must be considered non-potable raw water. To avoid any pollution, raw water must be purified and treated before being stored in the tanks or released into the water distribution system. In order to eliminate unidentified physical, chemical or biologic hazards, raw water should be purified by reverse osmosis technology or distillation (or any other method that is at least as effective). The use of any such treatment method must ensure that the stored and distributed water meets the analytical parameters set out in Appendix B. In case of raw water from a source with known contamination and sufficient defence, other less energy demanding processes can be used.

2. With regard to purifying raw water supplied at ports of call, pre-filtration and additional treatments may need to be considered, as an example:

- Raw water buffer capacity limits the incidence of momentary supply and load disruptions;
- A reinforced pre-filtration step shall remove components that could be detrimental to the proper functioning of reverse osmosis membranes (particulate hazards, chlorine, for example);
- To limit costs and water losses, a recirculation system can be installed on the reverse osmosis unit to increase efficiency. This system must be bypassed when treating seawater.
- The remineralization of water produced from fresh dock water must be adapted to the very low conductivity obtained at the output of production (injection of solutes).

3.4. WATER PRODUCTION AND TREATMENT

1. For vessels equipped with water production modules, equipment redundancy is recommended to cover a potential failure or non-repairable malfunction during the mission. Each one of the two production modules should be capable of producing at least 50% of the daily water requirements.

2. The water treatment process should include a system for continuous sanitization of produced and stored water in order to minimize risk of recontamination before consumption. Automated injection of an approved disinfectant is the preferred method.

3. The supply, transportation, storage and handling of concentrated disinfectant products should be kept to a minimum on board vessels, particularly while sailing.

4. To prevent corrosion of the distribution system and the release of undesirable compounds into the water, the water should be neutralized and/or remineralized before storage and distribution. The water stored and distributed on board should be chemically balanced (or facilitating a thin deposit of calcium carbonate). Neutralization/remineralization procedures should not cause contamination of the water, either through mixing with raw water or through unsanitary manual operations.

5. The final pH of water for human consumption before storage should be between 7 and 8,5.

3.5. STORAGE OF POTABLE WATER

1. During the water storage and distribution phases, a sanitizing process must be done. Depending on the disinfectant compound used, the following requirements must be applied:

- Chlorine use: during the storage and distribution phases, the concentration of free chlorine in the water must be maintained at between 0.3 mg/L and 0.5 mg/L in the storage tanks and at a minimum of at least 0.1 mg/L at all points in the system. The maximum concentration of free chlorine must not exceed 0.5 mg/L at the points where the water is released for consumption. Significant difference between total chlorine and free chlorine should initiate search for deficiencies in the water supply chain (production of chlorination by-products for example).
- Use of bromine: the target disinfection levels when using bromine is the same as when using chlorine but it is measured in total bromine residual (TBR). For example, the levels should be between 0.1 mg/L TBR and 0.5 mg/L TBR.
- Use of chlorine dioxide: the concentration of chlorine dioxide in the water must be maintained at between 0.05 mg/L and 0.2 mg/L ClO_2.

2. Tanks for receiving potable water must be composed of or fully lined with a suitable material that complies with the regulations in force for the proper storage of water. If paint is used on the tank walls, a health compliance certificate is required. The inner lining of the tanks must be light-coloured. Tank liners must be inspected and maintained in order not to represent a health risk for water consumers.

3. The potable water storage tanks must never be used for any other purpose. They must be equipped with a vent (placed so as not to allow the introduction of foreign matter) and at least one opening wide enough for a person to enter for complete cleaning and inspection. This opening shall be positioned in such a way that it can be hermetically sealed between inspections and protected by padlocks or sealed barriers. The design of the tanks must allow them to be easily emptied and cleaned (smooth walls, external reinforcements if possible, etc.). Pressure tanks and hot water tanks are included.

4. Sampling systems must be provided on each tank. These systems can be shared with other functions.

5. The tanks must be emptied, cleaned, sanitized and rinsed at least once every 12 to 24 months (or with an interval determined through a risk assessment performed by competent personnel), with products specifically intended for use in potable water systems.

6. Every time a water tank has been open, in case of potential microbiological contamination of the distribution system or for any other relevant indication, a disinfectant shock treatment has to be performed as a risk mitigating measure.

7. It is important to minimize the cargo water age or residence time as much as possible. A maximum cargo water residence time of 14 days can be considered.

8. On vessels where technical water is used, backflow preventers must be fitted to ensure that this water cannot mix with potable water and to avoid cross contamination, even as a result of an involuntary or accidental operation.

3.6. DISTRIBUTION OF POTABLE WATER

1. Potable water must be distributed in a dedicated system designed to prevent water stagnation or backflow of distributed water into the tanks.

2. An updated chart specifying in particular the type of materials used, the direction of water flow and the location of specific devices (such as valves and backflow preventers) must be available.

3. When a technical water distribution system is in operation, it must be separated from the distribution system for potable water by means of backflow preventers that have been maintained and tested.

4. Technical water distribution taps must be clearly marked with the words “non-potable water,” a pictogram that is understandable to the crew, a colour code that is clearly identified on board or an explicit symbol. The pipes and tanks in this system must be easily identifiable.

5. The distribution system must not be a source of contamination of potable water. Purging, cleaning and sanitizing measures must be applied when the hazard analysis indicates that they are required, particularly after any technical intervention that might contaminate elements of the water system or after any prolonged interruption in the distribution of water. The components of the distribution system must be appropriate and meet the regulatory requirements for contact with potable water (health compliance certificate).

6. The number of fittings in the distribution system must be kept to a minimum.

3.7. QUALITY MONITORING AND TESTING

1. The performance of water production facilities should be monitored and tested regularly to ensure that they are functioning properly. Some technical parameters (pressure, absence of leaks, etc.) could be monitored daily, and some microbiological and chemical parameters could be measured daily, or at least weekly, by the crew when water production is operating.

2. In addition to the monitoring analyses conducted by the crew while sailing, water analyses are routinely performed according to the analytical framework in Appendix B.These analysis may be done before a mission, in a base port laboratory.

3. Sampling points must be available for measuring and monitoring parameters: at the production output and before storage, at the tank outlet and in the distribution system.

4. Water quality monitoring consists primarily of:

- Regular inspections of the production, storage and distribution of potable water facilities to check condition, operation and integrity (including attempts at tampering);
- A program of tests or analyses conducted at designated points during the different phases of operation or use of the production, storage and distribution facilities. They must be capable of detecting any changes in the operation or use of the treatment, storage and distribution systems. This program can be modified based on the results of a hazard analysis or on recommendations made by the military health service. As with disinfection and remineralization, all or part of the monitoring function should be automated and real time (in-line analyzers). Automation allows for early detection of possible tampering (early warning system);
- A sanitation log with a chronological record of all monitoring results must be made available to the military health service as part of sanitary inspections.

5. The minimum monitoring analyses frequency is based on risk assessment. The recommendation below may not be applied on very small ships.
Analyses recommended frequency are:

- Daily measurement of the disinfectant concentration and turbidity of the water at the output of production and at least one point of release for consumption (defined by the risk analysis);
- Daily measurements of water conductivity at the outlet of the osmosis unit or boiler and downstream of remineralization;
- Regular hardness and pH measurements of distributed water. The frequency of these analyses is established based on the specific characteristics of each system. At minimum, these measurements must be performed weekly.
- Microbiological testing (Escherichia coli, Enterococcus) must be performed weekly at one point of release for consumption at least.

Based on the results of the hazard analysis, other monitoring parameters may be considered, namely metals (iron, zinc, copper, nickel, etc.) related to corrosion in the systems, and by-products of water purification treatments (metals in the case of boilers, chlorination by-products, etc.).

6. Additional analysis must be conducted following any maintenance operations on the tanks and system (emptying, cleaning, sanitizing) before water is released for consumption. The water samples required for these analyses must be taken from at least one point of release for consumption, selected based on the risk assessment and their objectives.

Command may request targeted monitoring in specific risk situations. In this case, a compatible analysis plan must be drawn up in cooperation with the laboratory.
In order to monitor sanitary hot water systems, thermometers must be placed so as to facilitate temperature measurements.
Sampling points, designed to prevent any water contamination and capable of undergoing flame or wipe sterilization, must be installed at the following locations:

- at the output of each production system;
- before and after complementary treatments (remineralization and chlorination);
- before storage;
- at the outlet of each storage tank.

7. The sanitary inspection of water is a posteriori verification of the management of the processes in place. It consists in assessing the relevance, factual elements and effectiveness of the management and monitoring measures in place and ensuring, by means of analyses, that the required results set by the regulations have been achieved.
Sanitary inspection is based on both periodic evaluation of the facilities and on the completion of analysis programs. Medical branch personnel performs this inspection.
Sanitary inspections must be performed when the vessel is docked in its home port.
The water analyses required for sanitary inspection must be conducted at minimum:

- every two years, if the flow rate of the facility is less than 100 m3/day;
- every year, if the flow rate is greater than 100 m3/day.

Test samples must be representative of the quality of the water produced and distributed on board when the vessel is at sea and may not include, in any quantity, water supplied dockside from a port's water supply system.
The sampler must be trained and if possible qualified, and follow sampling guidelines. The analyses must be accredited and carried out by a military or accredited civilian laboratory. The standard analysis plan, provided in Appendix B, includes the following for each set of analyses:

- a complete analysis of water sampled at the output of production devices;
- an analysis of samples taken at one point of use,at minimum. These sampling points are determined based on the risk assessment.

The results of the sanitary control shall be used by command in order to support or, if necessary, modify the initial decision to release the water for consumption and to take the necessary corrective measures.

If the vessel complies with the frequency for conducting the sanitary inspection analyses set out above, further analyses are not required to meet the requirements for inspections made under the International Health Regulations (IHR).

3.8. RELEASING POTABLE WATER FOR CONSUMPTION

1. The facilities on surface vessels should be capable of providing the crew with 150 litres/person/day of potable water, in line with the crew's activities, environmental conditions and other specific or operational water needs. On submarines, it is accepted that only 80 litres/person/day are available.

2. The cold and hot water distribution systems should allow shower times to be distributed in a 70/30 ratio (70% of showers taken in the morning and 30% in the evening).

3. For sailing times of more than 24 hours, each crew member should have the option to take one shower per day (except for submarines). Water consumption for personal hygiene is estimated at approximately 80 litres/person/day (cold and hot mixed) at an average temperature of +38 °C (+100°F).

3.9. SANITARY HOT WATER AND LEGIONELLA RISK

1. The temperature of sanitary hot water must be permanently at or above +55°C at the output of the production or storage equipment or be raised to a sufficient temperature at least once every 24 hours. Annex C of STANAG 2136 provides the minimum water temperature maintenance time to be observed.

2. In order to limit pollution incidents, the lining of sanitary hot water tanks must be durable (for example stainless steel water heater). Backflow prevention devices have to be installed.

3. In order to limit the risk of burns:

- In rooms designated as washrooms, the maximum temperature of the sanitary hot water must be set at +50°C (+122°F) at faucets;
- In other rooms, the maximum temperature of the sanitary hot water must be limited to +60°C (+140°F) at faucets.

4. Monitoring and measuring the temperatures specified above must be easy to perform.

5. Legionella analysis should be performed at least once a year, or with a frequency determined through a risk assessment.

6. In new vessels, the sanitary hot water distribution system must be looped.

The absence of a loop is permitted if the maximum volume of water contained in the pipe between the point of production (or point of storage) and the farthest point of use does not exceed three litres.

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CHAPTER 4 – PEST CONTROL ONBOARD MILITARY VESSELS

4.1. INTRODUCTION

Control of disease vectors such as insects and rodents shall be performed to maintain and to avoid to spread pests and diseases. Mosquitoes, rats, mice, cockroaches, flies, lice and rat fleas are all capable of transmitting disease.
Rodents are well established at port areas and are considered vectors for many diseases. Plague, murine and flea-borne typhus, salmonellosis, trichinosis, leptospirosis and rat bite fever are known to be spread by rodents. Malaria is transmitted to humans by mosquito vectors. If not properly controlled, such vectors could breed and be carried by ships. Ships affected by malaria infection during a voyage represent a serious risk to health and life of crew and passengers (International Health Regulations, WHO, 2011). Biological hazards (vectors, non-indigenous species, and transmissible diseases of animal and plant origin) can also affect human and animal public health and socio-economic stability in countries, if they are spread within or across national or international borders. To reduce this risk, special focus on cleaning, disinfection and disinfestation procedures on ships and cargo is needed.

4.2. RELATED STANDARDS

1. International Health Regulations (WHO, 2011). These describe the obligation for ships to have a Ship Sanitation Control Exemption Certificate/Ship Sanitation Control Certificate (SSCEC/SSCC) to ensure health authorities that no public health risk (including the presence of disease vectors) is found on board when entering a (foreign) port.

2. How to help to implement the practical aspects of vector control for ships is discussed specifically in the WHO Guide to Ship Sanitation (chapter 7).

3. STANAG 2557-AMedP 4.11 Measures to reduce risk of transfer of biological hazards during troop and materiel movement.

4. STANAG 2048-AMedP 4.2 Deployment pest and vector surveillance and control

4.3 .PEST CONTROL PRINCIPLES FOR SHIPS

1. In order to ensure pest control appropriate technical means must be developed and installed on the vessel at the design and construction stage.

2. To meet the requirements of the International Health Regulations, an Integrated Pest Management Programme should be in place. The control measures must be carried out under the direction of a ship’s officer charged with this responsibility and must be frequently inspected.

3. If Insecticides, rodenticides or any other poisonous or toxic substances have to be used, have this carried out by a personnel trained and certified in pest control (see STANAG 2048-AMedP 4.2).

4. A preventive approach using good design that minimizes the opportunity for vector penetration, hiding and proliferation is the foundation of any good vector control strategy. Pest control shall always be initiated with preventive measures in order to reduce the use of pesticides on board. Multiple barriers should be actively maintained, including:

- screening out vectors using all reasonable means;
- controlling vectors on board;
- eliminating habitats suitable for vector survival and breeding, where practicable;
- reducing the opportunity for exposure of crew to vector-related infectious agents.

5. One or more of the following control measures may be employed:

- regular inspection of ship spaces, particularly where infestation is most likely to occur, such as food storage, food handling and refuse disposal spaces;
- elimination of pest hiding places and point of accumulation in which trash, food particles or dirt may accumulate;
- frequent cleaning of living quarters and spaces where food is stored, prepared or served or in which dishes and utensils are washed and stored;
- proper storage and disposal of food refuse and rubbish;
- elimination of habitat for insect larvae, ideally through design, or, if unavoidable, though maintenance, such as preventing the formation of standing water in lifeboats;
- use of screens on all structural openings to the outer air during seasons when insects are prevalent;
- application of suitable insecticides.

6. As vectors may have access to ships when in port, pest control measures for the suppression of vermin infestation are necessary.

4.4. CONTROL OF INSECT VECTORS

1. Sleeping quarters, mess rooms and dining-rooms, indoor recreational areas and all food spaces must be effectively screened when ships are in areas where flies and mosquitoes are prevalent.

2. Residual and space spray may be used for the control of flying insects on board of ships. Crawling insects and other vermin are best controlled by preventive measures, and only if necessary, specific insecticides, properly applied to crawling, resting and hiding places.

3. Insecticides, rodenticides, any other poisonous or toxic substances and all equipment for their use must not be stored in or immediately adjacent to spaces used for storage, handling, preparation or serving of food or drink. Further, such poisonous substances should not be stored near dishes and utensils or tableware, linen and other equipment used for handling or serving food and drink.

4. Use only insecticides approved for this purpose.

5. Pesticides may contain substances toxic for humans. Pest managers (or pest management programs) need to ensure approval by the health care staff for any pesticides planned for use to ensure they will not have any impact on the health of the crew or sensitive equipment. Refer to Material Data Safety Sheets (MSDS) to make sure all pesticide characteristics are covered, and to the official agreement to make sure the product is authorized.

4.5. CONTROL OF RODENT VECTORS

1. Rodent proofing is installed and maintained. Rats can gain access to the ship in several ways; direct by hawsers or gangways or indirect concealed in cargo and other materials taken onto the ship.

2. Preventive measures shall proceed the use of traps and rodenticides. The procedures shall be described in a pest management programme.

3. Traps may be used to control vector populations (only if needed based on risk and the vector control programme).

4. Poisoned baits are used to control vector populations (only if needed based on risk and the vector control programme). Rodenticides may be very toxic to humans, caution should be used in their application. Baits should be placed correctly, appropriately marked and regularly checked.

5. Regular pest inspections are undertaken for rodent droppings, gnawing damage and grease marks. Inspection should focus particularly on spaces where food is stored and prepared and where refuse is collected and disposed of, as well as the cargo hold while in port.

4.6. RISK OF TRANSFER OF BIOLOGICAL HAZARDS BY CARGO

1. To reduce the risk of the transfer of diseases, pests and alien species by cargo like materiel used for operations and exercises and transported by ship, measures must be applied according to STANAG 2557-AMedP-4.11 “Measures to reduce risk of transfer of biological hazards during troop and materiel movement”.

2. The ships commander is responsible for the performance of a thorough risk assessment, risk communication and that all necessary actions are

performed, before the material is taken on board the ship. The main focus should be directed towards cleaning and disinfestation procedures both for the (re)deployment of troops and material.

4.7. RISKS OF ANIMALS ON BOARD OF SHIPS

1. Working animals, including working dogs or any other animal taken on board of the ship by crew or passengers, present unique considerations during risk assessment due to the hazards faced by these important assets, as well as existing legal transit requirements (examples include health certificates, prophylactic treatments and antibody tests). Commanders must consult veterinary personnel to ensure applicable documents, including AMedP8.4 and regulations of nations in transit and at destination, are reviewed to enable appropriate risk reducing measures.

APPENDIX A – FOOD SERVICE FACILITIES, EQUIPMENT AND MACHINERY

This appendix provides guidance and examples applicable to the layout of food service facilities on board military vessels.

1.1. GENERAL BALANCE OF SURFACES INTENDED FOR FOOD SERVICES FUNCTIONS

The total surface area of the food services facilities is often a matter of vessel architecture. This surface area is a compromise between:

- The minimum requirements for installing the list of prescribed materiel and performing the prescribed tasks;
- Not requiring personnel to move over too far distances between the different work stations and areas;
- Not requiring personnel to spend too much time cleaning large work surfaces.

1.2. GENERAL LAYOUT PRINCIPLES FOR THE FOOD SERVICES FUNCTION

The layout principles for the food services must comply with the forward flow principle of products. This principle should be extended as far as possible through the production cycle.

The functional organization of the food services facilities must comply with the following principles:

1. The various operations involved in preparing finished products in the galley are organized based on the “forward flow” principle.
2. The food reception and storage areas must be adjacent to the meal preparation and distribution area, on the same deck based on the “horizontal supply” principle.
3. If the “horizontal supply” principle cannot be achieved, the food reception and storage areas must be located on a different deck than the meal preparation and distribution area but within the same vertical section (“vertical supply” principle), with direct vertical links by elevator (dumbwaiters appropriately designed for the transferred loads). Additional daytime buffer storage (refrigerated and ambient temperature) must be provided in a food store annexed to the same deck and with direct access from the galley.
4. Clean and soiled circuits must be organized in such a way as to avoid overlap; however, time separation is an acceptable countermeasure if overlaps are infrequent.
5. “Cold/hot” and “clean/soiled” activities must be segregated in the galley.

6. Cold and hot chains must be strictly maintained from the onboarding of foodstuffs to their distribution. The maintenance of the cold chain is an operational input in handling and onboarding operations, including resupply at sea.
7. The performance of food service tasks requires optimal flow management (diners, personnel, food, materiel and waste), based on the shortest, simplest and most logical routes possible.
8. Good flow of diner traffic must be ensured. Any flow disruption, particularly between the distribution point and the tray return point must be avoided.
9. Food service facilities must be sized to accommodate the installation of the various pieces of equipment, the layout of work stations and the internal circulation of personnel and equipment.
10. The layout of the food service facilities and the set-up of the materiel must accommodate: operations at each work station, taking into account occupational safety (holding device to stabilize the working position in the event of major platform movements and to secure the equipment and its contents correctly) and ergonomics, particularly the positioning and clearance required for the operations to be carried out.
11. The layout of the food service facilities and the arrangement of the equipment must allow for effective cleaning and sanitizing.

1.3. SURFACES

1. Wall, suspended ceiling and door surfaces must be resistant to corrosion from food acids and cleaning and disinfecting agents, and must be smooth and easy to clean. For example, 304L austenitic food-grade stainless steel can be used. Maximum gaps of 2 mm are accepted, provided that they are cleanly grouted with food-grade sealer and accessible for inspection and repair.

2. The technical specifications for cold room ceiling and wall surfaces require, at a minimum, food-grade water resistant materials with a smooth surface easy to clean. For example, 304L austenitic food-grade stainless steel can be used.

1.3.1. Flooring

1. The galley and its annexes may have epoxy flooring or tile that can be cleaned with a brush and sanitized and that is non-porous, resistant to shocks, punctures, scratches, wear and tear, and load (passage of trolleys and equipment), resistant to spray of 100°C, rot-proof, light-coloured, washable and non-toxic. The non-porous flooring must be capped with concave moulding, creating a waterproof, “non-slip” area.

2. The epoxy flooring must be homogeneous (colour, slip and slope) at all points in the galley and its annexes, except underneath furniture, where the

anti-slip quality is not desired. Samples must be submitted to the prescribing department for approval.

3. Tile joints must be easy to clean, and resist to chemical products used to clean the galley.

4. A drainage slope to the gutters must be incorporated into the design and installation of the flooring and subfloor.

1.3.2. Wall Surfaces

1. The angles of intersection between the floor and wall surfaces, and the angles between two wall surfaces, must allow for cleanliness to be maintained at all times and guarantee watertightness from the deck. To achieve this objective, the angles of intersection, excluding external corners, must have concave moulding.

2. All wall surfaces in traffic areas, as well as those not protected by fixed storage spaces or equipment, must be protected against potential impacts from trolleys or tea carts. The doors must be equipped with identical protection.

3. Doors, drawers and their opening/closing systems must be designed to facilitate cleaning. Doors and closing systems must be designed to ensure safe passing without the use of hands.

4. The doors of the galley and its annexes must be kept closed when the facilities are in use. The door has to close automatically after each time it is opened. The closing system must be designed to ensure the safety of personnel passing through with full hands at all times (particularly for sliding doors).

1.3.3. Ceilings And Height under Hood

1. Hanging equipment in the galley and its annexes must be designed and constructed in a manner to allow cleanliness to be maintained at all times and to reduce condensation, prevent the growth of mould and the spillage of particles on food or surfaces likely to come into contact with food.

2. Suspended ceilings must dismantle completely to allow for occasional cleaning or maintenance work. An easily opened access hatch must be provided for technical components located in the plenum of the suspended ceiling that may require safety and/or maintenance work.

3. The galley and its annexes, regardless of whether or not they have suspended ceilings, must not be crossed by pipes for the drainage of wastewater or from washroom facilities, nor by condensate recovery systems.

4. If fume hoods are installed,access to and dismantling of the fume hood must allow for the maintenance of the exhaust duct for cleaning by the users.

5. Fresh air intakes must not lead to food contamination. Consequently, they must be equipped with dust filters and deflectors that direct air flow laterally. Exhaust ducts must also be protected from dust if necessary.

1.4. UTILITIES IN THE GALLEY AND ITS ANNEXES

All measures (insulation, ventilation, heating, air conditioning, etc.) must be taken to ensure a complete absence of condensation on the walls of the galley (excluding the cooking area) and its annexes.

1.4.1. Cleaning and Sanitizing of Facilities and Materiel

The following requirements apply:

1. The cleaning of the galley, its annexes (including the food store, cold rooms, changing facilities and toilets for personnel, laundries and waste storage room) and equipment is to be carried out with terminal-mixed wash/disinfection stations (WDS).

2. A sufficient number of WDS must be provided in convenient locations.

3. The facilities, machinery and equipment must be compatible with the use of these WDS.

1.4.2. Composition of a Wash/Disinfection Station (WDS)

1. A wash/disinfection station (WDS) must include:

- hot and cold water supply;
- detergent supply;
- a water–detergent control system compatible with the product and scheduled operations;
- a hose of suitable length and a spray system with adjustable flow rate, temperature and jet shape.
- The hose must not be stored on the floor.

2. The system must be equipped with a faucet at the bottom. The faucet must be appropriately positioned above a floor grate.

1.4.3. Drainage

The following requirements apply:

1. The galley and its annexes (including primary storage rooms) and corridors must be cleaned using wash/disinfection stations (WDS) and must be equipped with effective wash water drainage systems.

2. The water must be drained through stainless steel accessories, such as grated gutters and floor grates, equipped with a siphon outlet. These gutters are fed by the slope of the floors and surfaces. The wastewater drainage system must be efficiently designed and constructed in such a manner to prevent any food contamination (liquid and gaseous backflow). In particular, the capacity of the gutters, scuppers and drains must be sized to discharge the flow received and prevent any overflow. Drains must be adequately sloped to drain wastewater by gravity.

3. A sufficient number of these gutters must be placed in appropriate locations; they must be able to withstand the movements of the vessel to allow for effective drainage at all times. The gutters must also allow for the emptying of cooking equipment. The various parts of these gutters (anti-slip grate, scupper protection grate and inverted bell siphon) must be removable without tools to allow for cleaning upstream of the siphon.

4. The surfaces of these facilities must allow wash water to drain freely toward the drainage accessories. The floor covering on the skirting boards and under equipment must remain smooth.

5. The wash water from the cold rooms must be drained outside of the cold rooms in front of their doors. Evaporator defrost water must be automatically drained from the cold rooms by means of a specific external pipe.

6. Fat and starch separation devices (for vegetable peels and flour processing) must be installed before the discharge to the wastewater system. They must be accessible for daily cleaning by personnel.

1.5. GENERAL REQUIREMENTS FOR MATERIEL AND EQUIPMENT

1. The various surfaces that may come into contact with food must be made of smooth, light-coloured, rot-proof, washable and non-toxic materials.

2. Devices to secure food services materiel and furniture should be scaled to withstand platform movements, including hooked closures for cupboards. Such devices must be compatible with the sanitary maintenance requirements.

3. Materiel in use must be properly secured so that platform movements do not make it hazardous.

4. The drawers and doors of furniture and equipment must be equipped with closure systems that are of a sufficient size to prevent accidental opening from platform movements.

1.5.1. Cleaning/Sanitizing

1. The areas surrounding equipment must be large enough to accommodate cleaning tools to prevent bacterial growth in areas that are difficult to access (especially in spaces between materiel and surfaces). If the equipment is attached to the bulkheads, the connection must be made in such a way as to prevent any runoff on the rear and side surfaces. The devices for draining wastewater from equipment and materiel must not interfere with the cleaning and sanitizing of floors (e.g. squeegee access).

2. The interior and exterior of fixed materiel must be constructed to allow washing operations with a wash/disinfection stations (WDS). This materiel therefore must be able to withstand direct and indirect splashes on all sides. However, control and command panels in particular must be protected from direct and indirect water splashes.

3. Angles of equipment must be rounded, and not right angle.

1.5.2. Requirements for the use of Hand-Washing Facilities

1. Hot and cold water hand free hand-washing facilities must be available close to the primary storage rooms, the work stations in the galley and its annexes, in the lavatories for food services personnel and in the waste treatment room.

2. The hand-washing stations must be hands-free and include the following accessories: an antibacterial liquid soap dispenser, a single-use paper towel dispenser and a bin for collecting used paper towel. Bin lids must open hands-free.

3. Electric hand dryers are prohibited in the galley and its annexes.

1.6. STORAGE AND DISPOSAL

1. Lockable storerooms or furniture equipped with dedicated containers must be specifically designated for the storage of hazardous substances and preparations (insecticides, rodenticides, disinfectants).

2. Specific areas or furniture, placed in convenient locations in the galley and its annexes, must be designated for the safe storage of cleaning and maintenance products and equipment.

3. Storage shelves must be equipped with anti-roll bars to prevent their contents from falling as a result of sea movements without obstructing access to food.

4. A work station may be set up periodically in the food store and equipped with a computer and storage cabinets to allow the person in charge to prepare orders, track arrivals and archive the resulting records.

1.7. WASTE TREATMENT

Waste treatment is subject to the general requirements of Maritime Pollution (MARPOL) convention. Only the main characteristics of solid waste from the “food services” are set out in these directives.

1. Separate collection of solid waste must be provided by hygienic waste collection and disposal systems that can be opened non-manually and fitted with sealed single-use bags. A sufficient number of systems must be placed in each area or sector of activity where this type of waste is produced.

2. The transfer of waste must be limited and be performed with containers suited for single-operator handling operations. Collection and transfer conditions must make it possible to avoid any risk of contaminating facilities, equipment and foodstuffs.

3. Waste must be treated in the area or sector of activity where it is produced by means of specific and automated equipment. When shredders are used, primary treatment takes place in the production area.

4. Waste must be stored in one or more dedicated, ventilated rooms with smooth floors and partitions designed for daily cleaning (rounded skirting board on partitions). These rooms must be of an appropriate size. Waste must be stored in these rooms in airtight, sealed containers made of smooth material and that are easy to handle.

5. If, due to the nature of the waste or the specific stabilization treatment, microbial growth during storage cannot be prevented, the described facilities must also be refrigerated (the best temperature is -5°C).

6. Containers used in the collection, transfer or storage of waste must be capable of being cleaned and sanitized after each use on board the ship.

1.8. REQUIREMENTS FOR ACTIVITY AREAS AND SECTORS

The galley and its annexes must be divided into activity areas made up of a number of work sectors that are all physically separated from each other if the size of the premises permits.

The routes between activity areas should be the shortest, simplest and most logical.

1.8.1. Food Onboarding and Reception Area

1. Pre-storage activities include:

- Transportation to the primary storage rooms;
- Temperature control and all controls done during supplying operations;
- Unpacking;
- Weighing;
- Transfer of food to the storage rooms;
- Removal of pallets and packaging, either back to the dock or supply vessel or to the waste treatment system for disposal.

2. The links with the other sectors are as follows:

- Food storage area;
- Waste treatment system.

1.8.2. Food Storage Area

1. Food must be stored “in cold rooms and chambers.” The requirements are as follows:

Product groups to be stored	**Reference temperature**
Groceries: dry products, preserves, ingredients and pantry items, UHT milk and cream (+ consumables and small equipment) (note[1])	Between +10°C (+50°F) and +21°C (+70°F), but must not exceed +27°C (+80°F)
Beverages: water, soda, wine, beer, etc.	Between +10°C (+50°F) and +21°C (+70°F), but must not exceed +27°C (+80°F)
Pastry	Between 0°C (+32°F) and +4°C (+40°F)
Flour	Between +10°C (+50°F) and +21°C (+70°F), but must not exceed +27°C (+80°F)
Fruit and vegetables (note[2])	Between +7°C (+45°F) and +10°C (+50°F)
Creamery (butter, cheese, etc.), dairy products (excluding UHT), cheese and egg products	Between 0°C (+32°F) and +4°C (+40°F)
Fresh meats and cold cuts	Between 0°C (+32°F) and +4°C (+40°F)
Mollusks and shellfish	Between 0°C (+32°F) and +4°C (40°F)
Fresh fish and shellfish (note[3])	Between 0°C (+32°F) and +4°C (+40°F)
Meals (precooked supply)	Between 0°C (+32°F) and +4°C (+40°F)
Frozen products	-18°C (0°F) or lower
Thawing foods	Between 0°C (+32°F) and +4°C (+40°F)

2. Negative-temperature storage should be divided into two cold rooms to allow for periodic cleaning and sanitizing of each room (priority). This configuration also makes it possible to continue operations if one of the two cold rooms is damaged.

[1] see ventilation and air conditioning directives.
[2] Bananas and avocados are stored in the dry storage room.
[3] The storage of fresh fish and shellfish is designed to serve two meals.

3. Doors accessing cold rooms must be equipped with a heated strip to prevent freeze-ups that could compromise the handling and sealing of the doors.

4. A defrosting chamber for thawing frozen food before preparation should be located next to the negative-temperature cold room and serve as its sole access point.

5. Storage temperatures must be maintained within their tolerances regardless of the ship's deployment area, with the refrigeration units operating at their rated output.

6. The links between food storage area and the other sectors are as follows:

- Onboarding and reception area;
- Meal preparation area (primary processing sector, cold processing sector, cooking sector);
- "Meal distribution" area (including snack distribution, inpatient meal and reception areas);
- Bakery area;
- Cookware washing area (clean cookware storage);
- Waste treatment system.
- The layout of each food storage room must allow for optimal management of the products stored (checklists, inventories, sorting by category, lot, product type, etc.): Cold rooms may allow for storage on floor racks and on shelves;
- The pantry (dry food store) could be equipped with floor racks and shelf storage;
- Beverage storage must be equipped with floor racks and shelf storage;
- The flour storage must be equipped with floor racks.

7. The humidity level in the storage rooms for sensitive products, such as refrigerated and frozen products, must be controlled.

8. In case of large quantity of flour is stored, the storage room must comply with ATEX explosion protection standards. The air in the flour storage area must be dehumidified or at least adequately ventilated.

9. The layout of the storage rooms must be designed to ensure the safety of personnel and to prevent food from being displaced or falling regardless of platform movements.

10. Access must be restricted to food storage facilities, including peaks.

1.8.3. Refrigeration Systems

The onboard refrigeration systems must consist of:

- a refrigeration plant;
- cold rooms and temperature-controlled rooms;
- autonomous equipment distributed throughout the facilities: cold cabinets, cooling and freezing blast chiller, food and/or beverage dispensers, ice makers, mixed fountains, water coolers.

1. The technical design of the refrigeration systems must allow the cold rooms to be kept at the correct temperature even if one of their components breaks down.

2. An alarm system should be used to alert duty personnel if the defined temperature tolerances are exceeded for a time exceeding a door opening or defrost. Temperature monitoring devices may be installed.

3. The system must also be equipped with a “trapped person” alarm that is referred to the operational center.

4. In order to maintain the cold chain even in the event of technical failure, redundancy of the refrigeration units and evaporators is required.

1.8.4. Meal Preparation Area

1. For each of the following sectors, the characteristics of the facilities (e.g. surface area), equipment (e.g. number, performance) and furniture, and the work surfaces are to be specified by the designer and must be suited to the nature and volume of the operations carried out (number of meals and operating cycles).

2. Performance of operations in the “primary processing” sector:

- Vegetable processing: soaking, washing, peeling, cleaning/sanitizing of fruits and vegetables by immersion and spinning;
- Washing, opening of tincans, rinsing, draining of products if necessary;
- Removal of external primary packaging of certain products (removal of secondary packaging is carried out in the preparation sectors).

3. The facilities must allow for (proximity, sufficient space, etc.) the transfer of products prepared in the primary processing sectors to the “production” sector.

4. Buffer storage between 0°C and +4°C can be provided for foods produced from these operations in the primary processing sector (in addition to the rooms mentioned previously).

5. The links between the “primary processing” sector and the other areas are as follows:

- Storage area (in particular with the “fruit and vegetables” cold room);
- “Cooking,” “cold processing,” and “cookware washing” sectors;
- “Bakery” area;
- “Meal distribution” area;
- Waste treatment system.

6. The “vegetable processing” sector must be kept separate (high level of air contamination) from the “unpacking” and “unwrapping” activities.

7. A sufficient separation between work stations makes it possible to leave enough space between “clean” and “soiled” sectors and “hot” and “cold” sectors.

8. Performing operations in the “cold processing” sector with clean food before cooking, after cooking or between two phases of cooking:

- Cutting vegetables;
- Preparing meals;
- Slicing cold meats;
- Deconditioning of vacuum-sealed products.

9. Buffer storage between 0°C and +4°C can be provided for products processed in the cold processing sector.

10. The following areas are linked with the “cold processing” sector:

- Storage area;
- “Primary processing,” “cooking,” “cookware washing” and “dish washing” sectors;
- “Meal distribution” area (including snack distribution, inpatient meal and reception areas);
- Waste treatment system.

11. The “cold processing” sector must be designed to allow the cold chain to be maintained. A dedicated, temperature-controlled “cold processing” work station, adapted to and reserved for these activities, could be provided (preparation tables refrigerated, or a refrigerated cold preparation room).

12. Performance of operations in the “cooking” sector:

- Removal of secondary packaging of some dry products, frozen foods, etc.;
- Cooking operations;
- Temperature maintenance after cooking (at a temperature higher than +63°C);

- Rapid cooling (note[4]);
- Refrigerated storage of meals prepared on board;
- Transfer to distribution.

1.8.5. Diner Reception Area

1. Links between lounges and bars and access doors to other areas are as follows:

- Peaks and food storage area;
- Meal distribution and consumption area.

2. The number of lavatories for diners must be based on the capacity of the associated mess rooms. Diner washrooms must never be directly connected with the food service facilities or with the rooms where food is prepared or handled.

1.8.6. Meal Distribution and Consumption Area

1. Meals may be distributed in two main ways: table service and self-service.

2. For table service, the diner receives all components of the meal and beverages at a table set in advance. The dishes may be presented in communal or individual receptacles.

3. For self-service, diners serve themselves or are served at one or more distribution points (ramp, split self-service or counter) with food that is usually presented in individual portions and placed on a tray.

4. Ramps are the preferred self-service distribution point. Any other provisions must be subject to the approval of the prescribing department. The ramp should be directly accessible from inside the galley without the cook having to go through a door and must minimize diners' wait times in the corridor.

5. The self-service distribution is carried out from furniture arranged in a linear or split layout and located in the immediate vicinity of the "cooking" and "cold processing" sectors.

[4] Rapid cooling is used for:
- direct catering (service directly following preparation) for heat-treated preparations that are consumed cold;
- operations to start processing that are carried out at the earliest the day before the food is consumed (braising, roasting, searing, etc.);
- preparation by personnel of PPMs (pre-prepared meals = meals for which the stability is not guaranteed and that are intended for consumption during a service later than the one following their preparation).

6. Self-service distribution consists of sections (note[5]):

- "hot": (maintaining hot dishes at a temperature above +63°C: double boiler, glass-ceramic hot tables, etc.);
- "cold": for hors d'oeuvres and desserts (which must be kept at 0°C to +4°C in buffer storage at or near the distribution facilities and at a temperature below +10°C during presentation, in dispensing trays, for no more than two hours), ice cream (which must be kept at -18°C in buffer storage) and beverages, if not dispensed automatically;
- "neutral": for trays, cutlery, bread, glass distribution, etc.

7. The layout of the distribution facilities must minimize the movements of galley personnel and eliminate those of service personnel where possible.

8. Beverages must be served in locations compatible with the meal distribution methods and diner flow.

9. These dispensers or locations must be integrated into the distribution system (note[6]). They must not block the flow of self-service. One area could be reserved to provide diners with various condiments (oils, salt, mustard, etc.).

10. The zone map should show that the waiting time for diners is kept to a minimum. The food distribution method shall not cause unnecessary time consume for the diners. In larger vessels the ramp distribution should be organized to accommodate an average flow rate of seven people per minute.

11. Table-service distribution could be carried out from pantries (depending on the size of the ship and at the request of the prescribing department) through which prepared foods are brought from the "meal preparation" area. The presentation of the food in communal dishes and plating must be carried out in this room.

12. For table service, the conditions in the links between the meal preparation area and the pantries must ensure that food is kept at the right temperature before serving {post-cooking temperature, positive or negative cold (e.g. ice cream)} and to prevent any possibility of contamination.

13. For table service, the pantries are also used to store food in refrigerated cabinets (+4°C and -18°C) and lockable cupboards and for washing dishes from the tables (which may also be done in a communal wash area).

14. For table service, the "breakfast" service (coffee, milk and cocoa, hot water, fruit juice) is provided by the pantries (self-service or service by the maître d'hôtel). Beverages consumed during main meals must be made available to diners.

[5] The methods for distributing negative-temperature products (e.g. ice cream) are to be specified.

[6] Serving tables must be positioned in the mess room. Their capacity must not be taken into account in the calculation of self-service equipment.

1.8.7. Consumption Area: Mess Rooms

1. The links between this area and the other areas are as follows:

- Diner reception areas;
- Meal distribution area;
- Dish washing sector.

2. Diners are expected to be seated for an average of 30 minutes.

3. Serving tables with seasonings (spices, sauces, etc.) must be placed in the mess rooms. Chilled water (serving table) and ice must be made available to diners.

1.8.8. Cookware and Dish Washing Area

1. The characteristics of the facilities (e.g. surface area) and equipment (number, performance, etc.) must be compatible with the nature and volume of the operations carried out (number of meals and operating cycles). Depending on the layout of the facilities, cookware washing and dishwashing activities may be performed in the same room.

2. Segmentation (note[7]) must be used to differentiate between soiled cookware operations, washing and clean cookware operations.

3. Cooking utensils and mobile materiel are washed in a specific room called the cookware washing sector.

4. The following operations may be carried out in the “cookware washing” sector:

- Scouring of cookware, grills and cooking or processing containers;
- Washing of cookware and accessories;
- Cleaning and sanitizing of hot food carts and scales;
- Storage of clean cookware and accessories in an environment protected from recontamination (closed furniture).

5. The links between this area and the other areas are as follows:

- sectors: “primary processing,” “cooking” and “cold processing”;
- “Bakery” area;
- Waste treatment system.

6. The dishwashing area is the room in which dishes, glasses and cutlery from self-service mess rooms are washed and stored (dishes from mess rooms with table service are washed in the pantries).

7. The following operations could be carried out in the “dishwashing” sector:

[7] Segmentation is a sufficient separation between work stations that makes it possible to leave enough space between “clean” and “soiled” sectors and “hot” and “cold” sectors.

- Scouring of dishes;
- Sorting of dishes and glasses;
- Separate washing of dishes and glasses;
- Storage of clean dishes and glasses in an environment protected from recontamination (closed furniture).

8. The links between this area and the other areas are as follows:

- "Cold processing" and "cooking" sectors;
- Meal distribution and consumption area;
- Waste treatment system.

9. Adequate disposal plans must be in place.

10. Organic solid waste collected in the dish washing area must be disposed in a manner not representing a risk of cross contamination.

11. To ensure that cookware is properly sanitized, a cookware washing machine is required, supplemented by a double sink supplied with hot and cold water. A dishwashing machine must be used to properly disinfect dishes. These machines must be equipped with thermal and sound insulation. Unless technically impossible, these machines must be equipped with steam condensers.

12. Dishwashers and commercial dishwashers must be equipped with detergent and rinse agent dispensers to ensure optimal use.

13. Equipment for handling dishes must be provided (racks and trolleys). The handling and storage of the dish racks must be optimized.

1.8.9. Bakery Area

1. The following operations are carried out in the "bakery" area:

- Bread-making (rolls and loaves);
- Preparation of pastries;
- Preparation of sweet and savoury pastries.

2. The links between this area and the other areas are as follows:

- Food storage area;
- "Primary processing" and "cookware washing" sectors;
- "Meal distribution" area {including snack distribution, inpatient meal and reception areas (note[8]);
- Waste treatment system.

[8] In this respect, the link between the meal preparation area and the area of the ship where cocktail parties are usually held should be optimized.

3. The characteristics of the facilities (e.g. surface area) and equipment (number, performance, etc.) must be compatible with the nature and volume of the operations carried out (number of meals and operating cycles).

4. There must be segmentation (note[9]) between bakery and pastry activities.

5. Storage areas must be provided for:

- Handling and baking trolleys near the ovens;
- Drying bread after it comes out of the oven;
- Baskets.

6. All bakery and pastry equipment must have dimensions compatible with those of the accessories (baking trays, etc.). The accessories must be supplied with the equipment. The format of the proof cabinet and the oven must be compatible.

1.8.10. Dedicated Area for Galley Personnel

1. The characteristics of the facilities and materiel must be compatible with the armament plan of the “food services” function.

2. The vessel’s food service facilities should contain a lavatory for galley personnel, comprising lavatories with lid covered sitting toilets , connected to an efficient and sanitary drainage system and equipped with hands-free washbasins that are not directly connected to areas where food is handled (architectural layout or presence of a door).

3. On large ships, changing facilities reserved for galley personnel, equipped with individual storage lockers for work clothes and clean linens (separate) must be provided.

4. This area dedicated to galley personnel must be linked to the meal preparation area.

5. On large ships, personnel must be provided with individual lockers designed to be cleaned underneath, prevent objects being placed on top and provide two separate compartments, each at least 20 cm wide (on hangers): one for everyday clothes and the other for work clothes.

6. Lavatories must be located either in the changing facilities or in the “galley” area, separated from the work areas by a door.

7. The washbasins in the washrooms could be of the same type as those installed in the galley.

[9] Segmentation is a sufficient separation between work stations that makes it possible to leave enough space between “clean” and “soiled” sectors and “hot” and “cold” sectors.

Appendix B – ANALYTICAL FRAMEWORKS FOR POTABLE WATER ON BOARD MILITARY SHIPS

The standard analysis plans (SAPs) are intended to measure necessary and sufficient parameters to assess the level of water quality control.

These analysis might be done in a base port laboratory, before sailing for mission.
Samples must be taken during production following remineralization and chlorination.
Samples must be taken during distribution from at least one point of release for consumption. The number of sample points must be determined by the risk assessment (on small ships, a single sample point is acceptable).

The standard analysis plans are set out below:

1. SAP 1: VESSELS EQUIPPED WITH WATER PRODUCTION FACILITIES

Analytical parameter	Measured at production point	Measured at point of use	Standard
Enterococcus	X	X	0/100 mL
Escherichia coli (E. coli)	X	X	0/100 mL
Coliforms at 37°C	X	X	0/100 mL
Number of revivable aerobic microorganisms at 22°C and 37°C	X	X	Variation as a ratio of 10 from the typical value
Sulfito-reducing bacteria, including spores (Clostridium spp)	X	X	0/100 mL
Colour	X	X	Acceptable for the consumer
Smell	X	X	Acceptable for the consumer
Taste	X	X	Acceptable for the consumer
Conductivity	X	X	Between 180 and 1000 µS/cm at 20°C or between 200 and 1100 µS/cm at 25°C
Hardness, °F	X		Between 50 and 200 mg/L
pH	X	X	6.5–8.5 pH units

Turbidity	X	X	1 FNU in production 2 FNU in distribution
Temperature	X		4°C–30°C
Acrylamide	X		0.1 µg/L
Aluminum	X		200 µg/L
Ammonium	X		0.5 mg/L
Antimony	X		10.0 µg/L
Arsenic	X		10 µg/L
Barium	X		0.7 mg/L
Benzene	X	X	1 µg/L
Benzo(a)pyrene	X		0.01 µg/L
Boron	X		1.5 mg/L
Bromates	X	X	10 µg/L
Cadmium	X		5 µg/L
Calcium	X		200 mg/L
Calculation of calcocarbonic balance	X		Slightly nonaggressive
Alkalimetric titration	X		Balanced calculation
Full alkalimetric titration	X		< 500 mg/L
Total Organic Carbon	X	X	2 mg/L - no abrupt changes
Free chlorine	X (if water sampled after the chlorination stage)	X	Between 0.3 mg/L and 0.5 mg/L in storage, and > 0.1 mg/L at point of use
Total Chlorine	X (if water sampled after the chlorination stage)	X	For information purposes, to be compared with free chlorine
Chlorine dioxide	X (if water sampled after chlorination)	X	Between 0.05 mg/L and 0.2 mg/L
Chlorites	X	X	0.25 mg/L
Chlorate	X	X	0.25 mg/L
Chloride	X		250 mg/L
Chromium	X		50 µg/L
Copper	X	X	2 mg/L
Cyanides	X		50 µg/L
Epichlorohydrin	X		0.1 µg/L
Iron	X	X	200 µg/L
Fluorides	X		1.5 mg/L
1,2-Dichloroethane	X		3.0 µg/L

Polycyclic Aromatic Hydrocarbons (PAHs)	X		Total < 0.1 µg/L
Lead	X	X	10 µg/L
Magnesium	X		100 mg/L
Manganese	X		50 µg/L
Mercury	X		1 µg/L
Nickel	X	X	20 µg/L
Nitrates	X		50 mg/L
Nitrites	X		0.1 mg/L
Total pesticides	X		Total < 0.5 µg/L
Phosphates	X		< 3.3 mg/L PO_4
Potassium	X		< 12 mg/L
Selenium	X		20 µg/L
Sodium	X		< 200 mg/L
Sulphates	X		250 mg/L
Toluene		X	700 µg/L (WHO)
Total trihalomethanes	X (if water sampled after the chlorination stage)	X	Total < 100 µg/L
Tri- and Tetrachloroethylene	X		Total < 10 µg/L
Vinyl chloride	X	X	0.1 µg/L
Xylenes		X	500µg/L

2. SAP 2: VESSELS WITHOUT WATER PRODUCTION FACILITIES (ONLY STORAGE TANKS)

Analytical parameter	**Measured at point of use**	**Standard**
Enterococcus	X	0/100 mL
Escherichia coli (E. coli)	X	0/100 mL
Coliforms at 37°C	X	0/100 mL
Number of revivable aerobic microorganisms at 22°C and 37°C	X	Variation as a ratio of 10 from the typical value
Sulfito-reducing bacteria, including spores	X	0/100 mL
Colour	X	Acceptable for the consumer
Smell	X	Acceptable for the consumer

Taste	X	Acceptable for the consumer
Conductivity	X	Between 180 and 1000 µS/cm at 20°C or between 200 and 1100 µS/cm at 25°C
pH	X	6.5–8,5 pH units
Turbidity	X	2 FNU
Benzene	X	1 µg/L
Total Organic Carbon	X	2 mg/L - no abrupt changes
Free chlorine	X	> 0.3 mg/L in storage and > 0.1 mg/L in distribution
Total Chlorine	X	For information purposes
Chlorine dioxide	X (if water sampled after chlorination)	X
Vinyl chloride	X	0.1 µg/L
Copper	X	2 mg/L
Iron	X	200 µg/L
Nickel	X	20 µg/L
Lead	X	10 µg/L
Toluene	X	700 µg/L (WHO)
Total trihalomethanes	X	Total < 100 µg/L
Tri- and Tetrachloroethylene	X	Total < 10 µg/L
Xylenes	X	500 µg/L (WHO)

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