VECTOR MANAGEMENT PLAN

APPROVAL

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Notes:

1. This manual is valid from the issue date.
2. This manual is not to be altered or marked in any way.
3. Any review or alteration to this manual is to be carried out as per the system procedures.
4. Any revisions of this manual will be recorded on the Revision sheet.

Issued By:	Approved By:
Synergy Maritime Private Limited	 Head of Ship Management Team

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CHAPTER 1
INTRODUCTION & TYPES OF VECTORS

1. SCOPE AND PURPOSE:

The primary aim of this vector management plan is to present the public health significance of ships in terms of disease and to highlight the importance of applying appropriate control measures.

The main purpose is to recommend effective methods to control the hazards that may be encountered on ships.

1.1 GENERAL INFORMATION:

Infectious diseases on board may have a considerable toll on the operational capacity of ships and in extreme circumstances become impediments to international commerce and travel. Prevention of such incidents and a proper response should they occur are a top priority for all those responsible for ship design, construction and operation.

The main focus of this Vector management plan is to recommend effective measures to keep vectors at bay in the operation of ships thus ensuring health onboard.

1.2 TYPES OF VECTORS:

Rats and mice

Pests:

1. Cockroach
2. Stored products pest
3. Mosquitoes
4. Flies
5. Lice
6. Rat fleas
7. Miscellaneous shipboard pest

CHAPTER 2
HEALTH RISKS DUE TO VECTORS & ITS GUIDELINES

2. HEALTH RISKS ASSOCIATED WITH VECTORS ON SHIPS:

Control of disease vectors such as insects and rodents is necessary for the maintenance of health on board ships.

Plague, murine 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.

Caution: On board, the chances for early diagnosis and proper treatment are limited. Persons and vectors onboard can, in turn, spread disease to ports (e.g. Delmont et al., 1994).

2.1 MAJOR CAUSES:

Outbreaks associated with the presence of vectors on board are usually linked both to inadequate control and sanitation on board and to insufficient attention to preventing contamination in the first place.

The failure of initial prevention leads to contamination, which is then exacerbated by failed ongoing control.

2.2 GENERAL GUIDELINES TO VECTOR CONTROL:

Prevention of contamination at source to the maximum degree practicable is a key tenet of preventive control strategies. As ships load at ports, the port authorities play a vital role in protecting public health by seeking to provide the best practicable raw materials for ships. Authorities should clarify which entity has the Ship Sanitation Certificate and food inspection responsibilities.

The master must ensure that all reasonable measures are taken to protect crew and passenger health. Conscientious and diligent monitoring of operational control measures is the responsibility of the master and crew.

Ensure that there are adequate and properly maintained equipment and provisions, with sufficient numbers of adequately trained crew to properly manage health risks on board.

The ship's engineer is likely to be chiefly responsible, as delegated by the master, for the proper operation of the engineered systems that protect passengers and crew. These include many aspects of the ship's operation, such as the cooling and heating systems designed to maintain food and water at safe temperatures, water treatment systems for drinking-water, waste management and the integrity of piping and storage systems.

Medically fit seafarers, properly trained catering staff, socially responsible officers and a prudent master can prevent new outbreaks of diseases onboard.

“The competent authority shall require frequent inspections to be carried out on board ships, by or under the authority of the master, to ensure that seafarer accommodation is clean, decently habitable and maintained in a good state of repair. The results of each such inspection shall be recorded and be available for review”.

The organization and equipment of the catering department shall be such as to permit the provision to the seafarers of adequate, varied and nutritious meals prepared and served in hygienic conditions;

“The requirements for on-board health protection and medical care set out in the Code include standards for measures aimed at providing seafarers with health protection and medical care as comparable as possible to that which is generally available to workers ashore”.

The flag State, or a recognized organization that has the delegated authority to ensure compliance, is required to inspect, among other things, accommodation, food and catering and onboard medical care before issuing the certificate, which is valid for a period that shall not exceed five years (interim and intermediate certificates are also prescribed).

3. GENERAL PRECAUTIONS:

Conveyance operators should "permanently keep conveyances for which they are responsible free of sources of infection or contamination, including vectors and reservoirs"

Every conveyance leaving an area where vector control is recommended by WHO should be disinfected and kept free from vectors

State Parties should ensure that port facilities are kept in a safe and sanitary condition and free from sources of infection and contamination, including vectors and reservoirs. The vector control measures should be extended to a minimum distance of 400 m from passenger terminals and operational areas (or more if vectors with a greater range are present, as documented in specific guidelines).

3.1 PREVENTIVE APPROACH:

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.

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 passengers and crew to vector-related infectious agents.

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.

As vectors may have access to ships when in port, control measures for the suppression of vermin infestation are necessary. These control measures must be carried out under the direction of a ship's officer charged with this responsibility and must be frequently inspected.

3.2 RODENT CONTROL:

3.2.1 PRIOR ARRIVAL ACTIONS:

1. Concealed spaces, structural pockets, openings that are too large (greater than 1.25 cm), leading to voids, food spaces and gaps around penetrating fixtures (e.g. pipes or ducts passing through bulkheads or decks), regardless of location, need to be obstructed with rat-proofing materials.
2. Rat guards having a lock system must be inspected and kept ready.
3. Proper instructions to have the gangway lifted one foot above the jetty from dusk to dawn should be given to responsible officer & crew.
4. Arrangements for good lighting must be made for the mooring ropes and gangways.

3.2.2 CONTROL MEASURES:

1. Rat-proofing materials should be robust and damage resistant. Such materials include sheet metal or alloy of suitable hardness and strength, wire mesh and hardware cloth.
2. Hygienic practices are used to minimize rodent attractors. The garbage must be discharged compulsorily through Authorized Garbage Collectors if it's beyond the vessel's storage capacity.
3. All the vessel's mooring ropes must be secured with rat guards having a lock system which must be tight fitting to the mooring rope. Effective rat-proofing collars at suitable distances from the ship and able to withstand wind action should be fitted to any hawsers that connect the ship to shore.
4. Vessels Gangway to be lifted off the jetty when not required, especially during night time when use is not so frequent .
5. Good lighting is to be provided for the mooring ropes and gangways.
6. Rats leave droppings, gnawing damage and grease marks, which provide a ready indicator of infestation. Regular inspection of the ship to look for such evidence will show whether rats have gained access to the ship. 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.

7. All vessels must maintain a **Rodent Logbook** to record trapping and other rodent control measures taken by the vessel. All vessels must keep the traps during a port stay and for five (5) days continuously after leaving a port to prevent any harbourage of rodents from ports of departure. It must be weekly thereafter if the voyage is longer. The Log must have the details of the inventory for rodent control, e.g. traps (12 or more if infested or visiting plague endemic countries frequently), sticky traps (as needed), rodenticide medicines (as needed), and rat guards (twice the maximum number of mooring rope points). **If any rats are trapped during a port stay the Port Health Authority must be informed through the vessel agents immediately.**

Date	Time	Vessel	Location	Areas Checks Carried out	Bait Used (Trap / Food Item)	Result	Signature

8. The stevedore's garbage collection bins are to be kept on deck.
9. Vessels which require screening for rodents will be allowed to perform lightering at anchorage points under the following conditions:

- Record all the names of the tugs/barges as they come in contact with the vessel with the timings of alongside and departure;
- All the tugs/barges, during their casting with the vessel, must have rat guards with lock systems on the mooring line from the vessel side and the tugs/barge side; and
- The vessel agent is to declare the tugs and barges that are going for operations to the vessel to PHO for their inspection.

The vessel will be fined on a daily basis during the stay at port, if it fails to comply with these guidelines.

Once ship leaves a port:

10. The master of the ship can delegate one person to be responsible for the vector control programme.
11. Traps must be set after leaving any port where rats might have come on board either directly from the dock or with cargo or stores. If all traps are still empty after a period of two days, they can be taken up.

12. If rats are caught, the traps in that area must be reset until no more rats are caught. A record of where the traps were set, the dates and results must be entered in the ship's log and a copy made available for the port health inspector.
13. Most rodenticides may be very toxic and poisonous to humans. Caution must be used in their application, with instructions for their use carefully followed.
14. It should be checked that the baits have been correctly placed and whether they have been consumed.

All rat proofing needs to be kept in good repair, inspected and maintained regularly. Pest infestations must be dealt with immediately and without adversely affecting food safety or suitability. Treatment with chemical, physical or biological agents must be carried out without posing a threat to the safety or suitability of food.

3.2.3 RAT PROOFING MATERIAL TO BE USED:

The insulation layer around pipes, where over a certain thickness, 1.25 cm, needs to be protected against rat gnawing.

Metal wire or sheet metal gauges must be of adequate strength and corrosion resistant. For example, aluminium should have a thickness by the Brown & Sharp gauge greater than the thickness specified by the United States standard for sheet iron, because aluminium is not as strong. For example, 16-gauge aluminium (Brown & Sharpe) might replace 18-gauge sheet iron (United States Standard). For grades of wire and hardware cloth, Washburn & Moen gauges are also used.

Certain non-rat-proof materials are satisfactory in rat-proof areas provided that the boundaries and various gnawing edges are flashed. Wood and asbestos composition materials are acceptable under conditions such as the following:

- Wood must be dry or seasoned and free of warps, splits and knots.
- Inorganic composition sheets and panels must be relatively strong and hard, with surfaces that are smooth and resistant to the gnawing of rats. A list of acceptable non-rat-proof materials may be obtained from national health administrations. If a new material is intended for use, the national health administration must be consulted in order to initiate approval procedures.
- Certain composition sheets and panels that do not meet the requirements in the bullet point above may be made acceptable by laminating with metal or facing on one side using suitable materials. All materials in this category are likely to be subject to health administration approval for inclusion in an acceptable non-rat-proof materials list.

CHAPTER 3
GENERAL PRECATIONS & RODENT CONTROL

Cements, putties, plastic sealing compounds, lead and other soft materials or materials subject to breaking loose are not advised in place of rat-proofing materials to close small openings. Firm, hard-setting materials used to close openings around cables within ferrules might need to be approved by the ship inspection officer. Fibre boards and plaster boards are generally not acceptable non-rat-proof materials. For approval, the relevant health administration should be consulted.

Non-rat-proof sheathing need not be rat proofed when placed flush against, or within 2 cm of, steel plate or when placed flush against rat proofing material over insulation. Overlapping joints are not necessary for sheathing.

4. HYGIENE:

Rats pose a major threat to the safety and suitability of food. Rodent infestations can occur where there are breeding sites and a supply of food. Good hygiene practices should be employed to avoid creating an environment conducive to rodents. Good sanitation, inspection of incoming materials and good monitoring should minimize the likelihood of infestation and thereby limit the need for rodenticides.

4.1 INSECT VECTOR CONTROL:

4.1.1 INSECT-PROOFING: INSECT PROOF SCREENS AND INSECTICIDES ARE TO BE USED WHERE EVER THEY ARE NECESSARY AND WHERE EVER IT IS POSSIBLE TO USE THEM.

Screening of sufficient hole-tightness, no more than 1.6 mm spacing, is recommended, with screens on all outside openings.

Screen doors should open outwards and be self-closing, and the screening must be protected from damage by heavy wire netting or other means, which may include the use of metal kick plates.

Ship holding water must be screened from insects and inspected frequently to check for, and eliminate, mosquito breeding. Refuse stores must be screened and inspected frequently to check for, and eliminate, the breeding of flies or other vermin.

Screens need to be kept in good repair.

Bed nets, in good repair and properly placed, need to be used in sleeping quarters not provided with screens.

4.1.2 INSECTICIDES:

When leaving an area in which vectors are prevalent, and at regular intervals, residual and space sprays must be used for the control of flying insects that have entered the ship.

As spray insecticides may contain substances toxic to humans, all surfaces that come in contact with food, all dishes and utensils and all food and drink need to be covered or removed during spraying operations.

Insecticides, rodenticides, any other poisonous 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.

- Near dishes and utensils or tableware, linen and other equipment used for handling or serving food and drink.
- To prevent the accidental use of these poisons in foodstuffs, such hazards must be kept in coloured containers clearly marked as “POISON”.

4.1.3 SANITATION:

it takes a coordinated effort among all the Officers, crew and catering staff. The following sanitary guidelines must be carried out for cockroach control in the galley, pantry, mess rooms and provision rooms:

(I) Chief Officer and Team:

- Seal holes in walls, panels, dead space-entry exit points;
- Ensure wash basins, drainage lines and panels are free of any leakages;
- Paint all rusted walls, floorings, cabinets, store, cupboards regularly (2-3 months once);
- Repair broken panels and cupboards, especially wooden ones;
- Provide covered garbage bins;
- Ensure that scuppers of all drainage lines are removable for cleaning purpose and that drainage holes are cleaned, scraped and painted regularly;
- Ensure that the drainage line is even, any broken tiles are replaced or cemented and drainage lines are scraped of food wastes and painted regularly; and
- Provide separate color-coded garbage collection bins for plastics, food wastes and other wastes (tins, cans, bottles, paper crockery etc.) in the galley and pantry.

(II) Chief Engineer and Team:

- Provide warm water for cleaning; and
- Ensure the free flow of all the drains.

(III) Catering Team:

- Throw the food garbage after each meal into the deck storage drums and keep them covered at all times;
- Have separate garbage collection bins for food wastes, plastics and other wastes (follow ISM colour coding);
- At the end of each day, remove the scuppers and clean on both sides as this is one of the active breeding points and food source for cockroaches away from direct sight; and
- Implement a weekly cleaning program as detailed below in addition to the daily cleaning program.

(IV) All Vessel Personnel:

- Keep cabins free from leftover foods;
- Dine only at the allotted places; if it is necessary to dine at other than the allotted time, leave the plates inside the sinks or as per the sanitary guidelines of the vessel; never leave any left-over food out in the open; and
- Avoid food spills and cover the garbage bins after disposing of the food;

4.1.4 WEEKLY CLEANING PROGRAM:

During the weekly cleaning program one (1) volunteer from the Deck and Engine side should assist the catering crew on a rotational basis in order to inculcate a general sense of responsibility for sanitary upkeep instead of leaving it to the catering staff only

During the thorough weekly cleaning program, concentrate on cleaning all the hidden areas, corners, inside and behind cabinets and storage cupboards and behind and below the refrigerator.

Remove the drawers and clean by scrubbing with soap solution or bleaching solution in all the above mentioned places. This is done to remove all spilt foodstuff which cannot be cleaned during the daily routine, to remove any cockroach eggs thus controlling the second generation of cockroaches from hatching and to provide the opportunity to use insecticide spray to control them when their residence is disturbed and they come out into the open.

In addition, to control infestation, make a paste by mixing boric acid with gram flour (Besan) at a 1:2 ratio, with sweetened condensed milk, and make it into a paste. This paste is to be kept at the different places inside the galley, pantry, and mess rooms on a paper.

The same paste to be used to paste on the ceilings, all cupboards, inside cabinets, walls, behind refrigerators, below wash basins, in drainage pipes, in and around provision rooms and in cabins if needed.

4.1.5 MONTHLY MEASURES:

During the initial phase of the cockroach control, the paste has to be reapplied weekly for a month. Then, depending on the control, the timing of reapplication can be extended to two (2) weeks and then three (3) weeks.

The paste acts as bait. The condensed milk and besan powder are attractants and the boric acid causes the cockroaches to die of dehydration. Boiled potato or egg can be substituted for gram flour if necessary. When there is no open or spilt foods and the drains are clean, cockroaches have to eat this paste.

Provision stores: Thus the weekly cleaning program and keeping all the water collection areas, dry, is important when this control measure is applied.

Laundry Rooms and Toilets:

- Keep floors free from any water collection;
- Paint regularly; and
- Disinfect and deodorize regularly.

4.2 POINT TO CONSIDER:

In addition to all the above measures any measure appropriate to the vessel, its cargo and trade are to be taken by the Master and responsible officers onboard to ensure complete vector control and health onboard.

5. FOOD SAFETY PLAN

5.1 GENERAL

Foodborne outbreaks have been associated with sourcing unsafe food. Therefore, the first preventive strategy should be to source safe food. Even if the sourced food is safe, measures need to be put in place to ensure that it remains safe during the transfer, storage, preparation and serving activities that follow.

Components that provide multiple opportunities for the introduction, or proliferation, of contaminants in food:

- the source of food coming into the port;
- transfer of food to storage points on board ship;
- storage and general distribution of food on board ship;
- preparation and serving of food, including cooking and mixing by food handlers;
- handling and storage of food for personal consumption by passengers or crew, including taking food away and storing it in private areas for subsequent consumption.
- Factors contributing to foodborne outbreaks on board ship have included:
- contaminated raw ingredients
- inadequate temperature control
- inadequate heat treatment
- infected food handlers
- use of seawater in the galley.

5.1.1 PREREQUISITE OF FOOD SAFETY PLAN (FSP):

The prerequisite or supporting programs that form part of an FSP typically include:

- good design
- quality construction
- hygienic work practices
- training of chefs and food handlers
- quality assurance of raw material ingredients
- operation in accordance with any appropriate food safety legislation.

5.1.2 FSP'S AREAS OF FOCUS:

An FSP is designed and implemented for:

1. the food source
2. transfer of food to the ship
3. the ship food storage system

4. the ship food preparation and serving system
5. consumer handling and storage processes on board ship.

5.2 HYGIENE PROCEDURES:

Food poisoning on board ships can be reduced by vendor assurance and careful selection of suppliers, training of food handlers, optimum construction of galleys and strict personal hygiene. Control measures for biological hazards include:

- source control—that is, control of the presence and level of microorganisms by obtaining ingredients from suppliers that can demonstrate adequate controls over the ingredients and suitable transport of the ingredients to ships;
- temperature/time control—that is, proper control of refrigeration and storage time; and proper thawing, cooking and cooling of food.
- cross-contamination control, both direct (e.g. resulting from direct contact between raw and cooked food) and indirect (e.g. resulting from the use of the same utensils to contact both raw and cooked food);
- proper cleaning and disinfection, which can eliminate or reduce levels of microbiological contamination. Galleys should be designed so that the risk of cross-contamination is reduced. Specific guidelines for sanitary conveniences and hand-washing facilities for the shipping industry should be considered by those designing and maintaining ships. Seawater or non-potable water must not be used in or near food or food preparation areas;
- personal and hygienic practices. It is recommended that ships have policies for ensuring that staff with infections that can be transmitted via food do not perform any task connected with food handling. Food handlers with cuts, sores or abrasions on their hands should not handle food unless such sores are treated and covered.

Staff should not be penalized for reporting illness; rather, the reporting of illness should be promoted. Preventing outbreaks attributed to infected food handlers requires the cooperation of employers, as many food handlers may conceal infection to avoid pay loss or penalty.

It is important that first-aid boxes are readily available for use in food handling areas and that a suitably trained person is appointed to take charge of first-aid arrangements. There are no specific requirements covering the contents of a first-aid box, but minimum contents might reasonably be a plastic-coated leaflet giving general guidance on first aid, individually wrapped sterile dressings of assorted sizes,

sterile eye pads, individually wrapped triangular bandages, safety pins, medium sized (approximately 12 cm × 12 cm) individually wrapped sterile unmedicated wound dressings and one pair of disposable gloves.

5.3 APPROVED FOOD SUPPLIERS:

5.3.1 RECEIVING FOOD SUPPLIES:

Ship operators are expected to take all practicable measures to ensure that they do not receive unsafe or unsuitable food. This means that they must make sure that the food they receive:

- is protected from contamination;
- is clearly identifiable;
- is at the correct temperature and in the appropriate condition when it arrives (e.g. a food that is labelled frozen and shipped frozen by a food-processing plant shall be received frozen).
- Physical facilities of the food receiving area shall:
- have a smooth, non-absorbent and cleanable covering;
- be maintained sound and in good repair, free of chippings, cracks, leakage, seepage, mould, peeling and so forth;
- be free of unused or extraneous materials (cardboard, cloths, papers, sanitizing products, plastic bags, pallets, brooms, etc.);
- be provided with natural or artificial lighting that does not compromise food hygiene, does not change colour and enables good working conditions;
- be provided with electrical wiring installations that are properly covered and insulated;
- be provided with a ventilation system that avoids intense heat, vapour condensation and accumulation of mould, fumes or smoke.

The food receiving area must be cleaned with disinfectant. The disinfectant manufacturer’s instructions, including concentration and contact time, shall be followed precisely. The cleaning should take place immediately before food entry.

Food cannot enter by the same area from which solid waste is removed. If it is absolutely impossible to provide different areas, there should be a different schedule, and the area shall always be cleaned before food is received.

Integrated pest management actions shall be implemented at this area according to the provisions established Vector management plan of this guide.

The table given below shows the details of temperatures and conditions that should be confirmed as items are received.

Table 1

Examples of proper food receipt temperatures and conditions for foods supplied to ship

S.No.	Item	Temperature on receipt	Condition on receipt
1	Meat and poultry	5 °C or below	Obtained from an approved source; stamped with official inspection stamp Good colour and no odour Packaging clean and in good condition
2	Sea food	5 °C or below Codex recommends a temperature as close as possible to 0 °C	Obtained from an approved source Good colour and no off odours. Packaging clean and in good condition
3	Shell Fish	7 °C or below Codex recommends a temperature as close as possible to 0 °C	Obtained from approved source Clean, shells closed, no broken shells Shell stock tags must be readable and attached

4	Crustacea (unprocessed)	7 °C or below	Obtained from an approved source Clean and in good condition
5	Crustacea (cut & processed)	5 °C or below	Obtained from an approved source Clean and in good condition
6	Dairy products	5 °C or below unless labelled otherwise	Obtained from an approved source Packaging clean and in good condition
7	Shell eggs	7 °C or below	Clean and uncracked Obtained from an approved source
8	Liquid, frozen & dried eggs	5 °C or below	Pasteurized Obtained from an approved source

5.4 EQUIPMENT AND UTENSILS ARE SUITABLE FOR FOOD PREPARATION, FOOD STORAGE AND CONTACT WITH FOOD.

It is good practice to ensure that the equipment and containers coming into contact with food are designed and constructed to ensure that they can be adequately cleaned, disinfected and maintained to avoid the contamination of food. Equipment and containers must be made of materials with no toxic effect for their intended use. Where necessary, equipment should be durable, movable or capable of being disassembled to allow for maintenance, cleaning and disinfection and to facilitate pest inspection.

Containers for waste products and inedible or dangerous substances must be specifically identifiable, suitably constructed and, where appropriate, made of impervious material. Waste containers used in the galley must be provided with foot-operable lids, emptied frequently and easy to clean and disinfect.

All washing facilities, kitchen equipment, storage containers, stoves and hoods used in the preparation and serving of food and all food contact surfaces must be so constructed as to be easily cleaned and disinfected and kept in good repair.

The following is a list of examples of the sort of equipment that might need to be considered and assessed for its suitability:

- blast chillers incorporated into the design of passenger and crew galleys; more than one unit may be necessary depending on the size of the ship, the unit's intended application and the distances between the chillers and the storage and service areas;
- food preparation sinks in as many areas as necessary (i.e. in all meat, fish and vegetable preparation rooms; in cold pantries; and in any other areas where personnel wash or soak food); an automatic vegetable washing machine may be used in addition to food preparation sinks;
- storage cabinets, shelves, racks for food products and equipment in food storage, preparation and service areas, including bars, pantries and storage associated with waiter trays;
- portable tables, carts or pallets in areas where food is dispensed from cooking equipment, such as from soup kettles, steamers, braising pans, tilting skillets or ice storage bins;
- a storage cabinet or rack for large items such as ladles, paddles, whisks and spatulas;
- knife lockers that are easily cleanable and meet food contact standards;
- dish storage and dispensing cabinets;
- food preparation counters that provide sufficient work space;
- drinking fountains;
- cleaning lockers.

Depending on the size of the facilities and the distance to the central pot washing facilities, heavy-use areas such as bakeries, butcher shops and other preparation areas may require a three-compartment sink with a pre-wash station, or a four-compartment sink with an insert pan and an overhead spray. All food preparation areas are likely to need easy access to a three-compartment utensil-washing sink or a dishwashing machine equipped with a dump sink and a pre-wash hose.

Beverage or condiment dispensing equipment typically requires a readily removable drain pan or built-in drains in the table top. Bulk milk dispensers should have readily removable drain pans to enable cleaning of potentially hazardous milk spillages. A utility sink is desirable in areas such as beverage stations where it is necessary to refill pitchers or dispensers or discard liquids such as hot or cold drinks, ice-cream or sherbet. Dipper wells ideally need to be provided with running water and proper drainage.

Clean storage areas need to be sufficient to house all equipment and utensils used in food preparation, such as ladles and cutting blades.

The design of all installed equipment should direct food and wash-water drainage into a deck drain scupper or deck sink, and not directly or indirectly onto a deck.

For openings to ice bins, food display cases and other such food and ice holding facilities, tight-fitting doors or similar protective closures are desirable to prevent contamination of stored products. Countertop openings and rims of food service areas, bains-marie, ice wells and other drop-in type food and ice holding units must be protected with a raised edge or rim of 5 mm or more above the counter level around the opening.

5.5 FACILITIES THOSE ARE SUITABLE FOR SAFE FOOD PREPARATION AND SERVING.

5.5.1 WATER AND ICE

An adequate supply of potable water with appropriate facilities for its storage and distribution is required to be available whenever necessary to ensure the safety and suitability of food. Non-potable water (e.g. seawater) must have a separate system and must not be supplied to the galley unless essential. Ice that will come in contact with food or drink needs to be manufactured from potable water. Shore sources must be checked with the local health authority, and delivery of ice from shore to ship must be carried out in a sanitary manner. Upon delivery to the ship, shore ice needs to be handled in a sanitary manner, the handler wearing clean clothing, gloves and boots. Ice must be stored in a clean storage room and raised off the surface by use of deck-boards or similar devices permitting drainage and free flow of air. Ice manufactured on board ship needs to be handled and stored in a sanitary manner.

5.5.2 CLEANING AND DISINFECTING FACILITIES

To ensure safe food, adequate design criteria must be adopted in constructing systems for cleaning and disinfecting food, utensils, equipment and facilities. Such facilities need an adequate supply of hot and cold potable water.

5.5.3 VENTILATION

Adequate means of natural or mechanical ventilation help to support safe food operations. Ventilation systems must be designed and constructed so that air does not flow from contaminated areas to clean areas and so that they can be adequately maintained and cleaned. Louvres or vents at ventilation terminals must be readily removable for cleaning. Particular attention should be given to:

- minimizing airborne contamination of food—for example, from aerosols and condensation droplets;
- controlling ambient temperatures;

- where necessary, controlling humidity.

5.5.4 LIGHTING

Adequate natural or artificial lighting supports hygienic work practices. The intensity of light should be set according to the nature of the work. Lighting fixtures should be protected to ensure that food is not contaminated if breakage occurs.

5.5.5 STORAGE

Improper storage of provisions on board seagoing ships is a hazard, as provisions are frequently carried for many weeks or even months, and the ship can be subject to extreme climatic influences. Storage, especially in cold stores, in an unpacked condition might have an adverse effect on provisions.

The type of storage facilities required will depend on the nature of the food on board. Adequate facilities for the storage of food, ingredients and non-food chemicals (e.g. cleaning materials, lubricants and fuels) must be provided. Food storage facilities must be designed and constructed to:

- permit adequate maintenance and cleaning;
- avoid pest access and harbourage;
- enable food to be effectively protected from contamination during storage;
- provide an environment that minimizes the deterioration of food (e.g. by temperature and humidity control).

5.5.6 FOOD CONTACT AREAS

The materials used for food contact surfaces need to be suitable—for example, corrosion resistant, non-toxic, non-absorbent, easily cleanable, smooth and durable. This applies, especially to heating units in contact with food, cooking fats, oils or similar cooking media. Cutting boards should be of a suitable material, such as one equivalent to or better than hard maple. If using materials other than those already accepted and listed for use as food contact surfaces or containers, advice should be sought from the relevant public health authority before installation. In general, painted surfaces are not recommended for food contact unless appropriate paint is used.

5.5.7 NON-FOOD CONTACT AREAS

Materials used for non-food contact surfaces must be durable and readily cleanable. Welding materials used in joining together non-corrosive materials must be selected to ensure that the weld area is corrosion resistant. Surface coatings and paint should be suitable for their intended use and non-toxic. All permanent or stationary equipment needs to be installed and constructed with flashing to exclude openings hidden by adjacent structures or other equipment, unless adequate clearance for proper cleaning is provided. As an example, a minimum clearance of 15 cm is recommended under leg-mounted equipment between the lowest horizontal framing member and the deck.

It is important to ensure that counter-mounted equipment, unless portable, is either sealed to the table top or mounted on legs. Once again, to facilitate cleaning, counter-mounted equipment should have sufficient clearance

The clearance between the back of enclosed equipment, such as ranges and refrigerators, and the bulkhead should be governed by the combined length of the items.

If two items of equipment, such as ovens or ranges, are located near each other, the space between them needs to be adequate to enable cleaning. Alternatively, the space between them could be effectively closed on all sides by tightly fitting flashing.

When mounting equipment on a foundation or coaming, an adequate separation distance above the finished deck, at least 10 cm, needs to be provided. Cement or a continuous weld must be used to seal equipment to the foundation.

Equipment installed without adequate clearances, such as those suggested in the previous paragraphs, can have the spaces under, next to and behind them effectively enclosed and sealed to the deck and/or bulkhead. Penetrations such as cable, conduit or pipe openings must be provided with tightly fitting collars made of materials acceptable to the relevant national health administration.

Electrical wiring from permanently installed equipment must be encased in durable and easily cleanable material. The use of braided or woven stainless-steel electrical conduit outside of technical spaces or where it is subject to splash or soiling is not recommended. The length of electrical cords to equipment on benches should be adjusted or the cords fastened in a manner that prevents the cords from lying on countertops.

Other bulkhead- or deck head-mounted equipment, such as phones, speakers, electrical control panels or outlet boxes, must be sealed to the bulkhead or deck head panels. Such items must be kept away from areas exposed to food splash. Any areas where electrical lines, steam pipelines or water pipelines penetrate the panels or tiles of the deck, bulkhead or deck head, including inside technical spaces or work surfaces, should be tightly sealed. The number of exposed pipelines should be minimized.

5.5.8 FOOD HANDLING PERSONNEL ARE TO PRACTICE GOOD PERSONAL HYGIENE.

All food handlers should practise good personal hygiene.

Food handlers known to be infected with potentially hazardous conditions are not permitted to handle food.

Crew, including maintenance personnel, who do not maintain an appropriate degree of personal cleanliness, or who have certain illnesses or conditions, can contaminate food and transmit illness to consumers.

5.5.9 FOOD HANDLER HYGIENE

Food handlers need to maintain a high degree of personal cleanliness and, where appropriate, wear suitable protective clothing, head coverings and footwear. Cuts and wounds, where personnel are permitted to continue working, must be covered by suitable waterproof dressings.

Protective clothing should be light coloured, without external pockets and not one-piece overalls, as these could become contaminated from the floor when using the toilet. Disposable gloves might be used in some food handling situations; however, they can be misused and give food handlers a false sense of hygiene security.

Personnel need to wash their hands to ensure food safety, such as:

- at the start of food handling activities;
- immediately after using the toilet;
- after handling raw food or any contaminated material, where this could result in contamination of other food items.
- People engaged in food handling activities should avoid handling ready to-eat food and refrain from behaviour that could result in contamination of food, such as:
- handling money
- smoking
- spitting
- chewing or eating
- sneezing or coughing over unprotected food.

Personal effects such as jewellery, watches, pins or other items must not be worn or brought into food handling areas if they pose a threat to food safety.

5.5.10 **HYGIENIC HANDLING OF FOOD WASTE:**

Food waste is managed to prevent contamination of food and to prevent vermin proliferation.

Food wastes and refuse readily attract rodents and vermin, particularly flies and cockroaches. The proper retention, storage and disposal of such wastes on board, ashore and overboard where shore areas will not be affected will prevent the creation of health hazards and public nuisances.

5.5.11 **INVESTIGATIVE AND CORRECTIVE ACTION:**

In addition to the above guidelines and information any measure that might be appropriate to the design of the vessel's food receiving area, storage facility, galley and serving area are to be followed after careful consideration.

Any incident of food poisoning, food contamination and associated illness is to investigated carefully. The root cause of the incident is to identified and appropriate corrective action is to be taken in order to prevent recurrence of such incidents.

6. WATER SAFETY PLAN:

6.1 GENERAL INFORMATION:

Water when improperly managed is an established route for infectious disease transmission on ships.

Most waterborne outbreaks of disease on ships involve ingestion of water contaminated with pathogens derived from human or other animal excreta. Illnesses due to chemical poisoning of water have also occurred on ships, although chemical incidents are much less commonly reported than microbial ones.

Water safety plans (WSPs) are an effective overarching management approach for ensuring the safety of a drinking-water supply.

A WSP covering water management within ports, from receipt of water through to its transfer to the ship, complemented by water quality measures on board, provides a framework for water safety on ships.

6.2 CAUSES OF WATER BORNE DISEASES ON SHIPS:

To protect the health of passengers and crew, water used for potable purposes on board ship should be provided with sanitary safeguards in a multiple-barrier system (from the shore and distribution system, including connections to the ship system, through the ship treatment and storage systems and on to each water supply outlet), in order to prevent contamination or pollution during ship operation.

Outbreaks were associated with such causes as:

1. The source of water coming into the port / contaminated water supplied at the port
2. the transfer and delivery system, which includes hydrants, hoses, water boats and water barges; this water transfer process provides multiple opportunities for the introduction of contaminants into the drinking-water;
3. the ship water system, which includes storage, distribution and onboard production of drinking-water from overboard sources, such as seawater.
4. cross-connections between potable and non-potable water
5. poor design and construction of potable water storage tanks
6. inadequate disinfection.

6.3 PLAN FOR WATER SUPPLY:

1. A potable water system assessment has been carried out, with risks and control points identified.
2. Operational monitoring, including operational limits and health related targets, has been defined for the ship's water supply system, and corrective action plans have been developed, where necessary.
3. Management systems, including documentation, validation, verification and communication, have been included in the ship WSP.

Examples of hazards, control measures, monitoring procedures and corrective actions taken as part of a WSP for a ship water supply system are given in the Annex.

6.4 POTABLE WATER SOURCES FROM ASHORE AND USES ON BOARD SHIPS:

A port may receive potable water from either a municipal or a private supply and usually has special arrangements for managing this water after it has entered the port.

Potable water is used in various ways on board ships, including direct human consumption, food preparation and sanitation/hygiene activities.

Potential uses include:

- preparation of hot and cold beverages, such as coffee, tea and powdered beverages;
- ice cubes in drinks;
- reconstitution of dehydrated foods, such as soups, noodles and infant formula;
- food washing and preparation;
- direct ingestion from cold-water taps and water fountains;
- reconstitution and/or ingestion of medications;
- brushing of teeth;
- hand and face washing, bathing and showering;
- dishwashing, and cleaning of utensils and work areas;
- laundering purposes (could potentially use a lower grade of water);
- emergency medical use.

Although some uses do not necessitate consumption, they involve human contact and possibly incidental ingestion (e.g. tooth brushing).

6.5 BOTTLED WATER & ICE:

Bottled water is considered as drinking-water by some regulatory agencies and as a food by others (WHO, 2011). International quality specifications for bottled water exist under the Codex Alimentarius Commission (FAO/WHO, 2001) and are derived from the GDWQ (WHO, 2011). As it is commonly designated as a food product, bottled water is considered in chapter 3 on food.

Within this guide, ice supplied to ships or manufactured on board for both drinking and cooling is classified as food. Guidance pertaining to ice used on ships is contained in FSP. The GDWQ (WHO, 2011) apply to both packaged water and ice intended for human consumption.

6.6 WATER PRODUCTION ON BOARD:

Water may be produced on ships by desalination, reverse osmosis or distillation. A complete desalination process demineralizes seawater. This makes it corrosive, shortening the life of containers and conduits with which it is in contact. Special consideration needs to be given to the quality of such materials, and normal procedures for certification of materials as suitable for potable water use may not be adequate for “aggressive” desalinated water.

Because of the aggressive nature of desalinated water and because this water may be considered bland, flavourless and unacceptable, it is commonly stabilized by the addition of chemicals such as calcium carbonate. Once such treatment has been applied, desalinated waters should be no more aggressive than waters normally encountered in drinking-water supply. Chemicals used in such treatment must be subject to procedures for certification and quality assurance. The process of remineralization of desalinated water must be validated by the use of a testing kit for pH, hardness and turbidity. Water that has not been stabilized as a result of a failure in the re-hardening process typically shows a very low electrical conductivity (e.g. 50 µS/cm) and an elevated pH (above 8.0). High pH can be a reason for an unsatisfactory disinfection result, and reduced hardness may lead to leaching of metals into the water.

An evaporating plant that distils seawater and supplies water to the potable water system must be of such a design to produce potable water reliably. Distillation uses heat and pressure changes to vaporize seawater, thus liberating it of its dissolved and suspended solids and almost all dissolved gases.

High- and low-pressure units connected directly to the potable water lines should have the ability to go to the waste system if the distillate is not fit for use. As water is evaporated at low temperatures (<80 °C) in low-pressure units, it cannot be guaranteed that the distillate is free from pathogens.

According to ISO standards, water that has been produced at temperatures below 80 °C needs to be disinfected before it can be defined as potable.

Disinfection should be implemented in the water treatment process, ideally in a way that guarantees that all water (including bunkered water) is treated before reaching the potable water tank. A distillation plant or other process that supplies water to the ship's potable water system must not operate in polluted waters or harbour areas, as some volatile pollutants may be carried through this process. Treatment facilities should be designed to ensure efficient operation with the production of potable water that conforms to the GDWQ (WHO, 2011) or any relevant authority's requirements.

To help prevent cross-contamination, when seawater is to be treated on board for use as potable water, the overboard discharges should not be on the same side as the water intake. When it is not practicable to locate the overboard discharges on the opposite side of the ship, they should be located as far aft of, and as far below, the water intake as practicable.

6.7 ROLES AND RESPONSIBILITIES:

The ship operator's role is to provide a safe water supply to passengers and crew, fit for all intended purposes. Water on board should be kept clean and free from pathogenic organisms and harmful chemicals. Responsibilities are to monitor the water system, particularly for microbial and chemical indicators, to share sampling results with stakeholders, to report adverse results to the competent authority under the IHR 2005, where required, and to take corrective action. Adverse results should also be communicated to the crew and passengers when and where necessary. Where there are methods or materials recommended by WHO for particular tests, these should be applied.

The ship's master or officer responsible for bunkering water must be responsible for ascertaining whether or not the source of the water is potable. All staff should be encouraged to report symptoms indicating a potential waterborne disease. The ship's operator needs to provide adequate toilet and washing facilities for the crew to maintain personal hygiene.

Known carriers of communicable diseases should never come into contact with potable water supplies. An adequate ratio of crew to facilities is required on board ship to enable proper servicing and maintenance activities.

Minimum requirements can be found in ILO Convention C133 and the Maritime Labour Convention, 2006.

The term “fresh water” used in ILO conventions and the Maritime Labour Convention, 2006 should be interpreted as meaning potable water. To reduce disease spread among crew, shared drinking receptacles should not be used on ships unless they are sanitized between uses.

6.8 RECEIVING WATER & BUNKERING STATIONS:

To mitigate risks during bunkering of potable water, multiple barrier protection should be established. This starts with the use of appropriate hoses and fixtures, backflow preventers and filters at the bunker station and chlorination before water enters the storage tank.

To help protect the quality of water passing through filling hoses, they should be durable, with a smooth, impervious lining, and equipped with fittings that are designed to permit connection to the shore water supply system. Interior surfaces of potable water hoses should be made of material suitable for being disinfected and should not support the growth of biofilm. Hoses that are designed to be used for firefighting are not appropriate for use as potable water hoses. Potable water hoses should be clearly identifiable with words such as “POTABLE WATER”. Hoses used exclusively for the delivery of potable water should be kept on each ship. The ends should be capped when not in use. Keeper chains will prevent misplacement of caps. The hose needs to be handled to prevent contamination by dragging ends on the ground, pier or deck surfaces or by dropping into the harbour water. A hose that has become contaminated should be thoroughly flushed and disinfected. The hose must be flushed in all cases before being attached to the filling line. It must be drained and dried after each use.

The filling hoses should be stowed, with the ends capped, in special lockers designated and marked “POTABLE WATER HOSE ONLY”. Lockers must be closed, self-draining and fixed above the deck. The lockers should be constructed from smooth, non-toxic, corrosion-resistant and easily cleanable material. Hoses and fittings need to be maintained in good repair.

Non-potable water, if used on the ship, should be bunkered through separate piping using fittings incompatible with potable water bunkering. This water should flow through a completely different piping system that is identified with a different colour. To provide for safe bunkering, every potable water tank must have a dedicated, clean filling line to which a hose can be attached.

To avoid accidental connections of sewage hoses, the flange of this filling line should refer to suitable criteria such as defined in ISO 5620-1/2. To prevent contamination of water, the filling line needs to be positioned a suitable distance above the top of the tank or of the deck that the line penetrates.

It is typically painted or marked in blue and labelled "POTABLE WATER FILLING". The filling line can have a screw cap or plug fastened by a chain to an adjacent bulkhead or surface in such a manner that the cap or plug will not touch the deck when hanging free. Lines to divert potable water to other systems by valves or interchangeable pipe fittings are not generally considered acceptable, except where an air gap follows a valve. If only one filling line is used to load potable water to all tanks, a direct connection between the potable water tank and other tanks through an air gap is a satisfactory practice. To avoid intake of unwanted particles, a filter can be used in the filling line. These filters need to be backwashed or exchanged regularly according to the manufacturer's instructions. All potable water passing through the potable water filling line should pass through an automatic chlorination unit before it enters the potable water tanks.

6.9 DISINFECTION:

The water supply delivered to ports must be suitable for distribution and consumption without further treatment, except as necessary to maintain water quality in the distribution system (e.g. supplemental disinfection, addition of corrosion-control chemicals). A disinfectant residual should be detectable in water samples at the port, on the water barge and on the ship. Presence of a measurable disinfectant residual contributes to ensuring that water is microbiologically safe for the intended use. Presence of the residual will be affected by the original dose of disinfectant, type of disinfectant used, disinfectant demand, temperature and pH of the water and time since application. A significant reduction in disinfectant residual may also indicate post-treatment contamination.

New or repaired facilities must be disinfected before they are returned to service. In the event of contamination of the water provided to the port, the port must complete corrective action and notify the party responsible for bunkering water as soon as possible to enable mitigation to prevent contaminated water from being transported onto ships.

6.10 PREVENTION OF BACKFLOW AND CROSS-CONTAMINATION:

The lines' capacity should maintain positive pressure at all times to reduce the risk of backflow. There must be no connections between the potable water system and other piping systems. All fittings, meters and other appurtenances used for bunkering of potable water need to be handled and stored in a sanitary manner. Inlets and outlets of potable water meters are typically capped when not in use.

Approved backflow preventers need to be properly installed between the ship and shore systems to permit effective operation and inspection.

Drainage to prevent freezing may be needed. Non-potable water hydrants are not normally located on the same pier as hydrants for potable water unless absolutely necessary. Potable water hydrants must be identified with signs such as “POTABLE WATER”, and non-potable water hydrants with signs marked “NON-POTABLE WATER”. Hydrants need to be adequately covered and located so as not to receive waste discharge from ships. Drainage lines from supply lines or hydrants (or taps and faucets) should terminate above normal high-water level or the surge of water from incoming ships. Where compressed air is used to blow water out of lines and hydrants, a filter, liquid trap or similar device must be installed in the supply line from the compressed air system to protect the water supply.

6.11 SAMPLING AND QUALITY MONITORING:

Verification monitoring of potable water on the ship is carried out at locations selected to ensure that persons on board are provided with safe water. Verification steps should be adequate to provide assurance that water quality has been maintained at, or restored to, safe levels. It is important to separate verification monitoring from less sophisticated measures such as simple on-site tests and more complex procedures such as sampling for microbiological and chemical laboratory analysis. While simple on-site tests (e.g. regular verification and operational monitoring of pH and chlorination) can be performed by appropriately trained and competent ship staff, sampling for complex chemical and/ or microbiological analysis should always be performed by well-trained professional persons who are authorized by a certified laboratory. Only special sampling containers (e.g. sterile glass bottles that contain sodium thiosulfate for microbiological samples or special polyethylene bottles for chemical samples) should be used. Usually samples are taken in one port, and the ship will leave port while the results are still pending. Often the results need to be interpreted by the next port, and therefore it is desirable to follow a defined sampling scheme and sampling procedures (e.g. according to ISO 19458) to provide internationally comparable results.

A standard sampling scheme should be developed for each ship, depending on the size and complexity of the potable water system. At a minimum, it is diligent to take a sample directly from the tank (sampling taps are necessary) and one sample at the farthest point of the distribution system (e.g. tap at the bridge deck).

The tank sample gives information about the quality of the water supply on board, while the bridge sample gives information about the quality of the water for the consumer. If both samples have been taken at the same time, they can be compared to provide information about the influence of the distribution system. This is an easy and affordable way to obtain a quick overview of the system’s status.

6.12 RECORD KEEPING:

Documentation of monitoring should be kept for assurance and analysis in the event of an incident. Documentation should be showed to the competent authority under the IHR 2005 whenever requested.

Documentation of inspection, maintenance, cleaning, disinfection (to include concentration and contact time of disinfectant) and flushing shall be maintained for 12 months and shall be available.

6.13 POTABLE WATER TANKS:

Potable water needs to be stored in tanks constructed and located so as to be protected from any contamination from inside or outside the tank. Tanks need to be designed so that cross-connections between them and tanks holding non-potable water or pipes containing non-potable water are prevented. Ideally, potable water tanks should be located in rooms that have no sources of heat emission or dirt.

Potable water tanks must be constructed of metal or other suitable material that is safe for contact with potable water and must be robust enough to exclude contamination. Proper maintenance of anticorrosive coatings in water tanks is important.

Every potable water storage tank will need to be provided with a vent located and constructed to prevent the entrance of contaminating substances and vectors.

It is important that the potable water tank be provided with an overflow or relief valve, located so that the test head of the tank is not exceeded. The overflow must be constructed and protected in the same manner recommended for vents.

The potable water tank should be designed to be completely drained in case there is a need to dump water to remove contamination. The end of the tank suction line should be no closer than 50 mm above the tank bottom, to avoid the intake of sediment or biofilms.

Any means provided for determining the depth of water in potable water tanks should be constructed to prevent the entrance of contaminated substances or liquids. Potable water tanks need to be equipped with facilities to read the filling level of the tank from outside. This construction should not produce areas of stagnating water that could become a source of contamination. Manual sounding should not be performed, as this may lead to unnecessary contamination of the potable water.

All potable water tanks need to be clearly labelled with their capacity and words such as “POTABLE WATER TANK”.

The potable water tank will need an inspection cover giving access for cleaning, repair and maintenance. To avoid contamination when opening the cover, the opening should not give direct access to the unprotected water surface.

Sample cocks should be installed directly on each tank to allow tests to be taken to verify water quality and must point downwards to avoid contamination.

Potable water tanks and any parts of the potable water distribution system shall be cleaned, disinfected and flushed with potable water:

- before being placed in service; and
- before returning to operation after repair or replacement; or
- after being subjected to any contamination, including entry into a potable water tank.

Potable water tanks shall be inspected, cleaned and disinfected during dry docks and wet docks or every two years, whichever is less. Disinfection following potential contamination shall be accomplished by increasing free residual halogen to at least 50 mg/l throughout the affected area and maintaining this concentration for 4 hours, or by way of another procedure recognized by WHO.

6.14 POTABLE WATER PUMPS:

The potable water pump needs the capacity for regular servicing. To prevent contamination, the pump should not be used for any purpose other than pumping potable water. A filter can be installed in the suction line of the pump. Filters need to be maintained according to the manufacturer's instructions (e.g. exchange or regularly backwash). The installation of a standby pump is recommended for emergencies, such as breakdown in the main unit serving the potable water system. If this secondary pump and piping are filled with water, they must be operated alternating with the primary pump to avoid build-up of microbial contamination in stagnating water. Hand pumps, installed on some ships to serve galleys and pantries for emergency or routine use as a supplement to pressure outlets, need to be constructed and installed to prevent the entrance of contamination. Pumps should ensure continuous operation when required to maintain pressurization—for example, by priming automatically. A direct connection from the pump, with no air gap, should be used when supplying to a potable water tank.

6.15 HYDROPHORE:

Hydrophore tanks are used to pressurize the potable water installation and facilitate the transport of the water through the system. In extended potable water installations, permanent running potable water pumps are used instead of hydrophore tanks to establish a continuous positive pressure at all taps.

Hydrophore tanks need to meet the same criteria as other potable water tanks. The tanks should be equipped with maintenance openings for cleaning. They should be of adequate size and located away from any heat sources. Where compressed air is used to produce the air cushion inside the hydrophore tank, a filter, liquid trap or similar device must be installed in the supply line from the compressed air system to protect the water supply. More detailed information can be found in the ISO standards.

6.16 **CALORIFIER:**

Calorifiers are used to produce hot water. In small potable water systems, a so-called decentralized hot-water production system can be used wherever hot water is needed. In more extended installations, however, a central hot-water production unit is typically installed in combination with a hot-water circulation system. Calorifiers should meet the same materials and construction criteria as all other parts of the potable water system. They should be equipped with a maintenance opening and with thermal insulation.

To avoid the growth of Legionella spp., hot water should leave the calorifier at a temperature of at least 60 °C. A hot-water circulation system should be used, and the returning water should not be colder than 50 °C.

6.17 **WATER DISTRIBUTION SYSTEM:**

Ships should have plumbing suitable to protect water safety. Before being supplied, new ships should be inspected for compliance with the design specifications by the relevant competent authority or other authorized independent body. Technical standards such as ISO standards should be considered. A clear and accurate layout of the engineered system on the ship is likely to be needed to support this inspection.

Materials in contact with water need to be safe for the intended purpose. All materials used should be acceptable to the national health administration of the country of registration. Lead and cadmium materials should not be in contact with water via pipes, fittings and joints and should not be used anywhere in the potable water system, as these can leach into and contaminate the water.

Potable water piping should be clearly identifiable to help prevent cross connection plumbing errors. To identify potable water piping, a colour code according to international standards (ISO 14726: blue–green–blue) can be used.

Crew must be trained to take hygienic precautions when laying new pipes or repairing existing pipes. It is important in designing the ship to minimize the points where water could collect and become warm (>25 °C) and stagnant.

For example, temperature-control valves that prevent scalding must be fitted as close to the point of use as possible to minimize the formation of warm-water pockets. The number of distribution system dead ends should be minimized.

If hot-water piping and cold-water piping are laid side by side, appropriate thermal insulation must be applied to prevent warming or cooling of the respective pipes and the possibility of bacterial growth. All piping components should be able to resist water temperatures of 90 °C, to facilitate thermal disinfection whenever necessary. The distribution system should be designed to avoid the bypassing of any important treatment or storage processes.

6.18 **INVESTIGATIVE AND CORRECTIVE ACTION:**

In the event of contamination of water on the ship, the ship's operator or master should notify persons on board who may be affected to take immediate mitigation measures or arrange for an alternative water supply. Appropriate action may include additional treatment or flushing and disinfection of transfer equipment or ship water tanks.

Specific corrective actions must be developed for each control measure in the WSP to deal with deviations when they occur. The actions must ensure that the control point has been brought under control. They may include repair of defective filters, repair or replacement of pipes or tanks or breaking of cross-connections.

The ability to change temporarily to alternative water sources is one of the most useful corrective actions available but is not always possible. Backup disinfection plans may be necessary. Investigative action and response could be as basic as reviewing records or could include more comprehensive corrective action. Corrective action should involve remedying any mechanical, operational or procedural defect in the water supply system that has led to critical limits or guideline values being exceeded. In the case of mechanical defects, remedies should include maintenance, upgrading or refurbishment of facilities. In the case of operational defects, actions should include changes to supplies and equipment. In the case of procedural defects, such as improper practices, standard operating procedures and training programmes should be evaluated and changed, with personnel retrained. Any such changes should be incorporated into the WSP.

The competent authority under the IHR 2005 should be informed whenever required by the national regulations of the port State and in all cases of illnesses and/or complex problems on board. Reporting of illnesses and sanitary conditions that may pose a public health risk (e.g. water system in poor condition) is an international obligation under the IHR 2005.

Oversight should be provided to ensure that corrective actions are implemented in accordance with written procedures and quickly enough to minimize exposure of the travelling public and crew members. Oversight could be performed by the responsible party for that segment of the supply chain or by an independent party, such as a regulatory authority.

Emergency or contingency actions may need to be taken, such as provision of water from alternative sources. During periods when corrective action is being taken, increased monitoring is required.

Appendix 1:

Food receipt temperatures & condition table:

S.No	Food item	Temperature on receipt	Condition on receipt
1			
2			
3			
4			
5			

Signature of the responsible officer

Appendix 2:

Examples of hazards, control measures, monitoring procedures and corrective actions for the ship water supply system

Hazard / hazardous event	Control measure	Monitoring procedures	Corrective action
Contaminated source water	Routine checks on source water quality	Monitor turbidity and microbial indicators	Filter and disinfect, or use alternative source
Defective filters	Routine inspections and maintenance Regular backwashing and cleaning of filters	Monitor filter performance using turbidity	Repair or replace defective filters
Contaminated hoses	Regular cleaning and disinfection Regular repair and maintenance Proper storage and labelling	Routine inspections	Repair or replace Clean and disinfect
Contaminated hydrants	Regular cleaning and disinfection Regular repair and maintenance	Routine inspections	Repair or replace Clean and disinfect
Cross-Connections With non-potable water at bunkering	Correct design and plumbing Correct labelling No connection with non-potable water	Routine inspections	Install new plumbing Isolate part of system Re-chlorinate, flush
Defective backflow preventers at bunkering	No defects that allow ingress of contaminated water	Routine inspections, repair and maintenance	Repair or replace

Storage

Hazard/ hazardous event	Control measure	Monitoring procedures	Corrective action
Sediment at Bottom of storage tanks Procedure for cleaning storage tanks	Routine cleaning (e.g. every 6 Months)	Routine inspections, documentation	Filter and disinfect, or use alternative source
Damage to wire mesh in overflow or vent pipe	Routine inspection, repair and maintenance	Routine sanitary inspections	Repair or replace
Cross-connections between potable water storage tank and non-potable water storage tank or pipe	Cross-connection control Programme	Routine inspections, repair and maintenance	Repair or replace
Defects in potable water storage tanks	Routine sanitary inspection	Routine Inspections, repair and maintenance	Repair or replace

Distribution System

Hazard/hazardous event	Control measure	Monitoring procedures	Corrective action
Cross connections With non-potable water	With non-potable water Prevent cross-connections Procedures for inspection, repair and maintenance Correct identification of pipes and tanks	Routine inspections	Break cross connection
Defective pipes, leaks	Procedures for inspection, repair and maintenance	Routine inspections	Repair pipes

Defective backflow preventers at outlets throughout distribution system	No defects that Would allow Ingress of Contaminated water	Routine inspections Testing of preventers	Repair or replace
Contamination during repair and maintenance of tanks and pipes	No defects that Would allow Ingress into -potable water tanks or pipes Procedures for hygienic repair and Maintenance Procedures for cleaning and disinfection	Inspection of job Water sampling (microbiological analysis)	Train staff Written procedures Disinfect fracture area and fitting
Leaking pipes or tanks	Prevention of Leakage System maintenance and renewal	Routine inspections Pressure and flow monitoring	Repair
Toxic substances in pipe materials	No toxic Substances Specifications for pipe materials	Check specifications for pipes and Materials Check specification certificates	Replace pipes if Specification is not correct
Insufficient residual Disinfection	Adequate to prevent regrowth (e.g. maintaining free chlorine residual above 0.2 mg/l)	Online monitoring of residual, pH and temperature Routine sampling	Investigate cause and rectify