



Fleet Safety Manual

7.A.12 - POTABLE WATER QUALITY

1 PURPOSE

- a) To ensure that potable water supplied at CCG Facilities and aboard Canadian Coast Guard (CCG) vessels for drinking or food preparation meets the [Guidelines for Canadian Drinking Water Quality](#)
- b) This procedure applies to the drinking water produced, purchased in bulk, stored and distributed at CCG facilities and aboard CCG vessels.

2 RESPONSIBILITIES

2.1 REGIONAL DIRECTOR, FLEET OR DELEGATE

- a) The Regional Director, Fleet or Delegate shall ensure that information pertaining to the quality of water at specific locations where the vessel intends to load potable water is available.

2.2 COMMANDING OFFICER

- a) The Commanding Officer shall ensure that potable water taken aboard the vessel, or manufactured aboard is tested on a regular basis to ensure that water quality meets the standards prescribed in the Guidelines for [Canadian Drinking Water Quality](#).
- b) The Commanding Officer shall ensure that all documents concerning potable water quality are adequately completed, checked, and maintained aboard.
- c) The Commanding Officer shall ensure that water obtained for the vessel from hydrants or fill stations is water that is provided by a recognized drinking water system.

2.3 CHIEF ENGINEER

- a) The Chief Engineer is to ensure that fitted water production and purification equipment is maintained to the manufacturer's standard and that potable water tanks are inspected.
- b) The Chief Engineer, or their delegate, is to ensure that all maintenance performed on the potable water system is logged and that only approved parts and "potable water" coatings are properly applied and used.

2.4 REGIONAL OPERATIONS CENTRE (ROC)

- a) The ROC is the emergency contact point for laboratories reporting contamination in vessel/station test water samples. The ROC shall immediately notify the vessel/station of any report of contamination so that they can take the appropriate measures to discontinue use and to flush tanks.

3 INSTRUCTION

3.1 GENERAL

- a) All faucets accessible to the vessel/station complement that are not connected to a supply of potable water are to be clearly marked to indicate that the water provided from that faucet is not suitable for drinking or food preparation.
- b) To ensure potable water safety in empty cabins or seldom-used spaces, Site Specific Work Instructions or MAINTelligence tasks shall:
 - Ensure that on a weekly basis these areas are visited and potable water fixtures are flushed. Appropriate signage is placed above the potable water source and reference is made in the site specific orientation instructions to the effect that the taps shall be flushed by new occupant of the cabin before initial use.

3.2 SHORE SUPPLY

- a) Dock hydrants or fill stations are to be flushed for at least five minutes at full volume before being connected to the vessel's fill hose to ensure that standing water in the system has been cleared from the pipe.
- b) Water that is obtained from dock hydrants or fill stations shall be carried from the hydrant to the vessel in hoses that have been specifically marked for the carriage of potable water and are used exclusively for that purpose. When not in use these hoses are to be drained, kept capped, and are to be stored in a clean secured locker used only for potable water equipment. Potable water fill stations and all exterior potable water sounding pipes shall be fitted with a locking mechanism that shall be in use at all times and checked regularly for any breach to security.
- c) If it, at any time, becomes necessary to temporarily supplement the vessel's potable water supply hose with additional lengths, or to connect to a tank operator's hose, the additional hoses shall be dosed with unscented bleach (1 cup per hose filled with water and let sit for 30 minutes) and then flushed with the equivalent of five volumes of water or for two minutes.

3.3 WATER PRODUCED ABOARD

- a) Variances
 - There may be occasions where, due to the nature of the operations being conducted or the physical capacities of the vessel, parts of this procedure cannot be followed exactly. In such situations, the Commanding Officer shall ensure, by taking all prudent measures, that the potable water provided is safe for consumption.

- When the vessel is in a contracted refit where the contractor is to supply potable water to the crew, the Commanding Officer shall ensure that the contractor supplies the necessary certificates.
- b) Potable water production equipment shall be operated and maintained in accordance with the manufacturer's instructions and the Site Specific Work Instructions.

3.4 ENGINEER OFFICER-OF-THE-WATCH

- a) The Engineer Officer-of-the-Watch shall manufacture water only when advised by the Bridge Officer-of-the-Watch (OOW) that the geographic and operational limitations are favourable. The Engineer Officer-of-the-Watch shall stop manufacturing water immediately upon being advised by the Bridge OOW that conditions are no longer favourable.
- b) When vessels manufacture water aboard, the following conditions shall be considered:
 - The vessel shall be either underway or at anchor.
 - The vessel shall assess the possibility of contamination from shore sources in area.
 - The vessel shall monitor overboard discharges to avoid contamination in the area
 - The vessel shall be a minimum of one (1) nautical mile from shore or ensure that there is no contamination in the area.
 - The vessel shall not be in an area where there is a red tide or algae bloom warning.
- c) Where raw water for producing potable water is being drawn from a shared seabay that is also used for sea water cooling, the sea water cooling system must not be in recirculation mode.
- d) Regionally specified local prohibitions must be observed.
- e) When water production equipment is observed to be malfunctioning (operating outside manufacturer's specifications) the equipment is to be tagged and locked-out from the potable water system until the malfunction has been corrected and the equipment functions acceptably.

3.5 DISINFECTION

- a) All potable water, whether bulk purchased or produced aboard, shall be tested to ensure that an appropriate amount of free chlorine exists or that it passes through a functioning irradiation device prior to being used.

Note 1: Chlorination standard is 0.2 to 0.5mg/L. To attain a free chlorine level of 0.5 mg/L add unscented bleach (~5% sodium hypochlorite) at a rate of 1L/100m³.

Note 2: Irradiation standard is 254 nm at a minimum ultraviolet dosage of 16,000 $\mu\text{W.s/cm}^2$.

- b) After entry into a potable water tank for any purpose, the tank must be cleaned and superchlorinated with bleach to a level of 50 mg/L of free chlorine. All taps from this tank shall be turned on to supply superchlorinated water to all pipes. It may be necessary to bypass charcoal filtration to ensure chlorinated water is in all parts of the system. The superchlorinated water must be allowed to sit in the tanks for a minimum of 4 hours before being flushed.

Note 1: Superchlorination is achieved by adding unscented bleach [@ ~5% sodium hypochlorite] at a volume of 1L/m³ of water in the tank.

- c) Discharges of wastewater containing free chlorine are restricted by the Canadian Environmental Quality Guidelines. Superchlorinated water shall be de-chlorinated to a free chlorine level below levels of detection (<0.1mg/L) for discharge in saltwater, commercial harbours provided that the discharge takes place a least 100 meters from any seawater intake or aquaculture holding area. Chlorinated wastewater shall not be discharged to a freshwater body or in any sensitive area.
- d) If superchlorinated water cannot be treated for overboard discharge as outlined in this procedure, then the water must be removed by tanker truck for disposal in accordance with provincial or territorial regulations.
- e) Water can be dechlorinated by the introduction of hydrogen peroxide (H₂O₂).
- 71 grams of free chlorine are removed by 34 grams of hydrogen peroxide.
 - 1m³ of water at 50mg/L free chlorine contains 50 grams of free chlorine
 - 1L of 35% strength hydrogen peroxide contains 350 grams of H₂O₂
 - To ensure complete free chlorine removal, 33% overdosing with hydrogen peroxide is the Fleet standard.
 - Use the following formula to determine the dosing level
$$Y \times 0.478 \times 2.857 \times 1.33 = \text{ml of H}_2\text{O}_2 \text{ solution}$$

Y = amount of free chlorine (in grams) to be removed
 - To treat 1m³ of water containing 50mg/L of free chlorine requires approximately 91mL of 35% hydrogen peroxide
$$50 \times 0.478 \times 2.857 \times 1.33 = 90.81 \text{ ml H}_2\text{O}_2$$
- f) The procedure to be followed for dechlorination is as follows:
- Using the formula given above, add the calculated amount of hydrogen peroxide required to a mixing tank (a ballast tank is suggested but the potable water tank can be used).
 - Using a hose and a quick connect backflow prevented fitting on the potable water tank drain, dump the potable water tank through the valve manifold to the mixing tank. (Permanent connections between the potable water tank and any other tank without anti siphoning device or backflow preventers are not permitted.)
 - Test water in the mixing tank for free chlorine level – must be less than detectable level
 - If any free chlorine is detected add an additional amount of hydrogen peroxide (50% of the original amount used) through the appropriate tank vent(s) and retest

- If the free chlorine level in the mixing tank is less than 0.1mg/L, discharge water in accordance with 3.5 (d) above.
 - If the free chlorine level in the mixing tank is above 0.1mg/L; advise the Chief Engineer and lockout the tank from potential for overboard discharge. Unless in an emergency affecting the safety of the vessel, the water in the mixing tank will now have to be discharged to a tanker truck ashore for disposal.
- g) Record volume of water discharged, location, and results of tests (specify type of kit) showing free chlorine levels less than detection (<0.1mg/L) for a minimum of three samples; beginning, middle, and end of discharge.
- h) Ballast tank may be considered for dechlorination of superchlorinated water.

3.6 POTABLE WATER TESTING

- a) Regardless of the source of supply, vessels/station using chlorine as a disinfection agent shall conduct weekly checks of free chlorine level of on board potable water to ensure that free chlorine in drinking water is generally maintained between 0.2 and 0.5 mg/L, but never exceeds 5 mg/L. Tests shall be conducted at the tank and on at least two other downstream outlets: one selected at random; and one on the longest run of pipe.
- b) If the vessel/station uses ultraviolet irradiation for disinfection, the level of irradiance shall be checked daily to ensure that it is within the manufacturer's specification for adequate drinking water disinfection, and the result shall be logged. If chlorine is not introduced to establish a residual chlorine level for maintaining disinfection in the distribution system, then weekly checks shall be made for Escherichia coli (E. Coli) and total Coliform bacteria. Tests shall be conducted on at least two downstream outlets: one selected at random; and one on the longest run of pipe.
- c) Free chlorine test kits shall have sufficient accuracy to determine 0.1 mg/L of free chlorine.
- d) When free chlorine levels are observed to be below 0.2 mg/L, tanks shall be re-chlorinated with a secondary chlorine source (i.e. bleach) to be brought back to approximately 0.5 mg/L by dosing the tank as outlined in Section 3.5 (a) above. If doubts as to the acceptability of the water as being safe for drinking exist, the tank shall be dumped, flushed with fresh water, shocked at a level of up to 50 mg/L free chlorine as outlined in Section 3.5 (b) above, and then recharged.
- e) CCG vessels shall have potable water tested at least every three months, when in service, by an independent laboratory that has been accredited for the purpose of testing water quality. Tests shall be conducted on at least two downstream outlets: one selected at random; and one on the longest run of pipe.
- f) Three of the quarterly tests, identified in Section 3.6 (e) above, will test in five (5) parameters.
- E. Coli must be 0 detectable per 100ml
 - Total Coliform must be 0 detectable per 100ml
 - Total Dissolved Solids must be less than 500 mg/L

- pH must be between 6.5 and 8.5 pH units
 - Iron shall be below 0.3 mg/L
- g) One of the quarterly tests, conducted at least once annually, shall test for contamination in twenty-eight (28) parameters. Acceptable maximum values from the [Guidelines for Canadian Drinking Water Quality](#) are shown to the right of each test parameter.

Health-based Objectives

• E. Coli	0 per 100ml	• Nitrate/Nitrite	45 mg/L
• Total Coliform	0 per 100ml	• Mercury	0.001 mg/L
• Turbidity	1 NTU	• Selenium	0.01 mg/L
• Antimony	0.006 mg/L	• Uranium	0.02 mg/L
• Barium	1.0 mg/L	• Benzene	0.005 mg/L
• Boron	5.0 mg/L	• Xylenes	0.3 mg/L
• Cadmium	0.005 mg/L	• Fluoride	1.5 mg/L
• Chromium	0.05 mg/L	• Lead	0.01 mg/L
• Ethylbenzene	0.09mg/L		

Aesthetic Objectives

• Copper	1.0 mg/L	• Sodium	200 mg/L
• Iron	0.3 mg/L	• Zinc	5 mg/L
• Manganese	0.05 mg/L	• Toluene	0.024mg/L
• pH	6.5 – 8.5 pH Units	• Sulphates	500 mg/L
• Colour	15 TCU	• Chloride	250 mg/L
• Total Dissolved Solids	500 mg/L		

Note 1: Aesthetic quality guidelines address parameters which may affect consumer acceptance of drinking water, such as taste, odour and colour.

- h) When forwarding water test samples to laboratories for analysis, vessel/station shall ensure that the ROC is shown as the immediate contact point for the vessel/station in the event that samples indicated that contamination is present.
- i) Stations with potable water supplied by a municipality shall complete the annual test per the Public Works and Government Services Canada (PWGSC) testing standards or any regional variance in place. No other tests are required for stations with municipal water supply.
- j) Stations with potable water that is supplied by a source other than a municipality; shall have their potable water tested at least every three months by an independent laboratory that has been accredited for the purpose of testing water quality. Annually, one of these tests shall be to the twenty-eight parameters identified in 3.6 (g) above. Subsequent tests shall be to the five parameters identified in 3.6 (f) above. Tests shall be conducted on at least two downstream outlets: one selected at random; and one on the longest run of pipe.

3.7 CONNECTIONS TO THE POTABLE WATER SYSTEM

- a) When potable water is delivered under pressure to a non-potable system, the potable water system shall be protected against backflow by either backflow preventers, air gaps or anti siphoning device. Backflow preventers shall be located so that they can be serviced and maintained.
- b) The maintenance and testing of these devices shall be done as per manufacturer recommendations and shall be included in the vessel/station preventive maintenance system.
- c) Backflow preventers shall be fitted on potable water connections to:
 - Ice Machines
 - Coffee Machines
 - Chilled water fountains
 - Steam tables
 - Dishwashers
 - Garbage grinders
 - Self-cleaning range hoods
 - Laundry equipment
 - Sick Bays and their associated equipment
 - Boiler feed water tanks
 - Fire systems
 - Toilets
 - Ballast systems
 - Bilge or other waste water connections
 - International shore connection

3.8 POTABLE WATER TANK INSPECTIONS

- a) At the time of the potable water tank inspection, a verification shall be made of the physical piping (bulkhead, vent, load lines, hoses, etc.) to ensure that no repairs or alterations have been made to the system that are not in conformance with acceptable practices for the storage and distribution of drinking water.

3.9 RECORD RETENTION

- a) Potable water testing records shall be maintained for a period of five years from date of last entry.

3.10 TRAINING MEDIA

- a) Vessel and station personnel who are responsible for water quality, filling of any holding tanks, bottled water exchange and/or the maintenance of any portion of the potable water system from source to final distribution point, as applicable to their site, shall view the applicable training media and read the supplied documentation. This requirement shall be added to the familiarization routines of the identified positions aboard each vessel or site.
- Procedures For Conducting Water Sampling in Federal Facilities
 - Ultraviolet and Reverse Osmosis for Micro-Systems
 - Drinking Water Storage Tanks
 - Bottled Water Selection & Application in Federal Facilities
 - Water Wells for Micro-Systems
 - Water Filtration & Ion Exchange for Micro-systems
 - Disinfection for Micro-Systems
 - Advice for the Operation of Potable Water Field Test Equipment
 - Potable Water Test Kits
- b) Health Canada Drinking Water Awareness Program (6 modules available online)
- All Directors, Directors General, the Assistant Commissioner, the Deputy Commissioner Operation and the Commissioner shall view modules 1 and 2
 - All Managers and Supervisors shall view modules 1 to 3
 - All Fleet Safety and Security personnel shall view modules 1 to 6
 - All users of water onboard CCG vessels may view modules 1 to 6 to familiarize themselves with the process of providing potable water.

4 DOCUMENTATION

- Deck Log Records of Water Taken Aboard
- Engineroom Log of Water Produced Aboard
- Laboratory Test Certificates
- Records of On Board Testing
 - (Disinfection Tests – free chlorine or ultraviolet levels)
 - (Dechlorinated water discharge tests)
- Records of any repairs, modifications, or maintenance
- Records of annual audits conducted on the drinking water system and control documentation that confirm compliance with this procedure
- Health Canada Drinking Water Awareness Program

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