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Guide for the Development of a Potable Water Management Plan (PWMP) for Airlines

Travelling Public Program/
Le Programme du public voyageur

Canada

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II. FORWARD

This information and examples contained in this guide are for information purposes only and are not meant to be considered as legal or binding.

This document is considered to be a living document and is to be used as a template for preparation of a Potable Water Management Plan (PWMP) for each airline that provides potable water onboard their aircraft for their passengers and employees.

The individual airline is responsible for the development, implementation and updating of their PWMP.

1. INTRODUCTION

A Potable Water Management Plan (PWMP) is an integral part of an airline's Safety Management System. Water systems on board aircraft must provide potable water that is safe for the consumption by both passengers and employees.

A PWMP documents system assessment, operational monitoring and planning and describes actions in both normal operation and during “incidents” where a loss of control of the system may occur.

A PWMP will assist airlines in meeting their legislated responsibilities for the provision of potable water to employees and passengers on aircraft, both domestically and internationally.

This guide is intended to provide airlines with a framework for the development of their own company-specific water management plans taking into account the operations of their respective companies. Consideration must be made for the quality of the source of the water, the handling of the water, the quantity of the water used, the maintenance of the water systems on the aircraft, and the monitoring that is in place to ensure that the water for consumption on an aircraft is potable.

The aim is to ensure that appropriate measures are in place so that water delivered to the passengers and employees will meet established health-based targets and that information pertaining to the achievement and maintenance of drinking water quality is documented.

To be effective, the PWMP needs to exist within an appropriate framework in which roles and responsibilities are clear and where the flow of key information between stakeholders is assured.

2. GOAL/OBJECTIVES

The PWMP aims to ensure onboard potable water by identifying, eliminating or mitigating any deficiencies in conditions, policies and procedures, and by ensuring that staff consider at all times the health and safety implication of their own actions and those of their colleagues in ensuring potable water onboard aircraft for passengers and employees.

Provision of potable water to employees and passengers will be achieved by:

a) Ensuring compliance with all applicable legislative requirements and other applicable guidelines and standards;

b) Establishing procedures and policy for safe handling of water;

c) Selection of potable water sources;

d) Training of water handlers;

e) Water sampling:

- Onboard aircraft;
- Water trucks/carts;
- Potable Water Cabinets (PWCs);
- Filling stations.

f) Disinfection/Sanitization of Potable Water System:

- Following aircraft manufacturer procedures for aircraft sanitization;
- Water truck/cart/and hoses;
- PWCs and filling stations.

g) Taking action on:

- Incidents;
- Adverse results;
- Complaints.

h) A cooperative approach between airport authorities, haulers and airline companies.

3. SCOPE

This potable water plan applies to Canadian airlines and their potable water handling equipment and takes into consideration their contractors that provide potable water services to them.

4. POLICY

Refer to Safety Policy of Airline ABC.

5. LEGISLATIVE REQUIREMENTS AND GUIDELINES

1. Canada Labour Code: Sec. 124 – General Duty of Employer
   Sec. 125 (i) (j) – Specific Duties of the Employer.

2. Canada Labour Code: Sec. 126 – Duties of Employees.

3. Canada Occupational Health and Safety Regulations: Potable Water (Section: 9.24, 9.25, and 9.26).

"Every employer shall provide potable water for drinking, personal, washing and food preparation that meets the standards set out in the Guidelines fro Canadian Drinking Water Quality 1978, published by authority of the Minister of National Health and Welfare."

4. Aviation Occupational Health and Safety Regulations: Potable Water (Section: 4.10 – 4.13)

"Every employer shall provide employees with potable water for drinking, personal washing and food preparation that, where reasonably practicable, meets the standards set out in the publication entitled Guidelines for Canadian Drinking Water Quality, 1978, as amended in March 1990 and published under the authority of the Minister of National Health and Welfare. SOR/94-34, s. 10."

5. Department of Health Act: 4 (2) (e)

"The protection of public health on railways, ships, aircraft and all other methods of transportation, and their ancillary services;"

6. Potable Water Regulations for Common Carriers Sec. 5, 6, and 7.

RESPONSIBILITY OF COMMON CARRIER

Section 5 ***No common carrier shall operate or cause to be operated a conveyance unless the potable water system of such conveyance is:***

(a) operated without any connection to any system for handling, storing or distributing raw water;

(b) identified as a potable water system by signs on storage tanks, outlets and filling connections;

(c) protected from tampering by unauthorized persons; and

(d) maintained in a sanitary condition.

Section 6 ***Every common carrier who operates or causes to be operated a conveyance shall:***

(a) clean, sterilize with live steam or a chlorine solution and rinse with potable water the potable water system of such conveyance before it is used for the first time;

(b) clean, sterilize with live steam or a chlorine solution and rinse with potable water the potable water system whenever it has been exposed to contamination in any way or has contained raw water as revealed by the examination referred to in the definition "potable water";

(c) clean, sterilize with live steam or a chlorine solution and rinse with potable water the tanks and containers of the potable water system before they are used again after they have been entered into for inspection, repairs or maintenance;

(d) subject to paragraph (f), clean, sterilize with live steam or a chlorine solution and rinse with potable water at least once a month the potable water system that is being used;

(e) empty, clean, sterilize with live steam or a chlorine solution and rinse with potable water at least once every two weeks the water coolers and other chilling devices of the potable water system that is being used.

<u>Section 7</u> No common carrier that operates or causes to be operated a conveyance shall permit on it:

(a) any careless or unsanitary handling of potable water from the source of supply thereof to the points of consumption;

(b) the existence of by-passes around the treatment or purification apparatus of the potable water system;

(c) the existence of a raw water supply in a galley or kitchen quarters unless:

(i) the outlet of such water supply is located at a point less than 450 mm above the level of the deck or floor; and

(ii) a sign has been posted at the outlet indicating that the water is to be used only for the purpose of washing decks or floors.

(d) the storage of potable water in tanks that are exposed to contamination by or from:

(i) pipes that pass through them;

(ii) raw water;

(iii) toilets; or

(iv) any other potential source of pollution.

(e) the existence of raw water outlets unless there has been posted at each such outlet a conspicuous and legible sign that states that the water available is not to be used for drinking or culinary purposes. SOR/78-400, s. 1.

7. Commercial and Business Aviation Advisory Circular # 0208 (2002.05.31) "Air Operator's Responsibilities with respect to potable water systems on Board Aircraft".

8. **Provincial\Territorial Regulations \ Standards**

Ideally, the potable water provider (ex. water hauler, airport) meet Provincial\Territorial regulations\standards in regards to potable water. Airline ABC should consider having this indicated in their service contract.

9. **Guidelines for Canadian Drinking Water Quality**

Ensure as a minimum airline ABC meets these guidelines, most recent web version:

http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index_e.html

10. Personal Protective Equipment as per airline Health and Safety policy.

6. ROLES AND RESPONSIBILITIES

Each individual airline's water management plan must set out the responsibility, authority and accountability for activities for all relevant positions. Each airline must establish:

- The responsibilities for each position and task;
- The competencies required for each position;
- The line of responsibility for ensuring all staff are competent and trained for their duties and for ensuring that training takes place;
- The responsibilities of the manager responsible for externally supplied services. All unapproved contracting companies should meet the airline's own PWMP standards or an equivalent to them;
- Functional responsibilities (who reports to who);
- Quality assurance function;
- Overall accountability.

Involved personnel could include:

- Airline manager responsible for potable water;
- Maintenance manager;
- Pilot;
- Water Truck/Cart company responsible;
- Airport authority;
- Laboratory;
- V.P. operations;

- Other.

NOTE: ***An organizational flow chart should be developed and updated that would meet the organizational requirements and reflect reporting relationships and accountabilities.***

7. OPERATIONAL REQUIREMENTS

7.1 INVENTORY OF EQUIPMENT

The airline is to maintain an up to date inventory of their equipment at all times. The airline may consider the sharing of this information with Health Canada:

7.1.1 Aircraft fleet - Refer to Appendix A.

7.1.2 Potable water trucks/carts, PWCs & Filling Station - Refer to Appendix B.

7.2 POTABLE WATER FILLING STATIONS AND HOSES

7.2.1 Recommendations - Refer to Appendix C

8. SAMPLING PROTOCOL

See Appendix D for the Protocol for Sampling Drinking Water on Aircraft, Water Trucks/Carts, PWCs, and Filling Stations.

8.1 MICROBIOLOGICALPARAMETERS TO BE SAMPLED AND INTERPRETATIONS

- Total Coliform (TC)
- *Escherichia Coli* (*E. Coli* or EC)

The maximum acceptable concentration (MAC) of Escherichia coli *is non detectable per 100 mL.*

The maximum acceptable concentration (MAC) of total coliforms in water leaving a treatment plant and in non-disinfected groundwater leaving the well is non detectable per 100 mL. For distribution systems in public supplies where fewer than 10 samples are collected in a given sampling period, no sample should contain total coliform bacteria.

The presence of total coliform in a distribution system indicates water quality degradation, possibly via bacterial regrowth or post-treatment contamination and should therefore be investigated. Corrective action in such cases is required in order to maintain the usefulness of total coliform as an indicator of the overall quality of the water. In the absence of *E Coli*,

the presence of total coliform in the distribution system is of no immediate public health risk. However, their presence in a water system such as that on aircraft should prompt further action to determine the source of the problem and corrective measures required*. Refer to Appendix K "Total Coliform Adverse results flowchart" [(1)] for further information.

E Coli is a member of the total coliform group of bacteria and is the only member that is found exclusively in the faeces of humans and other animals. Its presence in water indicates not only recent faecal contamination of the water but also the possible presence of intestinal disease-causing bacteria, viruses and protozoa. Consequently, detection (any level above 0 CFU/100ml) of *E. coli* in any drinking water system indicates a health hazard and requires immediate action. See "*E. coli* Adverse Results Flowchart" in Appendix K for immediate actions.

NOTE: If laboratory report indicates 'Too Numerous to Count' (TNTC), or Overgrowth, the aircraft potable water system should be resampled.

1) Appendix K "Total Coliform Adverse results flowchart" revised in consultation with specialists from the Water Quality & Science Division of Health Canada's Water, Air and Climate Change Bureau.

DISINFECTANT MEASUREMENT

Since there is no consistent relationship between heterotrophic plate count (HPC) levels and adverse health outcomes, it might be advantageous to use disinfectant residual measurements when positive results are obtained for TC and EC. If the water is coming from a public supply it should contain a disinfectant residual, typically 0.3 to 0.5 mg/L. These levels should control HPC levels to less than 500 CFU/100 mL. Monitoring of this residual is fast, and in real-time, so it provides more immediate answers than HPC. As long as the stored water still contains a disinfectant residual (and no known contamination has occurred) it should be still considered safe. As for storage time, up to 48 hours may be reasonable. Beyond that, the water should still be safe, but may become aesthetically objectionable (i.e. taste, odour).

USE OF DESINFECTANT TEST KITS OR LITMUS PAPER TEST STRIPS

Consider the use of a test kit or test strips to check that the concentration of the disinfectant used to sanitize the aircraft and ground equipment potable water system is at full strength at the beginning and during the contact time period. Retesting the disinfectant concentration after flushing is recommended to verify that levels are below 5 ppm to control

possible taste and odour issues. Test strips or kits should be specific for the type of disinfectant used and should have an adequate range for these measurements. Standard Operating Procedures (SOP) should be

developed according to the manufacturer sampling test kit or test strips used.

8.2 OTHER PARAMETERS INVESTIGATED

Other chemical and radiological parameters may be sampled in order to address a potable water complaint.

8.3 FREQUENCY OF SAMPLING

8.3.1 AIRCRAFT

A comprehensive representative monitoring plan that will include collecting samples from at least one galley and one lavatory from every aircraft in its operating fleet. This monitoring plan shall be designed to collect all samples within a twelve (12) month period at the rate of approximately 25% of the operating fleet being monitored each quarter.

Monitoring plans should be reviewed yearly. Airlines are encouraged to incorporate sample collection before and after disinfection into their regular monitoring plan.

Development of sampling frequency should consider randomness and representativeness of flight activity of the fleet based on ABC airline historical data and evaluation of risk.

Distribution of samples within an aircraft should take the following into consideration:

- Number of sampling points;
- Number of potable water tanks onboard aircraft;
- Where water is boarded on aircraft most often.

8.3.2 TRUCKS/CARTS

- Sample once per month for the microbiological parameters in Section 8.1;
- Distribution of samples should be based on the number of trucks/carts;
- Sample weekly for the disinfectant residual.

8.3.3 POTABLE WATER CABINET (PWC)

- Sample once per month for the microbiological parameters in Section 8.1;

- Distribution of samples should be based on the number of PWCs;
- Sample weekly for the disinfectant residual.

8.3.4 POTABLE WATER FILLING STATIONS IN HANGAR

- Sample once per year for the microbiological parameters in Section 8.1;
- Distribution of samples should be based on the number of filling stations;
- Sample weekly for the disinfectant residual.

8.4 WHO IS RESPONSIBLE FOR SAMPLING

To be identified by individual airlines, truck and cart owner/operators and airport authorities.

8.5 SAMPLE COLLECTION PROCEDURE

See Appendix D, Section 5 for sampling procedures. Sampling procedures from laboratories should contain as a minimum, all the information listed in this section of the appendix.

8.6 DATA MANAGEMENT

Airline should develop their own mechanism to record and manage their results in a spreadsheet format. The Sampling Data Sheet should identify sample location, date, time, aircraft, truck/carts, PWCs, and filling stations, etc. and results obtained. The airline may consider the sharing of this information with Health Canada on a routine basis. Health Canada will require access to sampling data during periodic inspection or audits, and may request data at any time related to a complaint, etc.

8.7 BOARDING WATER FROM DOMESTIC AND FOREIGN SOURCES

Policies and inventories to be developed by each airline, taking into consideration water sources and the WHO potable water initiative. Refer to Appendix E – List of Water Filling Sites.

8.8 REPORTING - INTERNAL

8.8.1 AIRCRAFT

- Reports generated at the time of sampling and completed when laboratory results received;
- Responsible person to manage and distribute reports;
- Identify to whom the reports go;
- Responsible person to report adverse results to predetermined list of contacts;
- Refer to flow chart in Appendix G.

8.8.2 WATER TRUCKS/CARTS, FILLING STATION, AND PWC

- Reports generated at the time of sampling and completed When laboratory results received;
- Responsible person to manage and distribute reports;
- Identify to whom the reports go;
- Responsible person to report adverse results to predetermined list of contacts;
- Refer to flow chart in Appendix H.

8.9 REPORTING/COMMUNICATION – EXTERNAL

8.9.1 TO HEALTH CANADA

<table>
<tr><th colspan="3">ALL ADVERSE RESULTS FOR AIRCRAFT</th></tr>
<tr><th>Total Coliforms</th><th>E. Coli</th><th>Action</th></tr>
<tr><td>(CFU/100 mL)</td><td>(CFU/100 mL)</td><td></td></tr>
<tr><td>>25 Galley & Lavatory</td><td>≥1</td><td rowspan="3">• Follow adverse results decision flowcharts – Appendix K
• Call Health Canada at:

Regional Manager - West (BC, AB, SK, YT): 604-666-0263
Regional Manager - Central (MB, ON, QC, NT): 613-948-7606
Regional Manager - Atlantic (NS, NB, PE, NL, NU): 506-851-7005</td></tr>
<tr><td>≤25 Galley & Lavatory</td><td>≥1</td></tr>
<tr><td>Presence in Galley or Lavatory or any other sampling point to be considered >25 CFU/ 100 mL</td><td>Presence</td></tr>
</table>

ALL ADVERSE RESULTS FOR WATER TRUCKS/CARTS, PWC's and FILLING STATIONS		
Total Coliforms	***E. Coli***	**Action**
(CFU/100 mL)	**(CFU/100 mL)**	
≥1 or Presence	≥1 or Presence	• Follow adverse ground service equipment results decision flowcharts – Appendix H • Call Health Canada at: Regional Manager - West (BC, AB, SK, YT): 604-666-0263 Regional Manager - Central (MB, ON, QC, NT): 613-948-7606 Regional Manager - Atlantic (NS, NB, PE, NL, NU): 506-851-7005

8.9.2 TO AIRPORT AUTHORITY

- Airport authority to report adverse results to Health Canada
- Airline to develop a flow chart and SOP with the assistance of airport authority

8.9.3 TO POTABLE WATER TRUCKS/CART OWNER

- Adverse results
- Airline to develop a flow chart and SOP with the assistance of Water Trucks/Carts Owner

9. DISINFECTION/SANITIZATION OF POTABLE WATER SYSTEM

9.1 DISINFECTION/SANITIZATION OF AIRCRAFT

Regular disinfection frequency	Monthly (reference to Potable Water Regulations for Common Carriers Sec. 5, 6, 7) Required after work that exposes the potable water system to contamination
Disinfection after an occurrence/incident	After contamination of the system, included use of non-potable (raw) water Results from potable water system monitoring program that indicates additional sterilization is required **In the event there is an incident involving the above, assume the water is contaminated**
Disinfection/Sanitization procedure	According to manufacturer procedures (refer to airline Standard Operating Procedures, Airline Maintenance Manual and Task Cards)

Sampling after an occurrence/incident (locations include all sampling points from the same system (i.e. reservoir))	1. Collect sample after disinfection/sanitization 2. Collect sample 24 h after disinfection/sanitization 3. One from tap of adverse results 4. One from other galley tap 5. One from other lavatory tap 6. One from other tap on aircraft

9.2 DISINFECTION/SANITIZATION OF WATER TRUCKS/CARTS & HOSES

Regular disinfection frequency	Monthly (reference to Potable Water Regulations for Common Carriers Sec. 5, 6, 7). Daily inspections should be conducted according to airline checklist.
Disinfection after an occurrence/incident	Required after work that exposes the potable water system to contamination.
	After contamination of the system, included use of non-potable (raw) water from the filling station.
	Results from potable water system monitoring program that indicates additional sterilization is required.
	In the event there is an incident involving the above, assume the water is contaminated
Disinfection/sanitization procedure	According to airline procedures (refer to example provided in Appendix F – Disinfection of Water Trucks/Carts and Hoses).
Sampling after an occurrence/incident (locations include all sampling points from the same system (i.e. reservoir))	1. Collect sample after disinfection/sanitization. 2. Collect sample 24 h after disinfection/sanitization.

9.3 DISINFECTION/SANITIZATION OF PWC AND FILLING STATION

To be developed by the operator.

9.4 MUNICIPAL BOIL WATER ADVISORY/ORDER

When advised by an airport authority of a boil water advisory, airline ABC should either not board potable water or if water has been boarded, shut-off onboard potable water supply and provide bottled water. If contaminated water is or has been boarded, airline ABC should develop an SOP to address this issue.

10. COMMUNICATION PROTOCOL

10.1 INTERNAL CONTACTS

Airline ABC	
1st Contact Person: **Title:**	**Phone:** **Cell/Pager:** **Fax:**
2nd Contact Person: **Title:**	**Phone:** **Cell/Pager:** **Fax:**
Maintenance	
1st Contact Person: **Title:**	**Phone:** **Cell/Pager:** **Fax:**

10.2 EXTERNAL CONTACTS

Laboratory Services	
Name: **Title:**	**Phone:** **Cell:** **Fax:** **Email:**
Airport authority	
Name: **Title:**	**Phone:** **Cell:** **Fax:** **Email:**
Truck/Cart operator	
Company **Name** **Title:**	**Phone:** **Cell:** **Fax:** **Email:**
Health Canada	
Name: **Title:**	**Phone:** **Cell:** **Fax:** **Email:**

11. COMPLAINT LOG

Passenger/Employee complaints. An SOP to be developed by airline. See example provided in Appendix I.

12. TRAINING/EDUCATION

	Aircraft	Water Trucks \ Carts
Education	- Provide Water Management Plan	- Provide Water management Plan
Training	- Safety (Personal Protective Equipment (PPE)) - Collection of water samples - Disinfection/Sanitization - Reporting - Data Management - SOP - Annual review of PWMP components and elements	- Safety (Personal Protective Equipment (PPE)) - Collection of water samples - Disinfection/Sanitization - Reporting - Data Management - SOP - Annual review of PWMP components and elements
Who (Targeted audience)	- Operator will ensure training of all relevant stakeholder to their PWMP	- Operator will ensure training of all relevant stakeholder to their PWMP
Documentation	- Develop checklist (name, date of presentation, content) demonstrating training was given and received	- Develop checklist (name, date of presentation, content) demonstrating training was given and received

13. DOCUMENT CONTROL/REVISION LOG

The document control system is a process for managing and documenting changes to the airline PWMP. A complete review should be performed on a yearly basis (see Appendix J).

Document control purpose is to:

- Simplify and automate the change control process;
- Track, document, and safely implement changes to the PWMP such as documents and procedures;
- Define tasks for initiators, approvers, implementers, and verifiers;
- Define and enforce the change process automatically.

The result is:

- To maintain PWMP functionality in line with existing or updated regulations;
- A more efficient PWMP.

14. AUDIT

14.1 INTERNAL AUDIT

Develop a certified checklist that verifies that the ABC airline PWMP components and elements are operating as designed. Frequency to be defined.

14.2 EXTERNAL AUDIT

Conducted by Health Canada to verify that airline ABC is complying with their PWMP by interviews, reviewing documentation and on site observation. Frequency to be defined.

14.3 PLAN ACCEPTANCE

Individual plan will be reviewed for acceptance by Health Canada.

15. DEFINITIONS

1. **Accredited Laboratory:** refers to a laboratory for which an accreditation body carries out site assessments and operates a proficiency testing program. The laboratory should be proficient in testing the parameters that are being sampled for.

   An accredited laboratory can also refer to one that is licensed or approved by the province/territory for the analysis requested.

2. **Bacteria:** Simple, unicellular organisms with an average size of 1/1,000 mm diameter.

3. **Background colonies:** Background colonies are reported as the number of non-target colonies counted in a total coliform membrane filter test. Background colony levels in excess of 200 colony forming units/100mL can interfere with the analysis and interpretation of certain total coliform tests.

4. **Biofilm:** A heterogeneous community of microorganisms, held together by a matrix of organic material. Biofilm is found at the interface between water and a solid surface, for example, on the inside wall of a pipe in a water supply system.

5. **Coliform bacteria:** A group of bacteria commonly found in the intestinal tract of warm-blooded animals whose presence in drinking water may indicate contamination by disease causing microorganisms.

6. **Disinfection:** The destruction or inactivation, by chemical or physical processes, of organisms capable of causing disease. Spore forming bacteria and parasitic cysts can be resistant to traditional methods of chemical disinfection using in drinking water treatment.

7. **Escherichia coli (E. coli):** *Escherichia coli* is a member of the coliform group of bacteria, and is naturally found in the intestines of humans and warm-blooded animals. Unlike other bacteria in this group, *E. coli* does not usually occur naturally on plants or in soil and water. As such, it is considered the definitive indicator of recent faecal contamination of water. While most strains are non-pathogenic, some can cause serious diarrhoeal infections in humans.

   http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/escherichia_coli/index-eng.php

8. **Faecal coliforms:** This term has been replaced by thermotolerant coliforms.

9. **Heterotrophic Plate Count (HPC):** Heterotrophic plate count is a microbial method that provides an indication of the level of the general bacterial population in a sample. Other names for the procedure include total plate count, standard plate count, plate count, and aerobic plate count. HPC is a useful indicator of the overall quality of the water, but does not indicate the microbiological safety of the water.

10. **Microorganisms:** Living organisms that can be seen only with the aid of a microscope. Examples include algae, bacteria, fungi, protozoa, and viruses.

11. **Pathogen:** A disease causing microorganism.

12. **Potable Water:** Water suitable for drinking without harmful effects. Potable water should meet the most recent web version of the Guidelines for Canadian Drinking Water Quality (GCDWQ).

13. **Sanitization:** to treat by a process which destroys most microorganisms, including all pathogens. Sanitization is an effective bactericidal treatment by heat or chemical means which destroys pathogens on surfaces treated.

14. **Sterilization:** the removal or destruction of all microorganisms, including pathogenic and other bacteria (vegetative forms and spores), viruses and protozoa.

15. **Thermotolerant coliform:** Thermotolerant coliforms, previously referred to as faecal coliforms, include the portion of the total coliform group that are capable of growth at elevated temperatures (44.5□C). This group includes the genera *Escherichia*, *Klebsiella*, *Enterobacter* and *Citrobacter*. As most species within these genera are not exclusively associated with faeces, the more accurate term "thermotolerant coliforms" has replaced the term "faecal coliforms". Historically, thermotolerant coliforms were used to indicate the presence of faecal contamination, however, with the advent of specific methods for *E. coli*, it is now possible to test for *E. coli* directly.

16. **Total Coliform (TC):** Total coliform bacteria are a collection of relatively harmless microorganisms that live in large numbers in the intestines of humans and animals. Total coliforms are not faecal-specific; they occur naturally in other environments such as on plants and in soils. As such, total coliforms are used as general water quality indicators for drinking water, and *E. coli* is used to indicate faecal contamination.

    http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/coliforms-coliformes/index-eng.php

17. **Turbidity:** the cloudy appearance of water caused by the presence of suspended organic or inorganic particles. Turbidity resulting from organic material can interfere with disinfection and be a source of disease-causing organisms.

18. **Raw Water:** means water in its natural state, prior to any treatment for drinking. Raw water is also known as source water.

19. **Recreational water:** The Health Canada document "Guidance for Issuing and Rescinding Boil Water Advisories" states that during an advisory "Some local health authorities recommend that water for bathing and showering not contain more than 200 E. coli/100 mL as specified in the *Guidelines for Canadian Recreational Water Quality* (Health and Welfare Canada, 1992)." The latter guideline states "the geometric mean of 5 samples collected in a period not to exceed 30 days should not exceed 200 E. coli/100mL".

APPENDIX A

Inventory of Aircraft Fleet

Tail or Registration	Serial	Make	Model	Seating capacity	No. of Galleys	No. of Lavs	No. of fill ports	No. of potable water tanks	Food service	Filters Galley	Filter Type	Filters Lavs	Filter Type	No. of water fountains	No. of water points
									Y/N	Y/N		Y/N			

Appendix B

Inventory of Potable Water Trucks/Carts & PWC's and Filling Stations

INVENTORY OF SUPPLIER WATER TRUCKS/CARTS

Airport	Water Truck/Cart Company	Water Truck/Cart Registration Number	Water Truck/Cart Filling Station Location

INVENTORY OF AIRLINE OWNED WATER TRUCKS \ CARTS

STATUS	YEAR	SERIES	GSE ADVISOR #	DESCRIPTION	MANUFACTURER	MODEL	CAPACITY	LOCATION	BCC	BRANCH	Disinfectant Req'd (L)

INVENTORY OF AIRLINE OPERATED PWCS AND FILLING STATIONS

Airport	Owner	Location

Appendix C

Recommendations for Provision Stations and Hoses

The water transfer points between the airport source and the aircraft onboard storage and distribution system present significant opportunities for contamination. Potable water should be obtained from those transfer points approved by the competent authority. Backflow of contaminated water into the potable water system needs to be prevented by proper installation of piping, backflow prevention devices and plumbing. Water for use on aircraft should not be taken from water sources where danger of contamination exists or may develop.

The filling area should be designated for this purpose only (identified) and should be free from general waste and cleaning agents. The hose should be durable, have smooth interior surfaces and be compatible with potable water (food grade). The contact of filling hose nozzles and hose ends with the ground or any contaminating materials such as pools of water is not permitted. The nozzle on the end of the hose should be constructed so as to permit a tight connection with the filling connection of the aircraft and these connections should be disinfected regularly. The hose should be guarded (caps with keeper chains for hose ends) and stored on special reels or in lockers or cabinets that are used for no other purpose. The hose should be flushed thoroughly before using and periodically disinfected, and it should be immediately sanitized after any observed contamination from ground operations. Transfer procedures should be developed to ensure that contact with the ground and other contaminated surfaces is avoided.

Appropriate personal hygiene for employees handling water at the transfer point is important. As a minimum, employees should wash hands regularly when handling potable water related equipment. Under no circumstances should employees be tasked to simultaneously with both wastewater handling and potable water transfer.

It is recommended to ensure that a back flow prevention device is in place on the potable water provision station. It is recommended to verify with local authorities (building/plumbing departments) for specific requirements in the installation of a back flow prevention device at this point.

Please refer to the *Guide to Hygiene and Sanitation in Aviation, 3rd Edition*, WHO, 2009, for further information on the above. This document can be found at:

http://www.who.int/water_sanitation_health/hygiene/ships/guide_hygiene_sanitation_aviation_3_edition.pdf

Appendix D

Protocol for Sampling Drinking Water on Aircraft, Water Trucks/Carts, PWC, Filling Stations

1. PURPOSE

To provide the airline with the methodologies and techniques required for the sampling of drinking water onboard passenger aircraft, Water Trucks / Carts, PWC, Filling Stations

2. ANALYTICAL METHODS

Methods, preservation techniques and sample holding time utilized for this study are given in Table 2-1. (***Table 2-1 is an example***)

Table 2-1 Analytical Method Requirements

Analyte	Analytical Method	Holding Time	Bottle	Preservative[1]
Total coliform	Refer to: Standards Methods for the Examination if Water and Wastewater – latest edition published by the APHA-AWWA-WPCF*	As per method	As per method	As per method
E. coli				

[1] Preservative to be added to empty bottle by laboratory prior to sample collection.

***APHA:** American Public Health Association
***AWWA:** American Water Works Association
***WPCF:** Water Pollution Control Federation

3. MATERIALS REQUIRED

Sampling data sheet (SDS)
Copy of this protocol
Chain of Custody (COC)
Indelible pen
Sample bottles – See Table 2.1 for bottle type, size and preservative
Cooler with ice packs
Prepared alcohol wipes
Non-Latex gloves
Stopwatch
Ziplock ® or similar bags & garbage bags

4. SAFETY

Gloves shall be utilized when handling samples to minimize sample contamination and exposure to sample preservatives.

NOTE: Bottles are to be kept closed until ready to be filled.

5. PROCEDURE

5.1 Pre-Sampling Activities:

Notify laboratory and place order for sample bottles, ice packs and cooler(s) at least 48 hours prior to sampling. (Note: You will need a separate cooler for each day/location of sample collection.) The term 'tap' in this procedure means water tap, faucet, drinking fountain, or other fixture which provides water for human consumption.

5.2 Sampling Event Preparation:

- Samples are to be collected from a cold water tap only;
- Record sampling data on Sampling Data Sheet;
- Label all bottles with the Sample ID information correlating to the one listed on the Chain of Custody (COC) and Sampling Data Sheet;
- Inspect tap for aerator on outlet. If present, remove if possible, clean and disinfect;
- Indicate in Safety Data Sheet (SDS) if tap was equipped with a charcoal filter.

5.3 Sampling:

- Swab tap with alcohol wipe and allow to air dry;
- Put on gloves for each sample;
- Open tap and allow water to run for at least 30 seconds to flush tap (use stopwatch);

- Reduce water flow to allow sampling of water without splashing out of container (stream approximately 7 mm (0.25 inches) in diameter). Do not change the water flow once the sample collection has begun, as this could dislodge microbial growth;
- Do not sample from leaking taps or taps which allow water to run down outside of faucet;
- Open sterile cap of the sample bottle. Do not touch interior of cap or top of bottle. Do not place cap on counter;
- Place bottle under water stream. Allow approximately 2.5 cm (1 inch) air gap between top of bottle and water faucet;
- Do not rinse bottle. Do not fill bottle to top. Do not fill bottle past fill line. Allow 2.5 cm (1") air gap in top of bottle. Replace cap and tighten. Reinstall aerator;
- Remove gloves and dispose of them into the plastic bag.

5.4 Post Sampling:

- Complete chain of custody (COC) sheet. Ensure that sample ID matches that on the label and sampling data sheet. If COC not provided in duplicate, photocopy COC and Sampling Data Sheet for records;
- Sign and date the Sampling data sheet and COC. If there was any deviation from protocol, note at the bottom of sampling data sheet.

6. QUALITY CONTROL

Laboratories shall be accredited and/or approved, licensed by the province or territory where the sample is analyzed for the specific drinking water analyses requested. Accreditation certification must be kept on file.

7. DATA MANAGEMENT

The laboratory shall report results in accordance with the methods acceptable by the province/territory for the specified drinking water analyses.

Laboratory reports must include the date and time of sample receipt, date and time of analysis, protocol used and analyst performing test.

All sampling data sheets and associated COC sheets to be forwarded to:

Name of responsible (Airline, Trucks/Carts, PWC, and Filling Station):
Address:
Phone & Fax:

8. ATTACHMENTS (Separate Documents)

8.1 SAMPLING DATA SHEET: AIRCAFT

8.2 SAMPLING DATA SHEET: TRUCKS/CARTS, FILLING STATIONS, AND PWCS

8.3 CHAIN OF CUSTODY SHEET

8.4 DATA ENTRY/REPORTING

SAMPLING DATA SHEET: AIRCRAFT

AIRPORT: _____ DATE: _____

SAMPLER: _____ BEGIN TIME: _____

END TIME: _____

Sample ID	Date (MM/DD/YY)	Time (00:00 -24:00)	Flight No.	Aircraft Fin No.	Sampling Point*
					FGL

* Sampling Point Code

Sample point	Sample Identification
FG – Front Galley	Left side (L); Right Side (R)
BG – Back Galley	Left side (L); Right Side (R)
MG – Middle Galley	Left side (L); Right Side (R)
FL – Front lavatory	Left side (L); Right Side (R)
BL – Back lavatory	Left side (L); Right Side (R)
ML – Middle Lavatory	Left side (L); Right Side (R)
WF – Water Fountain	IBID

SAMPLING DATA SHEET: TRUCKS/CARTS, FILLING STATIONS, AND POTABLE WATER CABINETS

AIRPORT: _____ DATE: _____

SAMPLER: _____ BEGIN TIME: _____

END TIME: _____

Sample ID No.	Date MM/DD/YY	Time 00:00 hrs to 24:00 hrs	Potable Water Cabinet Location	Water Truck/Cart Company	Water Truck/Cart Registration Number	Airport Water Truck/Cart Filling Station Location

CHAIN OF CUSTODY

Date (DD-MM-YYYY)		
GENERAL INFO		
From		
Phone		
Fax		
E-mail		
ANALYSIS INFORMATION		
Matrix	Drinking water **(SAMPLE PRESERVED AS PER METHOD)**	
Analysis requested **Check box**	☐ Total Coliform ☐ E.Coli	
IN CASE OF POSITIVE RESULTS		
In case of positive results (i.e.>0), call within ___ hours and supply report via e-mail to:	Contact name	
Phone		
Cell		
E-mail		
	REPORT	**INVOICE**
Shipped to	Contact Name & Address	Contact Name & Address
Phone		
Fax		
E-mail		

CHAIN OF CUSTODY

Sample #	Date Collected (DD-MM-YYYY)	Time Collected (HH:MM)

CHAIN OF CUSTODY					
			Date DD-MM-YYYY	Time (HH:MM)	Comments
1	Sampled by*				
2	Relinquished by				
3	Received by				
Number of cooler submitted					
Number of sample submitted					

**I certify that all samples were collected in accordance with the "Protocol for Sampling Drinking Water on Aircraft, Trucks/Carts, PWC, and Filling Stations"*

---------- ----------

Signature Date

DATA ENTRY/REPORTING

AIRCRAFT

Sample ID	Date (MM/DD/YY)	Time (00:00 -24:00)	Flight No.	Aircraft Fin No.	Sampling Point*	TC Result	EC Result	Follow-up

WATER TRUCKS/CARTS/PWC/FILLING STATION

Sample ID	Date MM/DD/YY	Time (00:00-24:00)	PWC Location	Water Truck/Cart Company	Water Truck/Cart Registration Number	Airport Water Truck/Cart Filling Station Location	TC	EC	Follow-up

Appendix E

List of Water Filling Sites

Source Water: Domestic

Airport in Canada – Water Source and Treatment Method

Airport	Water Source	Treatment Method

Source Water: Foreign

Foreign Airport – Water Source and Treatment Method

Airport	Water Source	Treatment Method

Appendix F

Disinfection of Water Trucks/Carts and Hoses

EXAMPLE

1. BASIC PRECATIONS FOR MAINTAINING STERILE CONDITION:

a) The instructions regarding cleanliness, disinfection, inspection, operation, and maintenance of potable water service units must be strictly adhere to;
b) Inspect each unit at least once every 24 hours, and record details. Ensure records (develop an example) are maintained in a local file;
c) Refill each unit at least once every 24 hours (more often if necessary);
d) Disinfect each unit at least once every 30 days or less, and record.(develop log book for each unit);
e) When any work is done on the tanks, plumbing, etc., by Maintenance, complete disinfection must be carried out before the unit goes into service;
f) **DO NOT** park potable water service units in the same area as sanitary service units;
g) **DO NOT** tow potable water service units in the same train as sanitary service units;
h) When potable water servicing and sanitary servicing are done by the same operator, the water service must always **PRECEED** the sanitary service;
i) **DO NOT** fill or drain potable water service units in rooms where the waste from sanitary service units is disposed of;
j) Report malfunctioning of any equipment immediately to your Supervisor.

2. DISINFECTANT AGENT USED – AS PER MANUFACTURERS REQUIREMENTS:

a) Obtain the appropriate quantity of the disinfection solution (define type and quantity to be used for each unit);
b) Disinfection process to be develop by airline;
c) Remove the cap from the chlorinator line and pour in the chlorine solution;
d) Attach the station water supply hose to the fill line and turn on the water. This will help dispense the chlorine solution into the tank;
e) Fill up the tank completely to overflowing, shut off the water and remove the hose;
f) Connect the aircraft/supply hose to the tank water supply line by means of the adaptor, so that the water in the tank can circulate;
g) Engage the pump, and allow the water to circulate for not less than (xx) minutes;
h) Shut off the engine, and allow the water to stand for not less than (x) hours (specific contact time to be determine by airline & product used);
i) Start the engine again and allow the water to circulate for not less than (x) minutes;
j) Shut off the engine, and completely drain the chlorinated water from the unit;
k) Refill overflowing with fresh water and circulate the fresh water for not less than (x) minutes. Drain completely, flush out the aircraft delivery hose with at least (xx) gallons of water;
l) Refill with fresh water, re-cap the lines, and clean up. The unit will then be ready for use. Record disinfection.

Appendix F - (cont'd)

Disinfection record (log book) for each unit:

Truck\Cart ID	XX	
Type of disinfectant used	Name	
Disinfectant quantity required	(XX)	(Identify units)
Test & record disinfectant residual	(XX) mg/L	Targeted concentration in mg/L (i.e. (XX)mg/L)
By	John Doe	
Date	DD/MM/YYYY	
SOP #		
Signature		

EXAMPLE

PROCEDURES FOR THE DISINFECTION OF POTABLE WATER HOSES

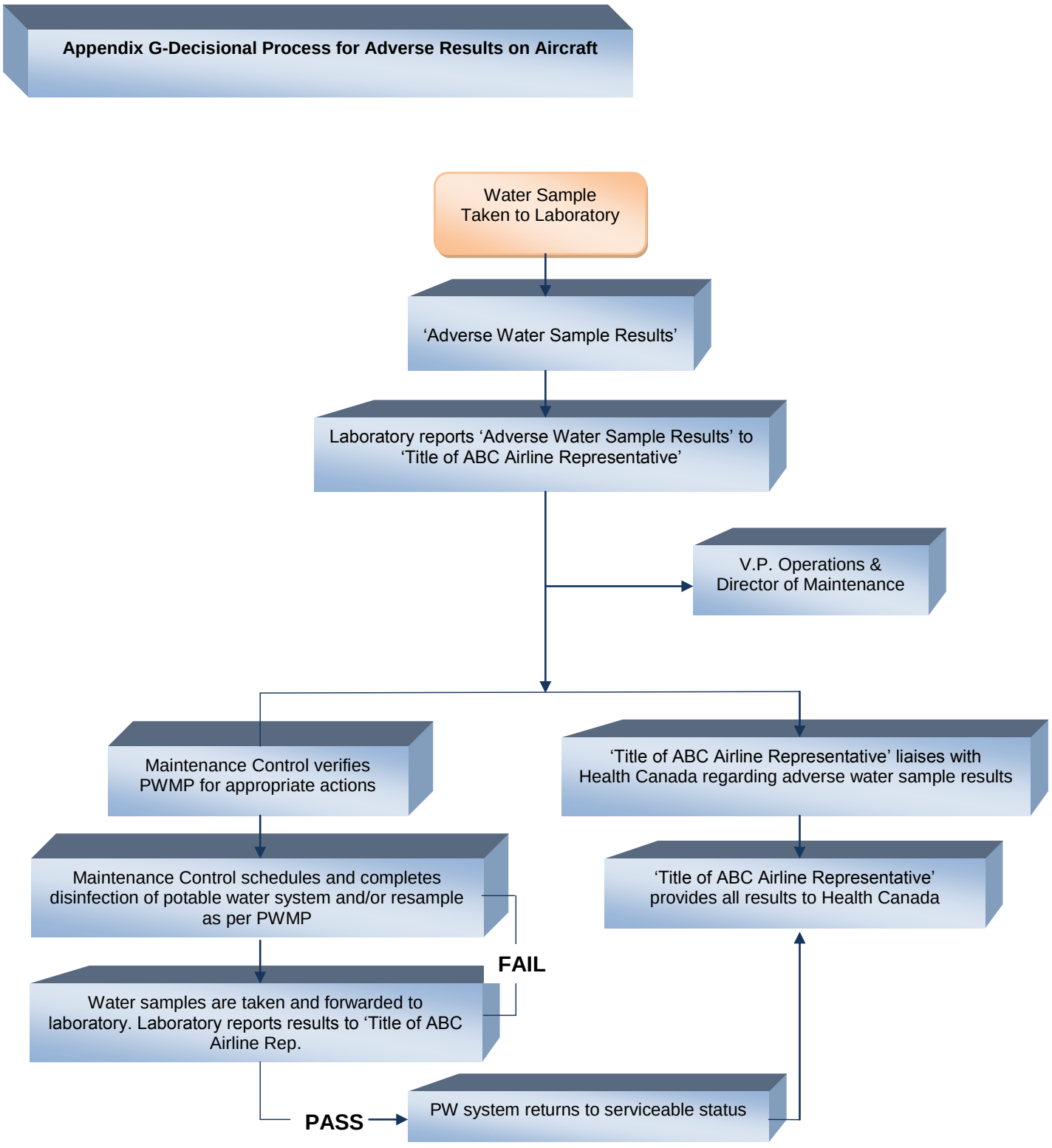
After a potential contamination and on a regular basis, hoses should be thoroughly flushed and disinfected as follows:

a) flush the hose thoroughly with potable water;
b) drain completely;
c) raise both ends of the hose, fill with disinfecting solution (a chlorine solution of 100 mg/litre free residual chlorine for example) close and let stand for 1 hour;
d) drain the disinfecting solution in a secure manner;
e) flush thoroughly with potable water before attaching to filling line.

In all cases, the hose should be flushed before attaching to the filling line. It should be drained after each use and stowed, with the ends capped, and stored on special reels or in lockers or cabinets that are used for no other purpose. Hoses and fittings should be maintained in good repair.

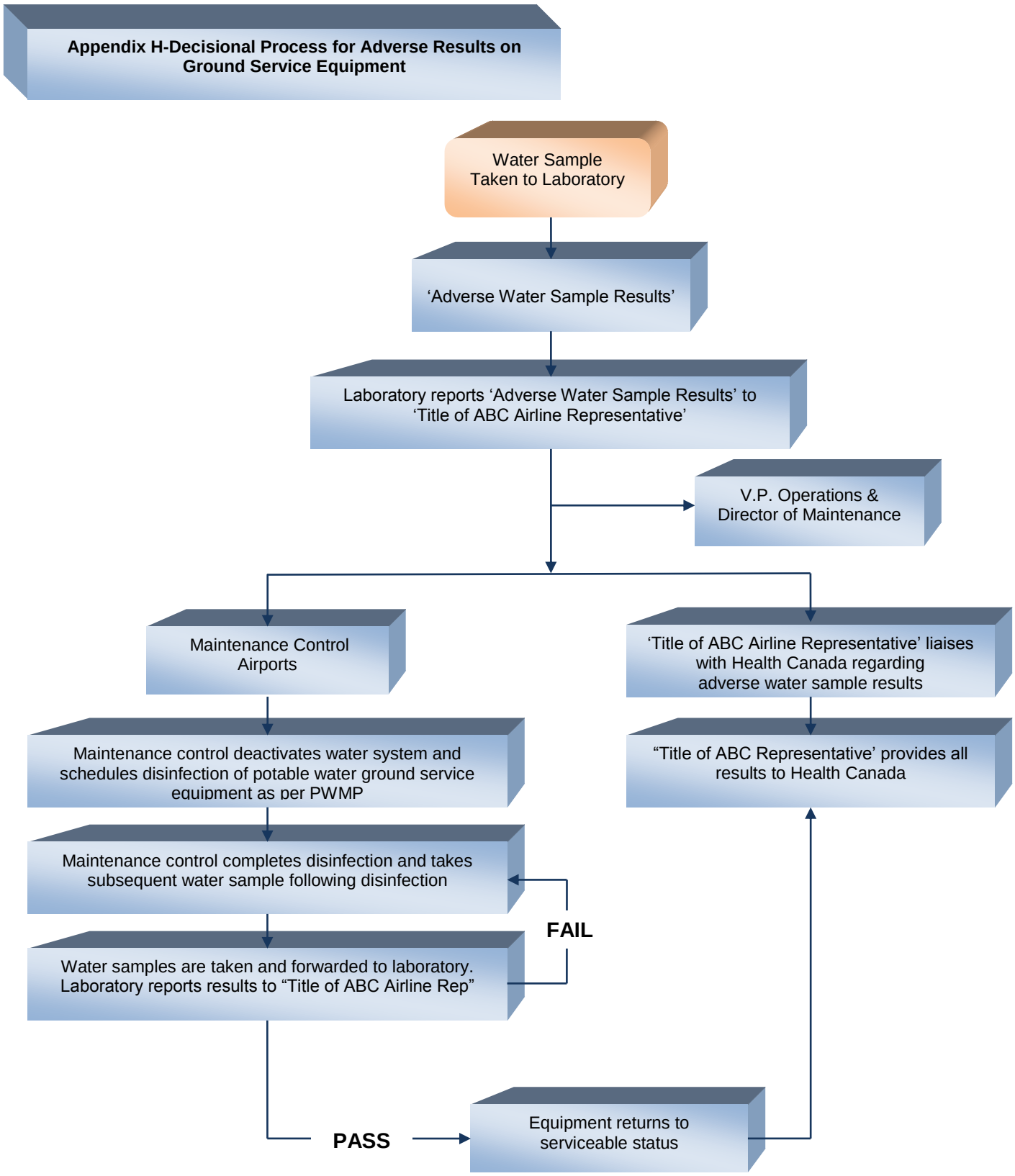
Appendix G

Adverse Results on Aircraft



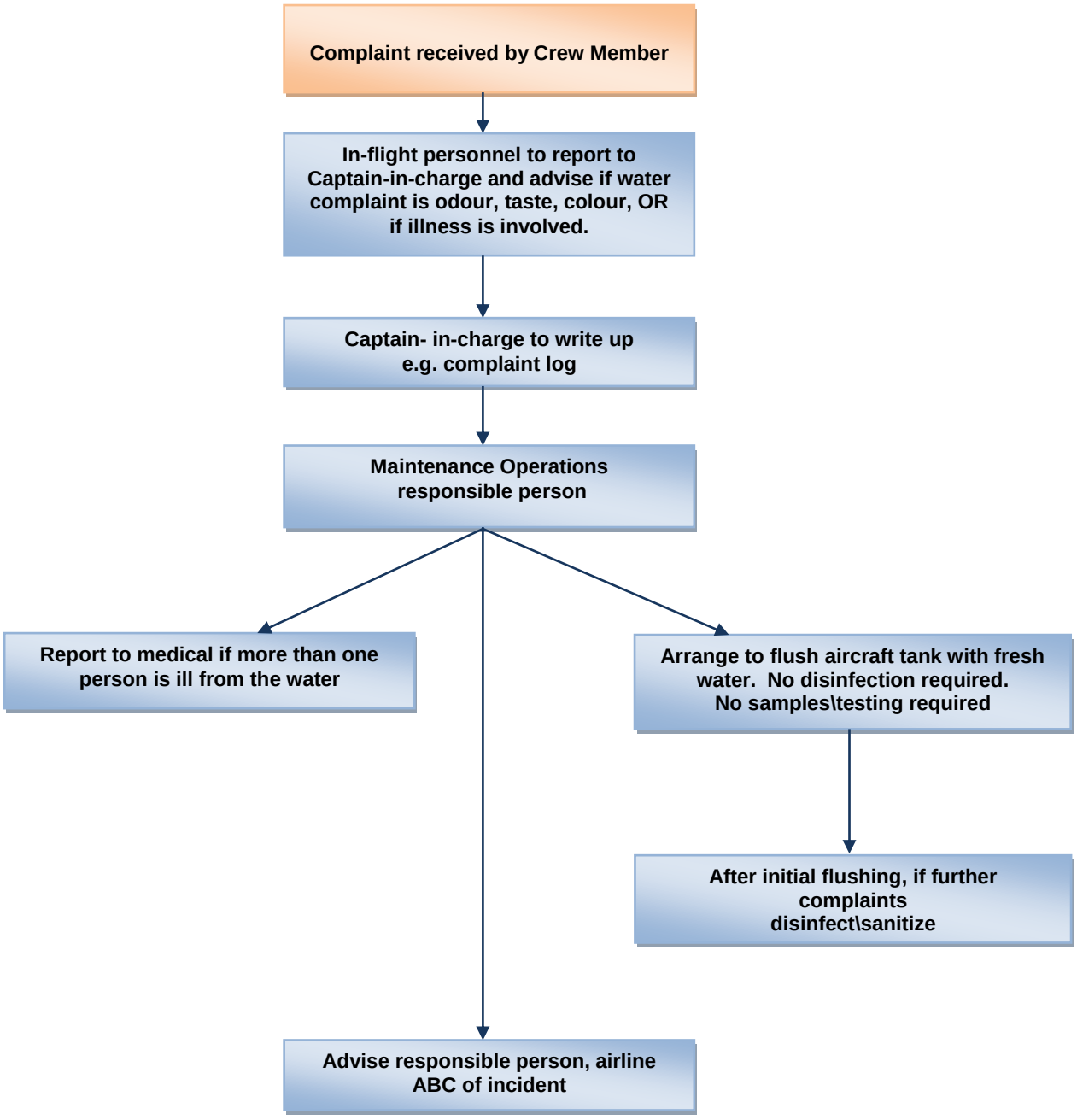
Appendix H

Adverse Results on Ground Service Equipment



Appendix I

Complaint Received From Passenger or Crew Member



Appendix I (cont'd)

Date of complaint: _____

Time of complaint: _____ AM _____ PM

Name of complainant: _____

Person recording the complaint: _____

Person responding to the complaint: _____

Complaint Description:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Action Taken:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Appendix J

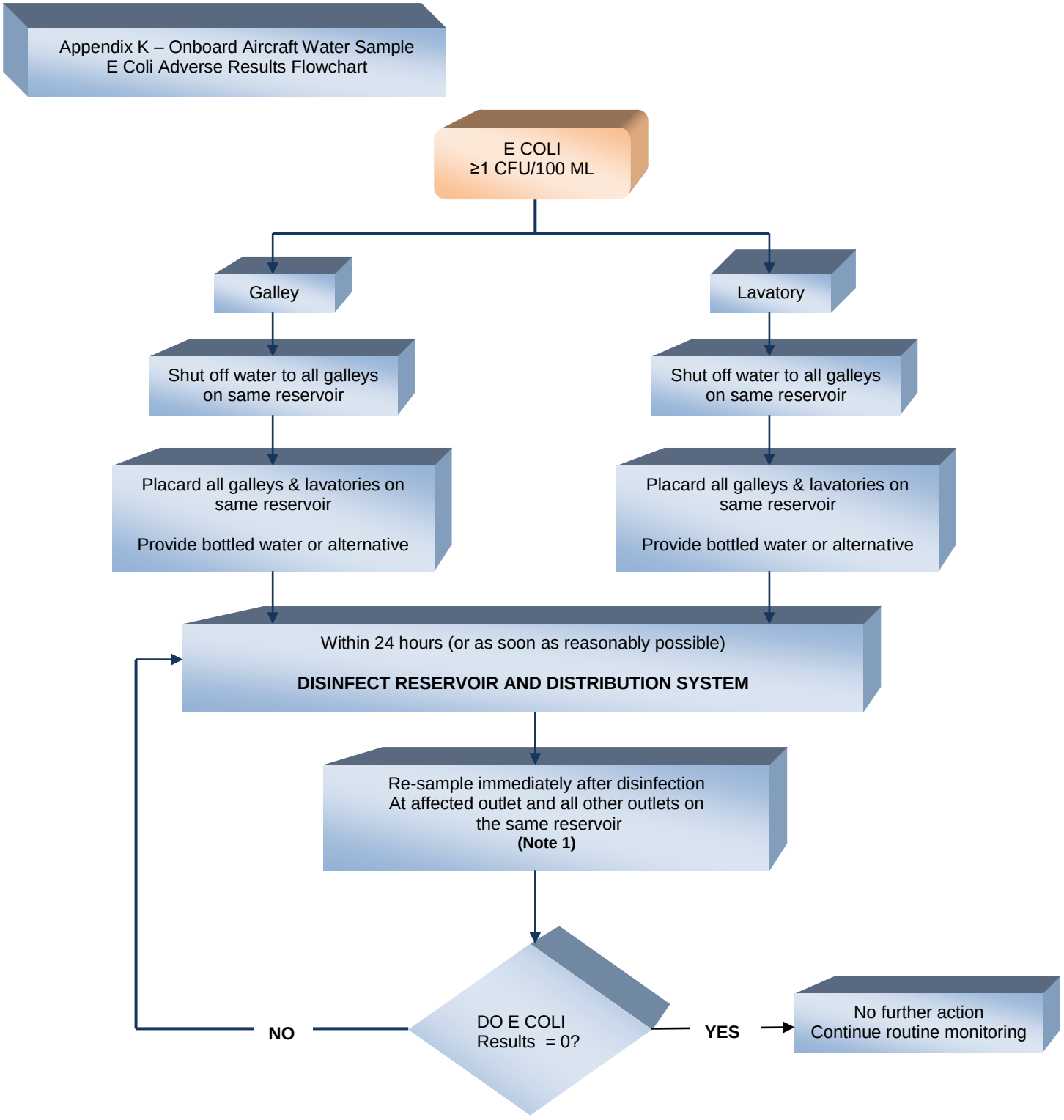
Document Control/Revision Log

ITEM	REVIEW BY	FREQUENCY	ACTION	COMPLETED Yes\No	DATE
Policy					
Legislation, guidelines, standards					
Roles and responsibilities					
Equipment inventory					
Sampling procedure					
Disinfection/sanitization procedure					
Communication protocol					
Complaint log					
Training/Education					
Record/Data management					
Definition review					
Audit					

Appendix K

Onboard Aircraft Water Sampling

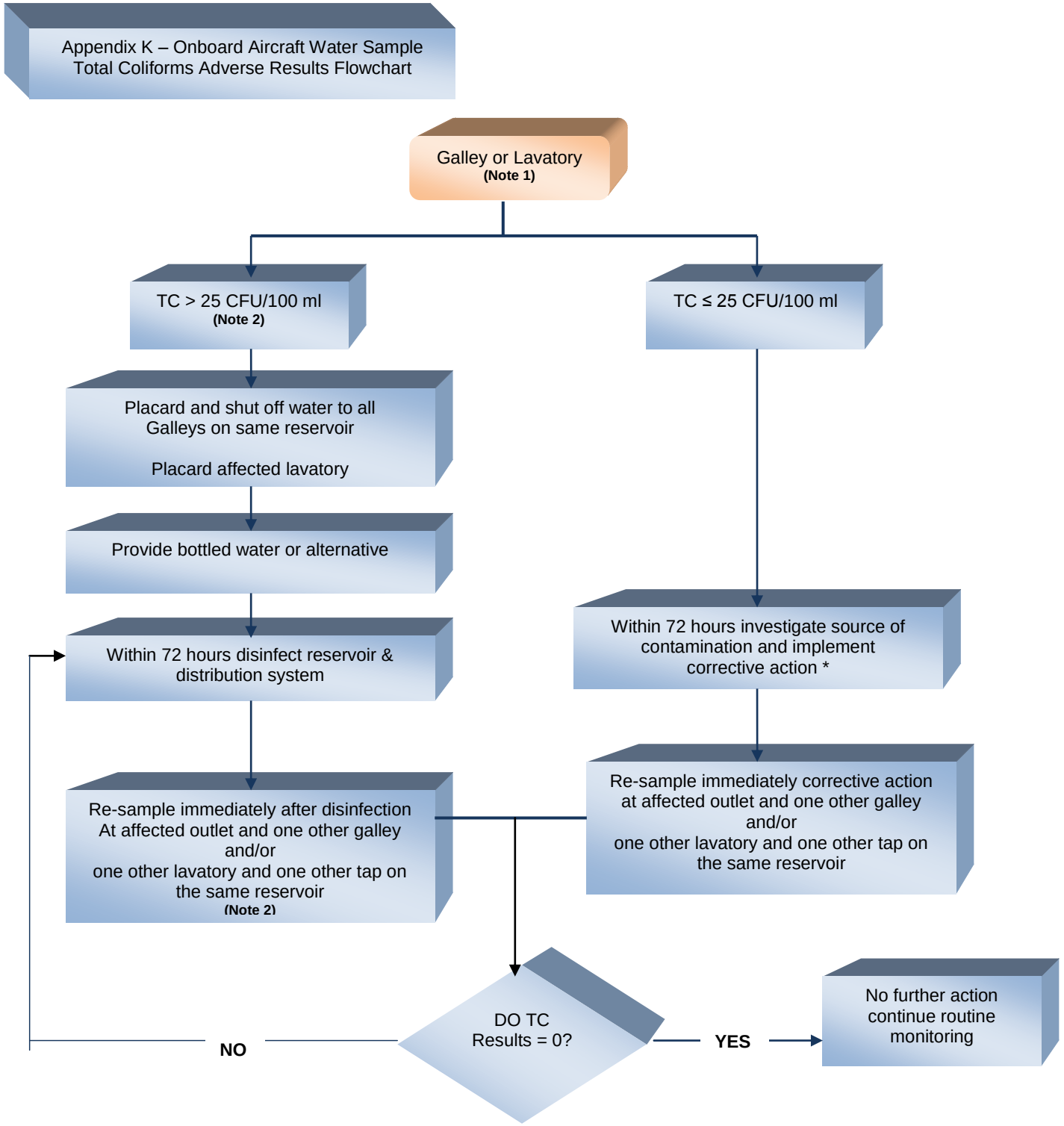
E Coli Adverse Results Flowchart



Note 1: Wait for laboratory results indicating no contamination before re-activating potable water system.

Appendix K
Onboard Aircraft Water Sampling

Total Coliform Adverse Results Flowchart



Note 1: If more than one sample, follow flowchart based on the worst TC result.
Note 2: A result of 'Presence' in a galley or lavatory or any other sampling point is to be considered > 25 CFU / 100 mL
Note 3: Aircraft potable water system can continue to operate provided that placards and bottled water are still provided.

***** If all corrective actions have been exhausted and Total Coliform re-sampling results remain above 0, a case-by-case review by Health Canada may be requested.

* Investigation of the Source of Total Coliform Contamination and Corrective Actions

The investigation of the potential source of contamination may consist of, but are not limited to, one or more of the following elements:

Review history of bacteriological sampling for the aircraft, water trucks/carts, filling stations, potable water cabinets and supply stations where water was uplifted;

Verify date that filters were changed;

Verify uplifting and sampling procedures (i.e.) disinfection procedures, hygiene;

Verify the sanitary condition of the potable water hose, trucks/carts, potable water cabinets, filling stations;

If water supply is halogenated, verify halogen level at supply stations or where water is uplifted.

Corrective actions may include, but are not limited to:

Flush aircraft reservoir and distribution system with fresh, potable water;
Disinfect aircraft filling port;
Disinfect hoses and hose ends;
Change filters;
Change faucet;
Wash hands and disinfect faucet outlet before sampling.

References

The Guidelines for Canadian Drinking Water Quality May 2008

The Guidelines for Canadian Drinking Water Quality: Guideline Technical Document Total Coliforms, February 2006

Guidance Manual for the Aircraft Drinking Water Rule – ADWR – Interim Final, EPA, October 2010