Guide to
Hygiene and Sanitation
in Aviation
Third Edition

Geneva
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# Table of contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLOSSARY</td>
<td>4</td>
</tr>
<tr>
<td>ACRONYMS</td>
<td>9</td>
</tr>
<tr>
<td><strong>1. INTRODUCTION</strong></td>
<td>10</td>
</tr>
<tr>
<td>1.1 General issue and concern</td>
<td>10</td>
</tr>
<tr>
<td>1.2 Scope, purpose and objective</td>
<td>11</td>
</tr>
<tr>
<td>1.3 Roles and responsibilities</td>
<td>12</td>
</tr>
<tr>
<td>1.4 Structure of the Guide to Hygiene and Sanitation in Aviation</td>
<td>13</td>
</tr>
<tr>
<td>1.5 Importance of the modular approach</td>
<td>14</td>
</tr>
<tr>
<td>1.6 Harmonization with the International Health Regulations</td>
<td>14</td>
</tr>
<tr>
<td>1.7 Development of the Guide</td>
<td>15</td>
</tr>
<tr>
<td><strong>2. WATER</strong></td>
<td>16</td>
</tr>
<tr>
<td>2.1 Background</td>
<td>16</td>
</tr>
<tr>
<td>2.1.1 Water supply and transfer chain</td>
<td>16</td>
</tr>
<tr>
<td>2.1.2 Water requirements</td>
<td>17</td>
</tr>
<tr>
<td>2.1.3 Health risks associated with water on aircraft</td>
<td>18</td>
</tr>
<tr>
<td>2.1.3.1 Water quality</td>
<td>18</td>
</tr>
<tr>
<td>2.1.3.2 Water quantity</td>
<td>19</td>
</tr>
<tr>
<td>2.1.4 Bottled water and ice</td>
<td>19</td>
</tr>
<tr>
<td>2.1.5 Uses of potable water on board aircraft</td>
<td>20</td>
</tr>
<tr>
<td>2.1.6 International Health Regulations</td>
<td>20</td>
</tr>
<tr>
<td>2.1.7 Overview of water safety plans</td>
<td>20</td>
</tr>
<tr>
<td>2.1.8 Applicability of GDWQ to GHSA</td>
<td>22</td>
</tr>
<tr>
<td>2.2 Guidelines</td>
<td>23</td>
</tr>
<tr>
<td>2.2.1 Guideline 1: Water safety plans</td>
<td>23</td>
</tr>
<tr>
<td>2.2.2 Guideline 2: Drinking-water quality standards</td>
<td>29</td>
</tr>
<tr>
<td>2.2.3 Guideline 3: Monitoring</td>
<td>32</td>
</tr>
<tr>
<td>2.2.4 Guideline 4: Corrective action</td>
<td>35</td>
</tr>
<tr>
<td>2.2.5 Guideline 5: Water quantity</td>
<td>36</td>
</tr>
<tr>
<td>2.2.6 Guideline 6: Independent surveillance</td>
<td>37</td>
</tr>
<tr>
<td><strong>3. CLEANING AND DISINFECTION</strong></td>
<td>39</td>
</tr>
<tr>
<td>3.1 Background</td>
<td>39</td>
</tr>
<tr>
<td>3.1.1 International Health Regulations</td>
<td>40</td>
</tr>
<tr>
<td>3.1.2 Critical aspects and rationale of cleaning and disinfection programmes</td>
<td>41</td>
</tr>
<tr>
<td>3.2 Guidelines</td>
<td>41</td>
</tr>
<tr>
<td>3.2.1 Airports: Routine cleaning and disinfection</td>
<td>42</td>
</tr>
<tr>
<td>3.2.2 Airports: Cleaning and disinfection after an event</td>
<td>43</td>
</tr>
<tr>
<td>3.2.3 Aircraft: Routine cleaning and disinfection</td>
<td>44</td>
</tr>
<tr>
<td>3.2.4 Aircraft: Cleaning and disinfection after an event</td>
<td>46</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>49</td>
</tr>
<tr>
<td>FURTHER READING</td>
<td>51</td>
</tr>
</tbody>
</table>
ANNEXES
Annex A Example of a water safety plan for an airport .................................................... 52
Annex B Example of a water safety plan for a transfer point ........................................... 54
Annex C Example of a water safety plan for an aircraft ................................................... 56
Annex D Example format for use by on-site inspectors in evaluating the sanitation status of the airline service area or transfer point ........................................................... 58
Annex E Guidance for cleaning of public areas at airport .................................................. 60
Annex F Routine cleaning and disinfection schedule for airport hotels ............................. 62
Annex G Routine aircraft cleaning and disinfection schedule ............................................ 63
Annex H Recommended attributes for aircraft disinfectant ............................................. 68
<table>
<thead>
<tr>
<th><strong>GLOSSARY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accessible</strong></td>
</tr>
<tr>
<td><strong>Adequate hygiene</strong></td>
</tr>
<tr>
<td><strong>Air break</strong></td>
</tr>
<tr>
<td><strong>Air gap</strong></td>
</tr>
<tr>
<td><strong>Aircraft water system</strong></td>
</tr>
<tr>
<td><strong>Airport water system</strong></td>
</tr>
<tr>
<td><strong>Backflow</strong></td>
</tr>
<tr>
<td><strong>Backflow preventer</strong></td>
</tr>
<tr>
<td><strong>Backflow, check, or non-return valve</strong></td>
</tr>
<tr>
<td><strong>Back-siphonage</strong></td>
</tr>
<tr>
<td><strong>Biohazard bag</strong></td>
</tr>
<tr>
<td><strong>Black water</strong></td>
</tr>
<tr>
<td><strong>Child activity facility</strong></td>
</tr>
<tr>
<td><strong>Cleaning</strong></td>
</tr>
<tr>
<td><strong>Closed joints, seams and crevices</strong></td>
</tr>
</tbody>
</table>
Closed-type construction
Construction in which places that are not easily inspectable are closed by means of dependable rat-proofing.

Communicable disease
Illness caused by organisms such as bacteria, viruses, fungi and parasites that can be directly or indirectly transmitted from an infected person to others. Sometimes the illness is not due to the organism itself, but rather a toxin that the organism produces after it has been introduced into a human host.

Competent authority
Authority responsible for the implementation and application of health measures under the International Health Regulations (IHR 2005)

Control measure
Those steps in the drinking-water supply that directly affect drinking-water quality and that collectively ensure that drinking-water consistently meets health-based targets. They are activities and processes applied to prevent hazard occurrence. [GDWQ]

Corrosion-resistant
Capable of maintaining original surface characteristics under prolonged influence of the use environment, including the expected food contact and the normal use of cleaning compounds and sanitizing solutions. Corrosion-resistant materials must be non-toxic.

Coved
Concave surface, moulding, or other design that eliminates the usual angles of ninety degrees or less.

Cross-connection
Any unprotected actual or potential connection or structural arrangement between a public or a consumer’s potable water system and any other source or system through which it is possible to introduce into any part of the potable system any used water, industrial fluid, gas, or substance other than the intended potable water with which the system is supplied. Bypass arrangements, jumper connection, removable section, swivel or change-over devices and other temporary or permanent devices which or because of which backflow can occur are considered to be cross-connections.

Deck sink
Sink recessed into the deck, usually located at tilting kettles and pans.

Disinfection
The procedure whereby measures are taken to control or kill infectious agents on a human or animal body, on a surface or in or on baggage, cargo, containers, conveyances, goods and postal parcels by direct exposure to chemical or physical agents.

Direct splash surfaces
Areas adjacent to food contact surfaces that are subject to splash, drainage, or dripping onto food contact surfaces.

Durable materials or constructions
Materials and Constructions that are able to withstand normal use and abuse.

Easily cleanable
Fabricated with a material, finish, and design that allows for easy and thorough cleaning with normal cleaning methods and materials.

Easily inspectable
Places which are open to view from the deck or conveniently accessible for inspection.

Environment control system
System that provides air supply, thermal control and pressurization for the passengers and crew traveling an aircraft used for airline operations.

Flashing
Capping or covering of corners, boundaries and other exposed edges of acceptable non-rat-proof material in rat-proof areas. The flashing strip would typically be of rat-proof material, wide enough to cover the gnawing-edges adequately and firmly fastened.
Floor sink  See deck sink

Food contact surfaces  Surfaces of equipment and utensils with which food normally comes in contact and surfaces from which food may drain, drip, or splash back onto surfaces normally in contact with food, this includes the areas of ice machines over the ice chute to the ice bins. (See also non-food contact surfaces).

Food display areas  Any area where food is displayed for consumption by passengers and/or crew.

Food handling areas  Any area where food is stored, processed, prepared, or served.

Food preparation areas  Any area where food is processed, cooked, or prepared for service areas.

Food service areas  Any area where food is presented to passengers or crew members (excluding individual cabin service).

Food storage areas  Any area where food or food products are stored.

Food transport areas  Any area through which unprepared or prepared food is transported during food preparation, storage, and service operations (excluding individual cabin service).

Grey water  All water including drainage from galleys, dishwashers, showers, laundries, and bath and washbasin drains. It does not include black water or bilge water from the machinery spaces.

Halogenation  In this context, disinfection using halogen disinfectants, such as chlorine, bromine or iodine, to treat recreational water or potable water to reduce the concentration of pathogenic microorganisms.

Indirect splash surfaces  Areas adjacent to food contact surfaces that are subject to splash, drainage, drippage, condensation, or spillage from food preparation and storage.

Non-absorbent materials  Materials whose surface is resistant to the penetration of moisture.

Non-food contact surfaces  All exposed surfaces, other than food contact or splash contact surfaces, of equipment located in food storage, preparation and service areas.

Non-toxic materials  Materials that when used in food processing areas, do not introduce harmful or injurious ingredients or substances into the food.

Open-type construction  Construction in which partially enclosed places are open to view for inspection and accessible for maintenance.

Operational monitoring  Assesses the performance of control measures at appropriate time intervals. [GDWQ]

Pandemic disease  Disease that occurs in several countries and in several regions of the world at the same time.

Personal protective equipment  Personal protective equipment is used to create a protective barrier between worker and the hazards in the workplace.

Portable  Description of equipment that is readily removable or mounted on casters, gliders, or rollers; provided with a mechanical means so that it can be tilted safely for cleaning; or readily movable by one person.

Potable water  Fresh water that is intended for drinking, washing, bathing, or showering;
for use in fresh water recreational water environments; for use in the vessel’s hospital; for handling, preparing, or cooking food; and for cleaning food storage and preparation areas, utensils, and equipment. Potable water, as defined by the WHO Guidelines for Drinking-water Quality 2004 does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potable water tanks</td>
<td>All tanks in which potable water is stored from bunkering and production for distribution and use as potable water.</td>
</tr>
<tr>
<td>Public health authority</td>
<td>Organization responsible for the protection and improvement of the health of entire populations through community-wide action, primarily by governmental agencies</td>
</tr>
</tbody>
</table>
| Public health emergency of international concern | Extraordinary event which is determined, as provided in the International Health Regulations (2005):
• to constitute a public health risk to other States through the international spread of disease and
• to potentially require a coordinated international response |
| Readily accessible    | Exposed or capable of being exposed for cleaning or inspection without the use of tools.                                                |
| Readily removable     | Capable of being detached from the main unit without the use of tools.                                                                    |
| Removable             | Capable of being detached from the main unit with the use of simple tools such as a screwdriver, pliers, or an open end wrench.            |
| Safe material         | Article manufactured from, or composed of materials that may not reasonably be expected to result, directly or indirectly, in their becoming a component of any food or otherwise affecting the characteristics of any food. |
| Scupper               | Conduit or collection basin that channels water runoff to a drain.                                                                      |
| Sealant               | Material used to fill seams to prevent the entry or leakage of liquid or moisture.                                                       |
| Sealed seam           | Seam that has no openings that would permit the entry of soil or liquid seepage.                                                          |
| Sealed spaces         | Spaces that have been effectively closed, all joints, seams and crevices having been made impervious to insects, rodents, seepage, infiltration and food fragments or other debris. |
| Seam                  | Open juncture between two similar or dissimilar materials. Continuously welded junctures, ground and polished smooth, are not considered seams. |
| Sewage                | Any liquid waste that contains animal or vegetable matter in suspension or solution, including liquids that contain chemicals in solution. |
| Smooth surfaces       | Surfaces having the following finishes (Vessel sanitation program, 2001):
• A food contact surface that is free of pits and inclusions with a cleanability equal to or exceeding that of a No. 3 finish (100 grit) on stainless steel.
• A non-food contact surface of equipment that is equal to commercial grade hot-rolled steel and is free of visible scale.
• A deck, bulkhead, or deckhead that has an even or level surface with no
roughness or projections that render it difficult to clean.

- **Smooth metal surfaces**
  - Corrosion-resistant alloys would typically have at least a No. 4 mill finish, properly applied.
  - Cast iron, cast and forged steel and cast nickel alloys, in the food area, would typically have a surface roughness not exceeding American Standard No. 125 (or equivalent).
  - Galvanized metal surfaces, where acceptable, would typically have the smoothness of good-quality commercial hot dip.
  - Other metals would typically be at least as smooth as commercial-grade rolled sheet steel and free of loose scale.

- **Splash contact surfaces**
  - Surfaces that are subject to routine splash, spillage or other soiling during normal use.

- **Surveillance**
  - Continuous and vigilant public health assessment and review of the safety and acceptability of drinking-water supplies. Two types of approaches: audit-based approaches and approaches relying on direct assessment. In audit approach, assessment activities, including verification testing, are undertaken largely by the supplier, with third-party auditing to verify compliance. In direct assessment, the drinking-water supply surveillance agency carries out independent testing of water supplies. [GDWQ]

- **Temperature Measuring Devices (TMDs)**
  - Ambient air, and water temperature measuring devices that are scaled in Celsius or dually scaled in Celsius and Fahrenheit shall be designed to be easily readable and accurate to ± 1.5°C (3°F).

- **Transfer point**
  - (to be added)

- **Traveller**
  - Natural person taking a voyage

- **Turbidity**
  - Cloudiness or lack of transparency of a solution due to presence of suspended particles.

- **Utility sink**
  - Any sink located in a food service area not used for hand washing and/or ware washing.

- **Validation**
  - Investigative activity to identify the effectiveness of a control measure. It is typically an intensive activity when a system is initially constructed or rehabilitated. It provides information on reliably achievable quality improvement or maintenance to be used in system assessment in preference to assumed values and also to define the operational criteria required to ensure that the control measure contributes to effective control or hazards. [GDWQ]

- **Verification**
  - Final monitoring for reassurance that the system as a whole is operating safely. Verification may be undertaken by the supplier, by an independent authority or by a combination of these, depending on the administrative regime of a given country. It typically includes testing for faecal indicator organisms and hazardous chemicals. [GDWQ]

- **Watering point**
  - Intermittent connection for water transfer between the hard plumbed airport water distribution system and the aircraft water system

- **Water safety plan**
  - Documented comprehensive strategy for managing and operating a water supply system.
ACRONYMS

ACI  Airport Council International
APHA  Association of Port Health Authorities
ETD  estimated time of departure
GDWQ  Guidelines for Drinking-water Quality
HPC  heterotrophic plate count
IATA  International Air Transport Association
ICAO  International Civil Aviation Organization
IHR  International Health Regulations
NTU  nephelometric turbidity units
OEM  original equipment manufacturer
POU  point of use
PVC  polyvinyl chloride
SARS  severe acute respiratory syndrome
SOP  Standard Operating Procedure
USEPA  United States Environmental Protection Agency
VOC  volatile organic chemical
WHA  World Health Assembly
WHO  World Health Organization
WSP  water safety plan
XDR-TB  extremely drug-resistant tuberculosis
1. **INTRODUCTION**

1.1 **General issue and concern**

Health and sanitation aspects of international traffic have been of concern to the World Health Organization (WHO) since 1951, when the Fourth World Health Assembly recommended that all governments should “improve sanitary and environmental conditions, especially in and around ports and airports” (resolution WHA4.80); at the same time, the need for “the sanitary protection of populations in mass movement” was also expressed (resolution WHA4.81). Subsequent resolutions of both the World Health Assembly and the Executive Board emphasized the importance of maintaining high standards of hygiene and sanitation in international traffic (particularly in relation to the provision of safe water and food and the correct procedures for the collection and disposal of wastes).

The annex to the first report of the WHO Expert Committee on Hygiene and Sanitation in Aviation (WHO, 1960a) was published in 1960 as a Guide to Hygiene and Sanitation in Aviation (WHO, 1960b). Its use was recommended by the Twelfth World Health Assembly to guide health administrations in “fulfilling their obligations under the existing International Sanitary Regulations, especially the provisions of Article 14, in providing safe food for international air traffic, and in maintaining satisfactory control of, and protection from, malaria vectors at airports” (resolution WHA12.18).

The reports of the Committee on International Surveillance of Communicable Diseases, as adopted by the World Health Assembly, also emphasized the importance of preventing disease through the improvement of sanitary conditions. The relevant articles of the International Health Regulations (WHO, 1969) laid down sanitation requirements at airports. The provision of criteria and guidelines for the use of administrations in fulfilling their obligations under the International Health Regulations forms an essential part of WHO’s functions.

In 1974, the Twenty-seventh World Health Assembly, “believing that, in view of the growth of international traffic, continuous attention should be given to the safety of food and water and the handling of wastes in such traffic”, stressed “the need for each Member State to clarify the ultimate responsibility for the safety of food and water and the proper handling of wastes in international traffic” and, furthermore, recommended that “Member States coordinate and ensure the close and active participation in such a responsibility of health authorities, port and airport management, aircraft operators, shipping companies, tourist associations, and any other service or agency concerned with international traffic” (resolution WHA27.46). At the same time, the Director-General of WHO was requested to maintain close contact with representatives of international organizations concerned with international traffic with a view to promoting the implementation and coordination of activities aimed at improving the safety of food and water and the handling of wastes, and to prepare appropriate guidance for the use of health professionals. The outcome of these activities was the publication of a second edition of the Guide to Hygiene and Sanitation in Aviation, in 1977 (WHO, 1977).

The basic principles of hygiene have not changed significantly since 1977; however, the magnitude of air transport operations has grown tremendously. The number of passengers flying on scheduled airlines rose from 438 million in 1975 to over two billion in 2006 (ICAO, 2006), figures that do not take into account the millions of charter-flight passengers and
global corporation business jet passengers whose numbers also continue to increase. Furthermore, the current trend in international civil aviation is towards aircraft of larger passenger-carrying capacity and greater range. The introduction of air service into areas with inadequate public health infrastructure such as food handling and storage, water supply and waste disposal creates a challenge for aircraft operators. To protect public health, the application of high standards of hygiene should form an integral part of airport and airline operations.

Though hygiene standards have improved during the last few decades, there remains a need to safeguard the health of crew and passengers against water and foodborne illnesses. Incidents of foodborne illness associated with international air travel that are reported from time to time (Turner, 1971; Peffers et al., 1973, McMullan et al., 2007) serve as a reminder of the need to ensure the quality of food and drinking-water on board aircraft. More recently, worldwide attention has turned to the potential for transmission of communicable diseases such as Severe Acute Respiratory Syndrome (SARS) and extremely drug-resistant tuberculosis (XDR-TB) on board aircraft, which has renewed interest in cleaning and disinfecting aircraft.

Based on the above considerations and the introduction of the revised IHR (WHO, 2005), WHO found it appropriate to revise the Guide to Hygiene and Sanitation in Aviation.

1.2 Scope, purpose and objective

The Guide addresses water, food, waste disposal, cleaning and disinfection, vector control and cargo safety, with the ultimate goal of assisting all types of airport and aircraft operators and all other responsible bodies in achieving high standards of hygiene and sanitation, to protect travellers and crews engaged in air transport. Each topic is addressed individually and Guidelines provide procedures and quality specifications that are to be achieved for each medium.

The guidelines in this document apply to domestic air travel as well as international air travel for all developed and developing countries.

While aircraft and airports operators should have a plan to respond to deliberate acts that may threaten public health, it is not within the purview of this Guide to cover this issue. It is also not the intention to address cabin air quality at this time since it is covered extensively elsewhere (WHO, 2006, 2008). Finally, the Guide will not address the epidemiological aspects of illnesses related to problems associated with the topics covered.
1.3 Roles and responsibilities

In addition to the responsibility of the individual stakeholders (aircraft and airport operators, ground service providers, etc.) a selected few international bodies, such as the International Civil Aviation Organization (ICAO), the International Air Transport Association (IATA) and the Airport Council International (ACI), play an important role in protecting the health of passengers and crew.

The aircraft operators are involved at many levels in the chain of events that provide a hygienic and sanitary environment for air travellers. For example, aircraft operators obtain potable water from numerous sources, and they have to make sure that each provides drinking water of acceptable quality. Water transfer is a key aspect of loading water onto the aircraft from the mains supply. The airline has the responsibility, usually under the surveillance of the airport health authority, to ensure that proper transfer procedures are observed.

The security of the potable water supply at the airport (including for provision to aircraft) is generally under the operational responsibility of the airport operator. The airport operator is generally subject to surveillance by the governmental authority responsible for regulating or licensing environmental health standards for facilities open for public use.

The airline has full responsibility for the management of water on board the aircraft; proper water system operation and maintenance procedures are essential to ensure that all of the intended potable water on board is safe. Cleaning of the aircraft water tanks at regular intervals is part of the aircraft maintenance process.

Airlines are responsible for the food they serve on board the aircraft, whether it is prepared in an airline-owned “flight kitchen” or is obtained from an independently owned catering company. The steps involved — including food preparation, transport to the aircraft, storage and finally serving on the aircraft — need to be well coordinated in order to avoid contamination.

Routine cleaning and disinfection are also important aspects of airline and airport operations. In addition, aircraft disinfection procedures following transport of a suspected case of communicable disease is a particularly difficult issue that needs to be addressed by many stakeholders in a cooperative approach, since not all effective disinfectants are suitable for use on board aircraft, as they can cause damage to the aircraft structure and contents. WHO, IATA, aircraft manufacturers and ICAO are the main organizations involved in determining a suitable disinfection process.

Liquid and solid waste disposal is a shared responsibility of the airlines, the airports operators and the ground service providers. Under the supervision of health authority, they have to use an effective system for the removal, transport and disposal of solid waste and waste waters.

Passengers and crews must be protected against diseases spread by insects and rodents. The range of responsibility for this aspect is wide and extends from the site selection of a future airport (away from mosquitoes breeding zones) to extermination of insects and rodents by airport and aircraft operators. The issue of aircraft disinsection is particularly controversial and will be covered in detail.
Cargo operations, especially with regards to animal transport and hazardous material is an important concern mainly for the aircraft operators. Ensuring compliance of the shippers and maintaining cleanliness of animal areas are two of the main responsibilities of the aircraft operators.

ICAO’s primary role has been the prevention of aircraft accidents, however, in 2004, the Assembly of ICAO, its governing body, stated that the “protection of the health of passengers and crews on international flights is an integral element of safe air travel,” and ICAO’s activities in this area have since increased.

Aircraft and airport operators should cooperate with public health authorities in public health surveillance. Public health surveillance, defined as the ongoing, systematic collection, analysis and interpretation of data about specific environmental hazards, exposure to environmental hazards and health effects potentially related to exposure to environmental hazards, for use in the planning, implementation and evaluation of public health programmes, must be implemented in the aviation sector, including airports and aircrafts. The purpose of conducting public health surveillance is to identify outbreaks of disease and other health issues and trace the cause or causes in order to control, and possibly even to eliminate or to eradicate, the health risks under surveillance. Public health surveillance that involves air travellers can be particularly challenging since this population is exposed to many different potential sources of contagion, including fellow travellers, and upon arrival at an airport typically disperses quickly. The cooperation of airports and airlines in providing information to the public and to public health authorities is essential in these situations.

1.4 Structure of the Guide to Hygiene and Sanitation in Aviation

The Guide is structured into the following seven chapters:

- Chapter 1 Introduction;
- Chapter 2 Water Safety;
- Chapter 3 Cleaning and Disinfection;
- Chapter 4 Food Safety;
- Chapter 5 Waste Disposal;
- Chapter 6 Vector Control;
- Chapter 7 Cargo Safety.

Chapter 1, the Introduction, sets the Guide in its legal context, considering the IHR (WHO, 2005) and describing the relationship between the Guide and other international documents. It also describes the roles, responsibilities and relationships between the relevant stakeholders.

Each of chapters 2–7 follows the same structural approach, consisting of two sections: “Background” and “Guidelines”.

The “Background” section describes critical issues and supporting health evidence applicable to the specific topic of the chapter. The Background section also presents an overview of the health significance of aircraft with respect to the topic of the chapter.
The “Guidelines” section in each chapter of the Guide provides user-targeted information and guidance applicable to the topic of the chapter, identifying responsibilities and providing examples of practices that can control risks. This section contains a number of specific Guidelines (a situation to aim for and maintain), each of which is accompanied by a set of Indicators (measures for whether the guidelines are met) and Guidance notes (advice on applying the guidelines and indicators in practice, highlighting the most important aspects that need to be considered when setting priorities for action).

1.5 Importance of the modular approach

To properly manage the wide scope of this Guide, a “modular” approach its development has been adopted. The modular structure of the Guide will simplify subsequent updating as well.

1.6 Harmonization with the International Health Regulations

The purpose and scope of the IHR (WHO, 2005) are to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade.

Table 1.1 illustrates Public Health functions related to points of entry and the mechanisms behind the implementation of the IHR, applicable to aviation, as well as other types of international transport.

<table>
<thead>
<tr>
<th>PREVENTION</th>
<th>EARLY WARNING</th>
<th>RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring sanitary conditions</td>
<td>Inspection</td>
<td>Contingency plans</td>
</tr>
<tr>
<td>Routine control</td>
<td>Screening</td>
<td></td>
</tr>
<tr>
<td>Controlling known public health risks at ports, airports, ground crossings</td>
<td>Detecting public health events of international concern</td>
<td>Controlling events and responding to emergencies</td>
</tr>
<tr>
<td>“Sanitary conditions” at points of entry and conveyances</td>
<td>Information and verification</td>
<td>Support to investigation and control measures</td>
</tr>
<tr>
<td>Vector control, vaccination</td>
<td>Notification</td>
<td>Information and recommendations</td>
</tr>
<tr>
<td>Travellers, goods, food, water, waste, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk management</td>
<td>Risk assessment</td>
<td>Event management</td>
</tr>
</tbody>
</table>


The IHR (WHO, 2005) is a legally binding document, guided by the Charter of the United Nations and the Constitution of the World Health Organization and the goal of their universal application for protection of all people of the world from the international spread of disease, with full respect for the dignity, human rights and fundamental freedoms of persons. The core aims of the IHR (WHO, 2005) are to strengthen the use of scientific principles to prevent, detect, reduce or eliminate the sources of infection, to improve sanitation in and around ports, airports and ground crossings, to prevent the dissemination of vectors and to improve national and international activities to help prevent the international spread of disease, irrespective of
origin or source. The IHR (WHO, 2005) is an international code of practice, providing a framework within which international harmonization may be fostered and reference for public health measures applied at conveyances and ports, airports and ground crossings and for surveillance and response for public health events of international concern. The third version of the IHR (WHO, 2005) became effective on 15 June 2007. The revision and update of the Guide to Hygiene and Sanitation in Aviation supports this function, with the aim of providing specific guidance on the application of the IHR (WHO, 2005) to aviation, in the interest of providing safe drinking-water and food services to travellers as well as enabling sound hygiene and sanitation practices while mitigating infectious disease vectors.

1.7 Development of the Guide

The Guide has been developed through an iterative series of drafting and peer review steps. This has included expert network meetings, the first being held in Geneva, Switzerland, 7–8 June 2007, the second in Montreal, Canada, 22–24 October 2007, and the third and last in Toronto, Canada, 24–26 March 2008. Draft material was presented and comments were captured and collated to reach a consensus on structure and content.

A complete list of contributors to the Guide can be found in the Acknowledgements section (to be developed).
2. WATER

2.1 Background

Travel can facilitate transfer of communicable and endemic disease. The volume and rapidity of travel can cause international impact on disease. This is particularly true for aircraft, as the global span of the aviation industry requires loading people and supplies from many locations all over the world. With the 21st-century potential for millions of people to have access to air travel on a global scale come the added problems encountered by aircraft operators that transit both into and out of disease-affected areas or areas with variable and sometimes inadequate standards of general hygiene and sanitation.

One of the greatest risks is posed by the potential for microbial contamination of aircraft water by animal or human excreta. This contamination may originate from source waters or may occur during transfer operations or while water is stored on board the aircraft. Waterborne disease burdens in many parts of the world include cholera, enteric fevers (Salmonella), bacillary and amoebic dysentery and other enteric infections. These diseases are not unique to water; food may actually be the dominant risk vector in some environments. However, any location is at risk if proper procedures and sanitation practices are not continuously followed to ensure the safety of water that is used for drinking and food processing and preparation.

2.1.1 Water supply and transfer chain

Even if the water at the airport is safe, that does not ensure that it will remain safe during the transfer to the aircraft and storage activities that follow. An understanding of the aircraft drinking-water supply and transfer chain will help to illustrate the points at which the water can become contaminated en route to the tap on board the aircraft.

Generally, the aircraft drinking-water supply and transfer chain consists of four major components:

1. The source of water coming into the airport.
2. The airport water system, which includes the on-site distribution system. It may also include treatment facilities if the airport produces its own potable system.
3. The transfer point (sometimes referred to as the watering point), including the water transfer and delivery system. It is typically a temporary interconnection between the hard-plumbed distribution system of the airport (e.g. at a hydrant), and the aircraft water system, by means of potable water vehicles and carts, refillable containers or hoses. This water transfer process provides multiple opportunities for the introduction of contaminants into the drinking-water.
4. The aircraft water system, which includes the water service panel, the filler neck of the aircraft finished water storage tank and all finished water storage tanks, including refillable containers/urns, piping, treatment equipment and plumbing fixtures within the aircraft that supply water to passengers or crew.

Figure 2.1 is a flow diagram of a typical aircraft potable water supply and transfer chain. It depicts the water path from potable water source to the aircraft’s galley and lavatory taps serving passengers and crew.
2.1.2 **Water requirements**

The water storage capacity required for all purposes onboard aircraft is based on the number of occupants (passengers and crew) and the duration of flight, while being limited by weight, aircraft design and other practical considerations.

In practice, the capacity of aircraft water systems varies considerably. Examples of the potable water carrying capacities of different aircraft are given in Table 2.1.

### Table 2.1. Approximate capacity of potable water tanks on select aircraft

<table>
<thead>
<tr>
<th>Aircraft type</th>
<th>Number of tanks</th>
<th>Quantity per tank (litres)</th>
<th>Total quantity (litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A380</td>
<td>6</td>
<td>283.3 (option 377.7)</td>
<td>1700 (option 2266)</td>
</tr>
<tr>
<td>A340-500/600</td>
<td>3</td>
<td>356.7</td>
<td>1070</td>
</tr>
<tr>
<td>A340-200/300</td>
<td>2</td>
<td>350 (option 525)</td>
<td>700 (option 1050)</td>
</tr>
<tr>
<td>744 F/P</td>
<td>4</td>
<td>416.3</td>
<td>1665.2</td>
</tr>
<tr>
<td>744 Combi</td>
<td>3</td>
<td>416.3</td>
<td>1248.9</td>
</tr>
<tr>
<td>MD11</td>
<td>4</td>
<td>238.4</td>
<td>953.6</td>
</tr>
<tr>
<td>777-200ER</td>
<td>3</td>
<td>412</td>
<td>1236</td>
</tr>
<tr>
<td>777-300ER</td>
<td>3</td>
<td>435</td>
<td>1305</td>
</tr>
<tr>
<td>A330</td>
<td>2</td>
<td>350</td>
<td>699</td>
</tr>
<tr>
<td>737-300/400/500</td>
<td>1</td>
<td>75.7/113.6/151.4a</td>
<td>75.7/113.6/151.4</td>
</tr>
<tr>
<td>737-600/700/800/900</td>
<td>1</td>
<td>75.7/113.6/151.4/189.25/227.1a</td>
<td>75.7/113.6/151.4/189.25/2</td>
</tr>
<tr>
<td>787</td>
<td>2</td>
<td>511</td>
<td>1022</td>
</tr>
</tbody>
</table>

*a* Individual size, location, and capacity of each tank may vary due to customer preference and use on the aircraft.
2.1.3 Health risks associated with water on aircraft

2.1.3.1 Water quality

The importance of drinking-water as a vehicle for the transmission of infectious disease microorganisms in water supplies has been well documented. The WHO Guidelines for Drinking-water Quality (GDWQ) (WHO, 2004) identifies the broad spectrum of contaminants, including microorganisms, inorganic and synthetic organic chemicals, disinfection by-products and radionuclides, that can reach hazardous concentrations in potable water supplies and describes systematic approaches to risk management. As a general definition, safe drinking-water, as defined by the GDWQ, does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages.

The WHO Guidelines for Drinking-water Quality (GDWQ) provide comprehensive guidance to ensure the quality and safety of drinking water. Most of the concerns involving the safety of drinking-water aboard aircraft focus on acute risks because of the short-term and limited exposure conditions. Thus, microbial risks are the principal concerns, although a few risks associated with acutely toxic chemicals also exist.

The greatest microbial risks are associated with ingestion of water that is contaminated with human and animal excreta, although exposure through food preparation and direct human contact is also a significant contributor to microbial disease risks.

Studies that highlight the aircraft water safety concern have recently been conducted by the United States Environmental Protection Agency (USEPA), Health Canada and the United Kingdom’s Association of Port Health Authorities (APHA) (see Box 2.1). Total coliforms, *Escherichia coli*, *Pseudomonas aeruginosa*, enterococci and clostridia were detected in one or more studies. *E. coli* are indicative of recent sanitary faecal contamination, and some *E. coli* are human pathogens; *P. aeruginosa* are considered to be opportunistic pathogens, particularly from external contact with, for example, open wounds; intestinal enterococci are found in the intestines of warm-blooded animals, so they are indicators of faecal contamination; *Clostridium* bacteria are found in the intestines of some humans, and more so, in dogs, which again points to faecal contamination (GDWQ, p. 288).

**Box 2.1. Studies on aircraft water safety**

Recent random testing of water on aircraft by Health Canada (June 2006) found that 15.1% of aircraft tested positive for total coliform bacteria and 1.2% tested positive for *E. coli* bacteria. Most contamination was found in water from lavatory faucets indicating the possibility of localized contamination rather than general water contamination (source: www.hc-sc.gc.ca)

During a USEPA study conducted in 2004, 327 passenger aircraft were randomly tested at 12 U.S. airports that served both domestic and international routes. EPA analysed the drinking water samples from galleys and lavatories for total coliform (and in the case of a total coliform-positive result, the sample was tested for *E. coli*/fecal coliform), total residual chlorine, heterotrophic plate count, total nitrate, and nitrite. In regard to microbiological presence, 15% (49) of the aircraft tested positive for total coliform in one or more sampling sites, and 4.1% (2 out of the 327) of these total coliform positive aircraft also tested positive for *E. coli* fecal coliform. Twenty-one per cent of the aircraft tested had a non-detectable chlorine residual (USEPA, 2008).

The APHA study conducted in 1999 examined 850 samples of water from mains, bowser and aircraft sources from 13 airports in the United Kingdom. *Pseudomonas aeruginosa* was detected in 27% of all samples, total coliforms in 7.8%, *E. coli* in 0.4%, enterococci in 1.2% and sulfite-reducing clostridia in 0.4%. Of the samples with coliform contamination, 7.9% had contamination with other
There are no known reports of illness associated with drinking contaminated water on airplanes as the cause effect relationships are difficult to detect. Nevertheless, the potential for serious illness exists, particularly for people with compromised immune systems.

The water quality guidelines directly applicable to water on aircraft focus on acute risks that may be incurred by contamination during transfer from the airport, through the transfer point, or on board the aircraft. The acute focus of these specific parameters is because the exposure that would occur during a flight and be experienced by passengers will be intermittent and of short duration (hours) rather than long term or lifetime as are the basis for most of the GDWQ. Crew exposures are of a greater extent. Typically, the GDWQ assume average 60 kg adult consumption of two litres per day for a lifetime (70-year default value), 1 litre per day for a 10 kg child, and 0.75 litres per day for a 5 kg bottle fed infant.

Besides microbial organisms, a few inorganic chemical substances, such as nitrate and nitrite (which can enter the source water from agricultural activity and sewage inflow, and from sewage cross contamination in plumbed systems) and copper (which may leach into drinking-water from copper piping), may also be of health concern due to subpopulations that may be at risk from excess short-term exposures. For instance, methaemoglobinemia may be caused by the temporary exposure of infants to nitrate and nitrite among other contributing factors; and gastric irritation may result from short-term exposure to copper (WHO, 2004).

Potential significant accumulative effects of acute chemical hazards should not be overlooked, as they may lead to long-term consequences.

2.1.3.2 Water quantity
An insufficient or non-existent quantity of potable water under pressure onboard the aircraft for drinking, culinary and personal hygiene can have an impact on the health and welfare of not only the passengers but also the crew. There may not be enough water for the safe use of washrooms which may lead to toilets overflowing, odours, contaminating surfaces, inability to wash hands or for the preparation/serving of food in a sanitary manner thereby impacting on the provision of safe food to passengers.

Adequate water intake during flight is also therefore important to maintain health and well-being (Fairechild, 1996). The humidity in aircraft cabins gradually decreases on long-distance, high-altitude flights, often approaching 1% (optimum comfort is at approximately 50% humidity). As a result, bodies become dehydrated during flight, with symptoms including thirst, itchy and bloodshot eyes, dry skin and constipation. Typical water consumption is on the order of 1–2 litres per person per day. Daily total fluid consumption requirements are on the order of 3.2 litres/day (IOM, 2004). Water intake is not evenly distributed during the day and in the particularly dry environment in an aircraft, the amount of drinking water and beverages that should be supplied to aircraft passengers and crew should probably be more than 0.1 liters per person per hour. The amount of water required for handwashing and other sanitation needs should be adequately dealt with in typical passenger aircraft designs.

2.1.4 Bottled water and ice
Bottled water is considered as drinking-water by some regulatory agencies and as a food by others (WHO, 2003). For many airlines, bottled water is the primary or exclusive source of
water used for direct consumption onboard aircraft, with the exception of hot beverages. International bottled water quality specifications exist under the Codex Alimentarius Commission (FAO/WHO, 2004), and are derived from the GDWQ.

Since it is commonly designated as a food product, bottled water will not be considered further in this chapter.

For the purposes of this guide, ice supplied to aircraft for both drinking and cooling has been classified as “food”. Guidance pertaining to ice used on aircraft is contained in chapter 3 on food. The GDWQ apply to both packaged water and ice intended for human consumption (WHO, 2004).

2.1.5 Uses of potable water on board aircraft
Potable water is used in a variety of ways on board commercial transport aircraft, 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;
- reconstitution of dehydrated foods, such as soups, noodles and infant formula;
- direct ingestion from cold water taps and watering fountains;
- reconstitution and/or ingestion of medications;
- brushing of teeth in lavatories;
- hand washing in lavatories and galleys;
- cleaning of utensils and work areas;
- preparation of hot, moist towels for hand and face washing;
- direct face washing in lavatories;
- onboard showering facilities;
- emergency medical use.

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

2.1.6 International Health Regulations
Annex 1 B 1 (d) of the IHR (WHO, 2005) requires every designated airport location worldwide to develop the capacity to provide potable water for the aircraft that use their facilities. However, it is the responsibility of each aircraft operator to ensure that these standards are being upheld, not just in terms of the quality of the water taken on board from the source of supply on the ground. In accordance with Article 24 (c) of the IHR (WHO, 2005), States shall take all practicable measures to ensure that conveyance operators keep the water system free of sources of contamination and infection.

Airports should comply with the core capacity requirements of Annex 1 B 1 (d) and the role of the competent authorities to ensure, as far as practicable, that the facilities are in sanitary condition and kept free of sources of infection and contamination, as per Article 22 (b), such as providing potable water from an uncontaminated source approved by the competent authority.

2.1.7 Overview of water safety plans
Water safety plans (WSPs) are the most effective management approach for consistently ensuring the safety of a drinking-water supply. A potable water source at the airport is not a
safeguard if the water is subsequently contaminated during transfer, storage or distribution in aircraft. A WSP covering water management within airports from receipt of the water through to its transfer to the aircraft, complemented by measures (e.g. safe materials and good practices in design, construction, operation and maintenance of aircraft systems) to ensure that water quality is maintained on the aircraft, provides a framework for water safety in aviation. A general overview of WSPs follows; their specific application to the safety of drinking-water on board aircraft will be described in section 2.2.

A WSP has three key components, which are guided by health-based targets and overseen through drinking-water supply chain surveillance. They are:

1. **system assessment** to include
   - description of the water supply system in order to determine whether the drinking-water supply chain (up to the point of consumption) as a whole can deliver water of a quality that meets health-based targets.
   - identification of hazards and evaluation of risks.
   - determination of control measures, reassessment and prioritisation of risks
   - development, implementation and maintenance of an improvement plan
2. **operational monitoring** to include identification of control measures that will control hazards and risks, and verification (to determine whether the system meets health-based targets)
3. **management and communication** including preparation of management procedures and developing supporting programmes to manage people and processes (including upgrade and improvement).

The various steps involved in designing and implementing a water safety plan are illustrated in Figure 2.2. *(Note to editor: may need to be updated according to new WSP Manual)*
2.1.8 Applicability of GDWQ to GHSA

The GDWQ describe reasonable minimum requirements of safe practices to protect the health of consumers and/or derive numerical guideline values for constituents of water or indicators of water quality. Neither the minimum safe practices nor the numeric guideline values are mandatory limits, but rather health-based guidance to national authorities to establish their enforceable standards which may also consider other factors. In order to define such limits, it is necessary to consider the guidelines in the context of local or national environmental, social, economic and cultural conditions.
Nevertheless, given the global nature of air travel and the need for aircraft to board water from areas with variable and possibly inadequate standards of general hygiene and sanitation, the GDWQ or national standards should be followed, whichever are more stringent. This approach will provide passengers and crew with consistent reliable protection from the potential risks posed by contaminated drinking-water.

2.2 Guidelines

This section provides user-targeted information and guidance, identifying responsibilities and providing examples of practices that can control risks. Six specific Guidelines (a situation to aim for and maintain) are presented, each of which is accompanied by a set of Indicators (measures for whether the guidelines are met) and Guidance notes (advice on applying the guidelines and indicators in practice, highlighting the most important aspects that need to be considered when setting priorities for action).

The guiding principle for this section is ensuring that water is safe for intended use. Five of the Guidelines that fall under this principle deal with water quality and one with water quantity.

Guidelines 2-5 can all be considered components under the umbrella Guideline 1. However, their importance in ensuring safe water quality in aviation warrants that they have additional detailed elaboration.

2.2.1 Guideline 1: Water safety plans

Guideline 1 - Water safety plans are in place for each component of the water supply chain

Indicators for Guideline 1
1. Design and implement water safety plan for the airport water source
2. Design and implement water safety plan for the airport
3. Design and implement water safety plan for the transfer point
4. Design and implement water safety plan for the aircraft

Guidance notes for Guideline 1
A water safety plan (WSP) is an effective means of achieving consistency in ensuring the safety of a drinking-water supply. The entity responsible for each component of the drinking-water supply chain (i.e. water source, airport, transfer point, or aircraft) should also be responsible for the preparation and implementation of a WSP for that part of the process. General roles and responsibilities for each such component are:

- **Source water supplier** (public or private): Role is to provide to the airport a safe water supply of sufficient quantity and quality. Responsibilities are to monitor the water system by sampling water and providing sampling results to the airport authority on request, advising the airport authority of any adverse results and action to be taken, and when the water supply has or may become contaminated and action taken.
- **Airport authority**: Role is to maintain the integrity of the water supplied and to provide safe water to the occupants, travellers, visitors, workers, water haulers, transfer points to
the aircraft within the airport grounds. Responsibilities are to monitor the water system by sampling water and sharing sampling results with authorities and also stakeholders on request and to advise not only the water supplier but all concerned parties who use their water of any adverse results and corrective actions. In some circumstances the airport may be both the source water supplier and provider of treated drinking water.

- **Water haulers (transfer point):** Role is to provide water to the aircraft. Responsibilities are to maintain a safe water supply from the transfer point to the aircraft, to maintain the equipment in good working order, to monitor the water system by sampling water and sharing sampling results with stakeholders on request and reporting adverse results and action to be taken to the aircraft operator and airport authority.

- **Airline/Aircraft:** Role is to provide a safe water supply to the passengers and crew for drinking, culinary purposes and personal hygiene. Responsibilities are to maintain their onboard water tank(s) clean and free of harmful microbial contamination, to monitor the water system by sampling water, sharing sampling results with stakeholders, report adverse results to the competent authority and take corrective actions, and when and where required to advise the crew and passengers of the adverse results.

The WSP for a source and airport provider may be fairly complex due to the size and complexity of the facilities, whereas for transfers and on board aircraft they may be relatively basic. The WSP should be reviewed and agreed upon with the authority responsible for protection of public health to ensure that it will deliver water of a quality consistent with the health-based targets.

WSP objectives are met through:

a. development of an understanding of the specific system and its capability to supply water that meets health-based targets;

b. identification of potential sources of contamination and how they can be controlled;

c. validation of control measures employed to control hazards (see Figure 2.3 for examples of hazards);

d. implementation of a system for monitoring the control measures within the water system;

e. timely corrective actions to ensure that safe water is consistently supplied;

f. verification of drinking-water quality to ensure that the WSP is being implemented correctly and is achieving the performance required to meet relevant national, regional and local water quality standards or objectives.

g. provision (to include development, assessment and overall management as necessary) of appropriate training for all personnel involved in installing, maintaining, operating and monitoring all components of the water supply and delivery chain identified in the WSP.

For more information on general principles of WSPs, see section 6.7.1 of the GDWQ (WHO, 2004) and the Water Safety Plan Manual (WHO, in preparation).
1. **Airport water source**

Airports should be supplied with safest water available from the water provider. The condition of the municipal supply source water provided to the airport should be known and controlled. Piped water supply delivered to airports should be obtained from well operated and maintained systems that conform to GDWQ or national standards monitored by competent authorities. If the water provided at the airport does not meet the GDWQ or national requirements, the airport will need to either utilize a higher-quality source or provide water treatment to meet those quality goals.

2. **Airport**

The airport authority has the responsibility to ensure the availability of a sufficient quantity of appropriate quality water. An airport may receive potable water from either a municipal/public or private supply, or the airport itself may be the water supplier responsible for producing the water that it uses. In the latter case, the airport would be almost identical to a public water supplier in its operations and responsibilities. The potable water is delivered to potable water cabinets, water trucks, carts, filling stations and airport buildings through the airport’s distribution system. The delivery of the potable water to the aircraft is by designated filling hoses connected to the airport water system either directly or indirectly through water trucks and carts.

Improperly managed drinking-water can be an infectious disease transmission route at airports just as it is in municipal supplies. Most municipal waterborne outbreaks have
involved ingestion of water contaminated with pathogens derived from human or animal excreta, which could be either from water that is supplied from the source or from contamination by cross connection in the distribution system. The aircraft is a closed system and post loading contamination should not readily occur with a properly designed system. At an airport, the transfer procedure between the airport water system and the aircraft is another significant potential contamination opportunity.

Another possible cause of waterborne outbreaks is cross-contamination within the airport distribution system. Airports should ensure that water in the airport is potable through operational monitoring and should implement rigorous programmes to control cross-contamination during loading, distribution, and treatment (e.g. having a cross-connection and backflow prevention programme).

Periodic self-audits or inspections should be carried out in addition to routine water quality measurements; these may differ in complexity from audits performed on the transfer point or aircraft. Corrective actions or procedures should be established and implemented if and when contamination is shown or improper practices are suspected. Communication of this information to public health authorities and other affected individuals, such as persons served in the airport or those with responsibility over the water transfer points, is essential.

An example of a WSP for an airport can be found in Annex A.

3. Transfer point
The water transfer points between the airport source and the aircraft onboard storage and distribution system present significant opportunities for contamination. Common equipment used to transfer water includes (but is not limited to) piping, hoses, potable water cabinets, bowser, tanks, filling stations, refillable urns and jugs, and hydrants (including taps and faucets). Equipment should be constructed of appropriate materials (e.g. corrosion-resistant materials) certified for this application, properly designed, operated, labeled, maintained and used for no other purpose that might adversely affect the quality of the water. Assumptions and manufacturer specifications for each piece of equipment need to be validated to ensure that the equipment is effective.

Potable water should be obtained from those transfer points approved by the competent, responsible regulatory authority. The lines’ capacity should be such as to maintain positive pressure at all times to reduce the risk of backflow. There should be no connections between the potable water system and other piping systems. 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 drinking and culinary use on aircraft should not be taken from water closets, washrooms or other places where danger of contamination exists or may develop.

Post-type or wall-type hydrants are preferred, but ground-level-type hydrants can be acceptable when necessary. Where hoses are used for loading potable water on aircraft, the hydrant outlet should have a type of coupling that will permit quick attachment and removal of the hose. For a hose permanently attached to the hydrant outlet, a threaded fitting will be acceptable. Outlets to all hydrants should terminate in a downward direction or gooseneck, except that ground-level-type hydrants may discharge horizontally. When the hydrant is of the ground-level type or is located in a pit, precautions should be taken in the construction of the transfer point to assure drainage from the hydrant area and from the hydrant box area.
adequate to prevent flooding. In new servicing areas, hydrants with weep holes are not recommended. Hoses should have smooth interior surfaces, be free of cracks, checked on a regular basis, and be sufficiently durable to withstand hard usage. 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 should be of a different size from that of any waste connections on the aircraft. All hose connections should be of the quick-coupling type, unless the hose is permanently attached to a water cart or hydrant. Water hose nozzles and the hose ends should not touch the ground or any contaminating materials, such as pools of water on the ground. Hose guard systems are designed in many forms. Guards, discs, balls or other devices, which will protect the nozzle end of the hose from contamination, should be provided and properly maintained. Valves at the filling end of such a hose should not be located on the nozzle side of the disc or protective device. The hose should be stored well away from wastewater equipment and on special reels or in lockers or cabinets that are used for no other purpose. Nozzles, fittings and linkages should be covered so as to avoid contamination. The hose should be flushed thoroughly before being used and periodically sanitized, and 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.

The tanks should be designed so that they can be disinfected and flushed and should be provided with a drain that permits complete drainage of the tank. They should be labelled “DRINKING WATER ONLY”. The inlet and outlet to the tank should terminate in a downward direction or gooseneck and should be provided with caps or closures with keeper chains for protection against contamination. The inlet and outlet should be equipped with couplings of a type that permits quick, easy attachment and removal of the hose. When hoses are transported on the water cart, storage facilities should be provided on the cart to protect the hoses from contamination.

Potable water provided in refillable urns or jugs for use at water transfer points between the airport source and the aircraft onboard storage and distribution system should meet relevant international standards. In such cases, the filling area should be dedicated for this purpose only and should be free of food manufacturing waste and by-products, general waste and cleaning agents and constructed and maintained in accordance with health regulations.

Appropriate personal hygiene for employees handling water at the transfer point cannot be overemphasized, and responsibilities for potable water transfer should be considered exclusive and separate from wastewater handling to avoid cross-contamination. Under no circumstances should employees be tasked simultaneously with both wastewater handling and potable water transfer. Other issues to consider include development of transfer procedures to ensure that contact by hose nozzles with the ground and other contaminated surfaces is not permitted; and procedures to ensure that water trucks and carts are not parked directly adjacent to sewage equipment.

The above lists of equipment and processes are by no means exhaustive. It is essential that, given the wide range of transfer equipment and processes, the WSP is informed by a fundamental understanding of the specific transfer processes obtained through hazard and risk analysis of each system and each type of aircraft and developing Standard Operating Procedures (SOPs) when appropriate (e.g. when coupling/decoupling from water point and aircraft). Periodic self-audits or inspections should be carried out and can complement routine water quality measurements; these may differ in complexity from audits performed on the
airport or aircraft. Corrective actions or procedures should be established and implemented if and when contamination is shown or improper practices are suspected. Communication of this information to public health authorities and other affected individuals, such as those with responsibility over the aircraft, is essential (USFDA, 1995).

An example of a WSP for a transfer point can be found in Annex B.

4. Aircraft

If WSPs at the airport and transfer points have been developed and implemented correctly, the water provided to the aircraft should be of acceptable quality. In the event that such available water being provided to the aircraft does not meet the GDWQ or national requirements, then the airline must take measures to ensure that water on board is safe. These may include, for example, a decision not to board water at that location or to obtain water from an alternative source, such as a contract provider.

Aircraft water systems include the water service panel, the filler neck of the aircraft water storage tank, and all water tanks, refillable containers/urns, piping, treatment equipment and plumbing fixtures within the aircraft that supply water for use by passengers or crew. In modern aircraft, water is generally stored in tanks. These should be constructed of welded stainless steel or reinforced fibreglass. They feed, either by pressure or by gravity, all aircraft water outlets (i.e. hand washing-basins, galley taps, drinking fountains and water heaters. Tanks should be designed to drain completely. If the aircraft has only one tank, or if several tanks are located together, there should be a single fill/overflow point; if, on the other hand, the tanks are located in different parts of the aircraft, each should have its own fill point. In all cases, the fill points should be separated from the toilet servicing panels to avoid cross-contamination. Drinking-water access points should be sited outside toilet compartments. If appropriate, the water should be cooled by passing through automatic coolers. All components in the water system should be corrosion resistant and suitable for use with hyper chlorinated water. On some aircraft, carbon filters are used to neutralize the chlorine in the drinking-water at the tap for taste purposes. On occasion, these are incorrectly described as purifying filters. If they are not serviced regularly, the cartridges may disintegrate. Also, once the chlorine content has been removed, the water has no protection against bacteria introduced downstream from the filter, and heterotrophic plate count (HPC) regrowth may occur. Such filters should therefore be fitted at each water outlet. If desired, point-of-use (POU) treatment devices exist with the capability of removing, inactivating or killing microorganisms in drinking-water. Careful testing and selection are necessary to determine the appropriateness and performance characteristics of candidate devices. POU devices are intended not to replace disinfection of the bulk water, but to provide an extra safety measure if it becomes necessary.

In some aircraft, water is stored in refillable urns or jugs or the aircraft tank supply is supplemented by an extra quantity in flasks. This practice is not recommended—particularly in the case of drinking-water—because of the great risk of contamination of flasks, since these are offloaded at all airports and may not always be properly disinfected before being refilled. However, in the case where refillable urns or jugs are used, suppliers of refillable urns or jugs installed as part of the aircraft onboard water storage and distribution system should meet appropriate international standards. Aircraft onboard water distribution systems incorporating refillable urns or jugs should be maintained using the original manufacturer’s guidance or approved bottle-change/cleaning procedures.
Manufacturer specifications and assumptions for proper use of each piece of equipment should be validated to ensure that the equipment is effective. Periodic self-audits or inspections should be carried out and can complement routine water quality measurements; these may differ in complexity from audits performed on the airport or transfer point. Corrective actions or procedures should be established and implemented if and when contamination is shown or improper practices are suspected. Communication of this information to public health authorities and other affected individuals, such as passengers and crew on board the aircraft, is essential (USFDA, 1995).

An example of a WSP for an aircraft can be found in Annex C.

2.2.2 Guideline 2: Drinking-water quality standards

**Guideline 2 - All water onboard aircraft intended for human contact meets GDWQ or national standards, whichever are more stringent.**

**Indicators for Guideline 2**

1. *E. coli* or thermotolerant coliforms are not be detectable in any 100-ml sample.
2. A disinfectant residual is detectable in water samples at the airport, transfer point and aircraft.
3. At a minimum, nitrate is not detectable above 50 mg/l (or 10 mg/l as nitrogen) and nitrite is not detectable above 3 mg/l (or 1 mg/l as nitrogen)
   All samples meet GDWQ or national standards for substances of acute significance, while their long-term averages meet applicable standards for substances of long-term significance.
4. Temperature, pH, ionic composition and alkalinity are controlled within appropriate ranges for the particular water type to minimize corrosivity and potential leaching of metals such as copper, lead and iron
5. Turbidity is monitored and increases in turbidity are investigated to ensure that water has not been subjected to post-treatment contamination
6. No undesirable tastes, colours, or odours are present in the drinking water
7. All airport and aircraft hand-washing facilities supply potable, hot and cold running water or warm running water. Each drinking-water tap supplies running water at room temperature or colder. The temperature of the water is comfortable for its intended use, but not so scalding as to discourage use or inflict injury. Water pressure is sufficient for the intended purpose

**Guidance notes for Guideline 2**

All of the water on the plane intended for drinking, food preparation or human contact should be potable and meet the GDWQ specifications or national standards, whichever is are more stringent. Specific requirements applicable to water on aircraft are provided in Guideline 2. If the water provided at the airport, transfer point, or aircraft does not meet the GDWQ or national requirements, the appropriate responsible entity must take measures to ensure that water on board will be safe. These may include, for example, providing water treatment, deciding not to board water at that location, and/or obtaining water from an alternative source, such as a contract provider.

More detailed discussions can be found in the GDWQ (WHO, 2004).
1. *E. coli* (or thermotolerant coliforms)

By far the greatest risks in drinking-water are associated with microbial contamination from human excreta sources. *E. coli* or thermotolerant coliforms are utilized as the indicators of potential contamination with pathogens associated with human excreta. These should be measured using generally accepted analytical techniques.

In some instances, local source water contamination may indicate the potential for presence of protozoan pathogens such as *Cryptosporidium* or viruses whose presence may not be well indicated by *E. coli* or thermotolerant coliforms and that require more stringent treatment. Based upon the findings of the WSP, additional controls and measurements may be necessary.

Heated water utilized for beverage and food preparation adds additional protection of pasteurization if the water is heated to sufficient temperatures for sufficient times. Some organisms, such as certain viruses, are more resistant and require more stringent conditions of time and temperature for inactivation, so water should be managed to ensure their absence.

2. Disinfectant residual

The presence of a measurable disinfectant residual in the water at the point of use provides valuable information that contributes to the assurance that the water is microbiologically safe for the intended use. First, it demonstrates that the water has been disinfected; then it indicates that some level of protection is being provided during transport and storage, and that some control of bacterial growth is being provided. The most common disinfectant used is usually a form of chlorine; in that case, the residual could be free chlorine, hypochlorite or chloramine.

Chlorine disinfection of low-turbidity water with appropriate contact time and pH will control bacteria and viruses. However, some protozoa are resistant to chlorine disinfection, and their control requires other disinfectants or efficient filtration. If present, protozoa should be controlled by source water treatment (e.g. filtration or ultraviolet light for some organisms). The presence of the residual will be affected by the original dose, the disinfectant demand of the water, the type of disinfectant being utilized, the temperature, the time since application of the disinfectant and whether subsequent contamination has occurred since application of the disinfectant. A “free chlorine” residual is more biocidal than a “combined chlorine” residual. Disappearance of a free chlorine residual may also indicate post-treatment contamination. Other disinfectants such as chlorine dioxide are sometimes used; each has its strengths and weaknesses. Chlorine is a potent disinfectant, but its high chemical reactivity leads to a short life in the system. Chloramines are less potent disinfectants but are more stable in water for longer times. A disinfectant residual should be detectable at least at 0.2 mg/l for reliable measurement. As the concentration increases, the likelihood of taste detection increases.

3. Nitrate/nitrite

Nitrate and, especially, nitrite are concerns in drinking-water, because infants below 3–6 months of age are sensitive to potentially fatal methaemoglobinaemia, especially if there is concurrent gastrointestinal infection or if the water is also microbially contaminated. Usually repeated exposure is required for significant effects to be observed. If the water provided at the transfer point meets the GDWQ (50 mg/l as nitrate = 10 mg/l as nitrogen; 3 mg/l as nitrite = 1 mg/l as nitrogen), the principal concern for nitrate/nitrite contamination in the aircraft
water system would be from cross-connections with the liquid waste system. This type of contamination might also be indicated from taste and odour, colour, loss of disinfectant residual, or microbial indicator detection.

4. Corrosion-related contaminants
Corrosion in plumbing systems is a function of the stability and aggressiveness of the water towards the surfaces and fixtures that the water will contact during transport and storage. Metals such as copper, lead and iron can be leached from some materials into the water and contribute adverse taste or, in some cases, health concerns. Excess copper or iron can cause metallic taste; copper can cause gastrointestinal upset; excess lead can cause cognitive deficits from long-term high-level exposure in young children. The GDWQ guideline value for copper is 2 mg/l; iron can be detectable by taste at about 0.3 mg/l and above, and the lead guideline is 0.01 mg/l. In lieu of or in addition to monitoring for metals, appropriate management could be achieved through a corrosion control programme. The materials used in the construction of all of the surfaces (hoses, couplings, pipes, tanks, fixtures, soldered joints) that the water may contact during production, transfer and storage should be approved for water contact by an appropriate authority (regulatory or independent third party) and meet appropriate standards. The water that is being provided should not be corrosive to those surfaces and fixtures. Factors such as temperature, pH, ionic composition and alkalinity need to be controlled within appropriate ranges for the particular water type (see WHO, 2004).

5. Turbidity
Turbidity (cloudiness) is caused by light being diffused by particulate matter that may be present in the water. It also may be present in groundwater, which is usually of no sanitary significance if it is inorganic matter. It can also be caused by sloughing of biofilms. Excess turbidity in water from the treatment plant can be an indicator of insufficient water filtration treatment or inadequate control of coagulant dosing and sedimentation, and it could indirectly indicate inadequate removal of filterable microorganisms. Disinfectants function more effectively in low-turbidity water because microorganisms are often aggregated on particles rather than freely suspended in the water. Turbidity may increase slightly during transit through pipes due to particle agitation. Turbidity increase in the aircraft water after transfer from the airport to the aircraft could indicate that foreign matter has entered the system during the transfer. WHO does not set a health-related turbidity guideline but recommends 0.1 nephelometric turbidity units (NTU) as a process performance parameter for effective disinfection (GDWQ, WHO, 2004). However, this value is for water leaving the treatment plant rather than for water in distribution.

6. Aesthetic parameters (odour/colour/taste)
Aesthetic parameters such as undesirable taste, colour or odour that appear after water treatment may be indicative of corrosion or cross-contamination, cross-connections, contamination by foreign substances during transfer to aircraft, or inadequate plumbing conditions on board the aircraft. They signify the need to determine their cause and to take corrective actions so that the water on the aircraft is both potable and palatable.

7. Temperature
Cool water is generally more palatable than warm water, and temperature will impact on the acceptability of a number of other inorganic constituents and chemical contaminants that may affect taste. High water temperature enhances the growth of microorganisms and may increase taste, odour, colour and corrosion problems (WHO, 2004) (see also No. 4 above).
Guideline 3 - Critical water quality parameters are monitored

Indicators for Guideline 3
1. Monitoring at airport water taps is carried out at locations to ensure that persons served by the airport are provided safe water. Recommended parameters monitored at entrance to transfer point are \textit{E. coli} or thermotolerant coliforms, disinfectant residual, nitrate/nitrite, corrosion related contaminants, turbidity, and aesthetic parameters.
2. Monitoring at transfer point takes place to ensure that water boarded on aircraft is safe. Recommended parameters that should be monitored at transfer point to aircraft (includes bowsers, trucks, carts, hoses, refillables) are \textit{E. coli} (or thermotolerant coliforms), disinfectant residual, and if required, turbidity.
3. Monitoring on aircraft is carried out at locations to ensure that persons on board the aircraft are provided safe water. \textit{E. coli} or thermotolerant coliforms, disinfectant residual (if applicable), nitrate/nitrite, corrosion related contaminants, turbidity, and aesthetic parameters. The monitoring should take place each time the aircraft is serviced in the hangar, in addition to regular \textit{E. coli} spot checks while in service. Recommended parameters are monitored at representative taps (such as galley, lavatory, drinking fountains) is \textit{E. coli} (or thermotolerant coliforms). Complaints about aesthetic parameters (odour/colour/taste) trigger further investigations into the water quality. Disinfectant residuals are also measured after the aircraft has been disinfected and flushed.
4. All critical parameters are monitored at a sufficient frequency to ensure safe water.

Guidance notes for Guideline 3
In addition to national standards applicable to a particular component of the water supply chain:

1. Airport
The piped water supply delivered to airports should 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). In the event of a contamination occurrence of water provided to the airport, the airport should complete corrective action and notify the party responsible for transfer of water to the aircraft as soon as possible so it can take mitigation measures or prevent the boarding of contaminated water on the aircraft. Documentation (recordkeeping) of monitoring should be kept for assurance and analysis in the event of an incident.

No \textit{E. coli} (or thermotolerant coliforms) should be detected in any 100-ml sample of the water. A positive test may be an indication of potential pathogenic (primarily bacterial) microorganisms associated with human excreta.

The presence of a measurable disinfectant residual contributes to assurance that the water is microbially safe for the intended use. The presence of the residual will be affected by the original dose, the disinfectant demand of the water, the type of disinfectant being utilized, the temperature, the time since application of the disinfectant and whether subsequent contamination has occurred since application of the disinfectant. Disappearance of a disinfectant residual may also indicate post-treatment contamination.
Provided that water entering the airport conforms to acceptable standards as described above, the principal concern for nitrate/nitrite contamination at the airport would be from cross-connections with the liquid waste system.

Corrosion in plumbing systems is a function of the stability and aggressiveness of the water towards the surfaces and fixtures that the water will contact during transport and storage. Metals such as copper, lead and iron can be leached from some materials into the water and contribute adverse taste or, in some cases, health concerns.

Turbidity that increases in the airport could indicate that dirt has entered the system during the transfer.

Detection of aesthetic parameters (odour/colour/taste) may indicate cross-connections with the liquid waste system.

2. Transfer point

Potable water for aircraft, including bowsers, water trucks, water carts, filling stations and potable water cabinets, needs to be obtained only from those water sources and water supplies that provide potable water of a quality in line with the standards recommended in the WHO GDWQ (WHO, 2004), especially in relation to microbial, chemical and physical requirements. In the event of a contamination occurrence of water at the transfer point, the party responsible for transfer of water should notify the airline as soon as possible so it can take mitigation measures or prevent the boarding of contaminated water on the aircraft. Documentation (recordkeeping) of monitoring should be kept for assurance and analysis in the event of an incident.

No *E. coli* (or thermotolerant coliforms) should be detected in any 100-ml sample of the water. A positive test may be an indication of potential pathogenic (primarily bacterial) microorganisms associated with human excreta.

The presence of a measurable disinfectant residual contributes to the microbial safety of water for the intended use. The presence of the residual will be affected by the original dose, the disinfectant demand of the water, the type of disinfectant being utilized, the temperature, the time since application of the disinfectant and whether subsequent contamination has occurred since application of the disinfectant. Disappearance of a disinfectant residual may also indicate post-treatment contamination.

Turbidity that increases in the aircraft water after transfer from the airport to the aircraft could indicate that dirt has entered the system during the transfer.

2. Aircraft

Potable water should be obtained from those transfer points approved by the competent, responsible regulatory authority. In the event of a contamination occurrence of water on the aircraft, the airline should notify persons on board as soon as possible and take mitigation measures or prevent the boarding of contaminated water on the aircraft. Documentation (recordkeeping) of monitoring should be kept for assurance and analysis in the event of an incident.

No *E. coli* (or thermotolerant coliforms) should be detected in any 100-ml sample of the
water. A positive test may be an indication of potential pathogenic (primarily bacterial) microorganisms associated with human excreta.

Detection of aesthetic parameters (odour/colour/taste) may indicate cross-connections with the liquid waste system. On some aircraft, carbon filters are used to neutralize the chlorine in the drinking-water at the tap for taste purposes. On occasion, these are incorrectly described as purifying filters. If they are not serviced regularly, the cartridges may disintegrate. Also, once the chlorine content has been removed, the water has no protection against bacteria introduced downstream from the filter. Such filters should therefore be fitted at each water outlet. Complaints about aesthetic parameters may indicate the need to monitor for turbidity or HPC and/or take corrective action. Turbidity that increases in the aircraft water after transfer from the airport to the aircraft could indicate that dirt has entered the system during the transfer.

Disinfectant residual should also be measured after the aircraft has been disinfected and flushed as per the aircraft manufacturer’s specifications with a test kit that is specific to the disinfectant and used as per the manufacturer’s specifications. The disinfectant residual for chlorine (the most common disinfectant) should be no less than 0.2 mg/l and no more than 5 mg/l. Testing of the disinfectant residual should be done at the cold water faucet of galley(s), fountains and some lavatories and prior to the filters being reinserted where applicable. Results should be recorded. Should the disinfectant residual be above 5 mg/l, the flushing process should be repeated and disinfectant residual remeasured and recorded.

3. Frequency of monitoring
Regular monitoring of each parameter is necessary to ensure that safe water quality is maintained, as each step in the water transfer chain provides an opportunity for contamination. Documentation (recordkeeping) of monitoring should be kept for assurance and analysis in the event of an incident.

In certain situations, the frequency of monitoring should be increased for a period necessary to determine appropriate corrective action and/or assurance that measured parameters have returned to safe levels. Examples of situations warranting increased monitoring are positive E. coli (or thermotolerant coliforms) results, excessively humid conditions, during or after natural disasters affecting source water quality, and immediately after maintenance activities that has the potential to affect water quality.

Aesthetic parameters such as odour, colour, or taste are typically “measured” through customer complaints, though the crew may also wish to do an independent periodic check. This is a subjective parameter, as individuals have different sensitivities.

Some countries may request additional monitoring for parameters over and above those requested by the GDWQ within their jurisdiction for operational or regulatory reasons. Airports, water haulers and aircraft operators should verify with their local competent authority if additional monitoring is required and what parameters the competent authority within their jurisdiction are requesting. These should be included in the WSP.
2.2.4 Guideline 4: Corrective action

Guideline 4 - Appropriate response is ensured when the water safety plan is not properly implemented or a public health risk is detected.

Indicators for Guideline 4
1. Investigative action and response procedures are established and documented
2. Investigative action and response procedures are implemented in a timely manner
3. Follow-up is performed to ensure corrective action was effective and water quality is no longer of concern

Guidance notes for Guideline 4

1. Establishment and documentation of procedures
   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 guideline values being exceeded or when other improper practices are suspected. 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, and personnel should be retrained. Any such changes should be incorporated accordingly into the WSP.

   When there is evidence of contamination, appropriate action should be taken immediately to eliminate the public health threat of such contamination. Appropriate action may include additional treatment or flushing and disinfection of transfer equipment or aircraft water tanks.

   In addition, emergency/contingency actions may need to be taken, such as the provision of water from alternative sources. During periods when corrective action is being taken, increased monitoring may be advisable.

2. Implementation of procedures
   Investigative action and response could be as basic as reviewing records or could include more comprehensive corrective action. Oversight should be provided to ensure that corrective actions are implemented in accordance with written procedures and quickly enough to minimize exposure of the traveling public, employees, visitors, etc. Such 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.

3. Verification of procedures
   Verification steps should be adequate to provide assurance that water quality has been restored to safe levels. At a minimum, monitoring as described in Guideline 3 should be performed.
2.2.5 Guideline 5: Water quantity

**Guideline 5 - Potable water is available in sufficient quantities, pressures and temperatures for all uses at the airport, water transfer points and on the aircraft**

**Indicators for Guideline 5**
1. Potable water quantities at the airport are sufficient to ensure adequate pressure at all taps to minimize potential contamination.
2. Potable water quantities at transfer points are sufficient to ensure adequate pressure to minimize potential contamination, and to replenish water supplies on board aircraft.
3. Potable water quantities on board aircraft are sufficient to meet foreseeable needs for consumption, cooking and cleaning (e.g. food preparation, sanitation, and hygiene activities), and to achieve sufficient water pressure at each tap to minimize the potential for contamination.

**Guidance notes for Guideline 5**
The basic components of a water supply for human consumption is continuity of supply, water quality and water pressure. While continuity of supply is often taken for granted until the well or the river runs dry and in most land-based facilities, for aviation it is very different.

1. **Airport**
   To achieve minimum pressures, a variety of water pumps or air pressure is used, while pressure-reducing valves are used when the system pressure is too great for the application.

2. **Transfer points**
   To achieve minimum pressures, a variety of water pumps or air pressure is used while pressure-reducing valves are used when the system pressure is too great for the application.

3. **Aircraft**
   Water supplies on aircraft must be sufficient to operate sanitary systems on the aircraft (e.g. vacuum toilet bowl rinsing rings and for humidifiers to maintain cabin comfort). Additionally, food service fixtures, coffee makers, drinking taps, and hand wash sinks (lavatories) must have sufficient supply under adequate pressure to operate as designed. Water supply tanks on aircraft must be correctly sized and pressurized for these systems to work and serve passengers and crew. Water supply tanks must be correctly sized and filled with sufficient frequency that meets expected use.

   Water at sufficient pressure is required to operate fixtures and equipment on the aircraft. Most fixtures are rated to operate at certain minimum/maximum pressures. To achieve minimum pressures, a variety of water pumps or air pressure is used, while pressure-reducing valves are used when the system pressure is too great for the application.
2.2.6 Guideline 6: Independent surveillance

Guideline 6 - Independent surveillance of drinking-water safety is performed by competent authority

Indicators for Guideline 6
1. Audit/inspection procedures are in place by competent authority
2. Documentation of water safety plan and its implementation are reviewed and feedback provided
3. The independent, competent authority response is ensured following reports of incidents with the potential to adversely affect public health.

Guidance notes for Guideline 6
Aviation water quality surveillance is an ongoing investigative activity undertaken to identify and evaluate potential health risks associated with the use and consumption of potable water in airports and on board aircraft. Surveillance contributes to the protection of public health by promoting the improvement of the quality, quantity, accessibility and continuity of potable water supplies. This guideline only addresses surveillance of these factors, and does not address surveillance relating to monitoring of or response to outbreaks or other disease events (i.e. public health surveillance).

The levels of surveillance of drinking-water quality differ widely, just as economic development and provision of community water supplies vary. Surveillance should be developed and expanded progressively, by adapting the level to the local situation and economic resources, with gradual implementation, consolidation and development of the programme to the level ultimately desired. When accepting a WSP, the competent authority in a given jurisdiction may take responsibility for surveillance of the programme, which may include performing random water sampling and the auditing of the WSP programme.

Although this guideline addresses surveillance by oversight authorities, many of the concepts discussed here could be employed by the water supplier to ensure that the WSP is being implemented effectively.

1. Establishment of procedures
In most cases, surveillance primarily consists of sanitary inspections based on the WSP of airports, transfer points, or airlines. Sanitary inspection is a tool for determining state of the water supply infrastructure and the identification of actual or potential faults and should be carried out on a regular basis.

A surveillance agent should have the authority to conduct independent inspections and verify the reliability of the supplier’s information. This does not normally need to be as frequent as the continuous control performed by airports/airlines.

Surveillance should be accomplished by authorized and trained public health authorities, or they may utilize services of qualified independent auditors and inspectors.

Specifications for qualifications of the inspectors should be established, and they should undergo essential training including periodic updates and recertification. Independent auditors and inspectors should meet the same requirements as those from the public.
Annex D provides an example of a format that can be used by on-site inspectors for use in evaluating the sanitation status of the airline service area or transfer point. It can be adapted to specific circumstances and situations that may exist in various countries and airports.

2. Review of documentation and plan implementation
All documentation pertaining to WSP should be reviewed, and WSPs should be provided by the airport authority, water haulers (transfer points), and airlines. The independent review of the WSP should include a systematic approach, based upon the components of the WSP, by external auditing of the documentation, implementation, and monitoring of critical control points.

Some of its components include inspection of employee personal hygiene through demonstration of employees following procedures, inspection and the recording of these inspections of equipment and environmental conditions to ensure dedicated equipment is used and stored in sanitary condition, and water sampling through on-site or laboratory tests. Periodic microbiological surveillance of the entire water supply system from the source to the aircraft’s galley and lavatory taps or fountains should be a key priority because of the acute risk to health posed by pathogens in contaminated drinking-water. Verification of compliance with water standards should range from the source and throughout the water system distribution. Each water point source, transferring point / critical point in the distribution system and end-point should be monitored. If not, end-points should be monitored, but one needs to be able to trace back when an unsatisfactory result is found.

Inspection of procedures or control systems should be adequate to provide assurance that responsible parties in the water supply chain are able to implement timely corrective measures. Supporting programmes should be reviewed to ensure that management procedures and training are adequate to ensure a safe supply of water.

Risk communication procedures by and to the water supplier, airport authority, water haulers (transfer points), airlines, and public should also be reviewed. A notification system should be established that integrates all parties within the water supply and transfer chain.

3. Response to incidents
Response to incidents may include written reports from the responsible party or parties or independent inspectors or written or verbal reports from affected individuals or their representatives.

The competent authority should investigate reports of incidents by interviewing reporters, responsible parties and other affected individuals, and independently verifying water quality and relevant process parameters (maintenance checklists, training records, etc.) through onsite inspections and other means.

The competent authority should coordinate with and advise the responsible part(ies) on appropriate corrective actions (modifications to water safety, management, training and maintenance plans, notification of potentially affected individuals, etc.) and ensure that remedial action plans are effective and implemented and completion is verified.
3. CLEANING AND DISINFECTION

3.1 Background

This chapter covers cleaning and disinfection procedures for both airports and aircraft.

Cleaning refers to removal of visible dirt or particles, while disinfection refers to measures taken to control, deactivate or kill infectious agents such as viruses and bacteria.

In 2006, over two billion passengers were carried by airlines operating scheduled flights (ICAO, 2006). This fact indicates that commercial air transport is potentially an efficient means for spreading communicable disease widely.

Possible routes of infection transmission that might occur onboard aircraft fall into three categories:

1. directly inhaled respiratory droplets, suspended airborne particles, or both;
2. direct contact with faecal matter, blood or other body fluids; and,
3. contact with respiratory secretions, faecal matter or body fluids deposited on surfaces or, for maintenance crews, entrained in ventilation systems.

The main source of infection to other travellers is from an infected person and proximity to an infected person is an important risk factor for airborne infection. Once an infected person has left the scene, most of the risk from droplet exposure will have been removed. The residency time of suspended airborne particles may be longer and will depend on the particles’ mass and on the ventilation rate/air circulation patterns in the cabin (ANSI/ASHRAE, 2008).

Airborne exposure aside, there is a concern that the agent of disease (pathogen) can remain in the airport or aircraft environment largely by infecting common surfaces (e.g. fomites) after the infected traveller has departed. The guidance in this chapter is directed at the second and third possible routes of transmission. In some cases the cause of illness for an individual traveller will not be known immediately and possibly not for some time afterwards. This guidance therefore adopts a “universal precaution” approach that treats all respiratory secretions, faeces, blood, and other body fluids as potentially infectious.

Sometimes, a case of communicable disease is only known several days (or longer) after the infected person has travelled and may have deposited pathogens on surfaces in the airport or on the aircraft. The risk of infection upon contact with such contaminated surfaces will depend on the viability of the organism, the number of organisms, whether the surface has been properly cleaned and/or disinfected, and whether the contaminant is touched and transferred. Frequent hand washing reduces the risk. After several days, the risk that any deposited pathogens remain in place and be transmissible is very low due to the time since deposition and routine cleaning and disinfection activities.

There may be epidemiological information, such as an outbreak occurring at the origin of the flight e.g. the 2003 episode of severe acute respiratory syndrome (SARS). In such instances, public health experts may offer specific guidance targeted at a particular pathogen. However, the likelihood of detection is low, therefore, the value of this source of evidence is limited.
To reduce the risk of transfer of pathogens from an infected person to others via surfaces or inanimate objects on the aircraft or in the airport, it is necessary for airline and airport operators, and ground handling agents, to have a coordinated plan in place to deal with the arrival of an affected aircraft having carried such a traveller, or the presence of a person with a communicable disease in the airport. For aircraft, the plan needs to take into account the unusual features of the aircraft cabin in comparison with a ground-based facility. For airports the plan should address the challenge of managing potential contamination in a large public space such as the terminal building. Such plans should also address potential contamination of an aircraft or airport with an infectious agent that is not transmitted person-to-person. Considering that an aircraft carrying an infected person is hard to identify, the focus should be on the: (a) assumption that all aircraft are periodically occupied by infected travellers and therefore require routine and frequent cleaning and disinfection; (b) the fact that certain events (e.g. vomiting onboard) lead to a greatly increased risk of disease transmission and that such incidents should be reported and lead to specific cleaning and disinfection measures.

Disinfectants tend to be oxidizers and the interior of an aircraft contains many materials susceptible to damage from cleaning products and disinfectants. Metals used in the construction of the aircraft may corrode upon exposure to such products, safety critical cables and wires may deteriorate on exposure, and aircraft furnishings may have their fire resistance properties reduced. It is therefore necessary to exercise caution in selecting suitable products and before applying these products in the aircraft. It is important to protect the health of the cleaning personnel, and to ensure effective action, therefore, manufacturer’s instructions must be followed carefully.

It is essential to provide a hygienic environment for travellers. Areas where food is prepared, stored and served, any surfaces commonly touched by people, bathroom facilities, amongst others, should be kept free from contaminants that might compromise human health, even when there is no identified outbreak of disease. Prevention or mitigation of disease transmission is the goal. Hygienic conditions also minimise the likelihood the infestation by rodents, acting as vectors of disease.

3.1.1 International Health Regulations

According to the World Health Organization International Health Regulations (WHO, 2005), airports and aircraft should be kept free of sources of infection and contamination. In addition, capacity to adopt control measures, such as cleaning and disinfection, should be in place, monitored and supervised by the competent authority, to prevent the spread of disease and its agents at airports and on aircraft.

If sources of infection and contamination that may lead to public health risk are found on board an aircraft, the affected conveyance may be required to undergo health measures, such as cleaning and disinfection, which are necessary to control risk and to prevent spread of disease (Art. 27).

Whenever health measures are taken pursuant to the IHR, they “…..shall be carried out so as to avoid injury and as far as possible discomfort to persons, or damage to the environment in a way which impacts on public health, or damage to baggage, cargo, containers, conveyances,

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1 An affected aircraft refers to one which carries sources of infection or contamination, so as to constitute a public health risk (see IHR (2005) Definitions). Aircraft affected due to criminal activity are outside the scope of the guide.
goods or postal parcels” (Art. 22) and “….initiated and completed without delay, and applied in a transparent and non-discriminatory manner” (Art. 42).

3.1.2 Critical aspects and rationale of cleaning and disinfection programmes

The critical aspects of cleaning and disinfection programmes include the availability of: cleaning schedules and procedures for timely and effective airport and aircraft routine cleaning and disinfection by designated personnel; procedures for cleaning and disinfecting after an event; effective cleaning and disinfectant agents that are not detrimental to aircraft materials; appropriate personal protective equipment and, adequate training for designated personnel.

There are several reasons why cleaning and disinfection programmes are critical to ensuring a sanitary environment in airports and on aircraft that, in turn, ensures that air travellers are exposed to minimum risk. Schedules and procedures for routine, effective, airport and aircraft cleaning and disinfection (and additional disinfection measures in higher risk areas when necessary) are vital in maintaining a hygienic environment. The availability of procedures for cleaning and disinfecting after an event \(^2\) is also critical, since body fluids such as respiratory secretions, blood, vomit and faeces may contain infectious agents that could be transmitted if not properly contained.

Cleaning and disinfection on aircraft requires special attention, since it is necessary to use agents that are not corrosive or otherwise detrimental to aircraft components - for this reason not all effective cleaning and disinfectant agents can be used in the aircraft cabin. This is because several of the materials found on board are susceptible to damage from certain cleaning/disinfectant agents.

Cleaning crews \(^3\) need to be adequately trained so they understand and respect the procedures that will ensure effectiveness of the cleaning and disinfecting agents, use the proper personal protective equipment, prevent contamination of other areas and minimize occupational health and safety risks to personnel.

Unlike the routine procedure, post-event cleaning and disinfection is not a frequent practice and the requirements are likely to differ. It is therefore particularly important that the training emphasizes these “event-driven” procedures for the cleaning crew, because they will not be as familiar as routine cleaning and disinfection procedures.

Competent authorities (authorities responsible for the implementation and application of health measures contained in IHR (2005)) have responsibilities to ensure airports and aircraft are kept free of sources of infection and contamination. The competent authority should supervise cleaning and disinfection programmes so that its obligations under the IHR (2005) are fulfilled.

3.2 Guidelines

This section provides user-targeted information and guidance, identifying responsibilities and providing examples of practices that can control risks. Five specific Guidelines (a situation to aim for and maintain) are presented, each of which is accompanied by a set of Indicators.

\(^2\) An “event” means a “manifestation of disease or an occurrence that creates a potential for disease” (IHR (2005), e.g. presence in an airport, or carriage by air, of a suspected case of communicable disease.

\(^3\) “Cleaning crew” refers to designated personnel that may undertake cleaning and/or disinfection.
(measures for whether the guidelines are met) and Guidance Notes (advice on applying the guidelines and Indicators in practice, highlighting the most important aspects that need to be considered when setting priorities for action).

3.2.1 Airports: Routine cleaning and disinfection

Guideline 1 - Airports are kept in a sanitary condition at all times

Indicators for Guideline 1
1. A documented, tested and updated routine cleaning and disinfection programme exists, assuring that premises are regularly and hygienically cleaned.
2. Appropriate number of trained personnel is available, in relation to the volume and complexity of the airport facilities and cleaning procedures.
3. Personal protective techniques and equipment are used by personnel: related equipment and information (operational procedures for its use) is available.
4. Cleaning equipment and supplies are available in relation to the volume and complexity of the airport facilities and cleaning procedures.
5. Cleaning equipment is properly identified and satisfactorily maintained and stored in a designated storage area.

Guidance notes for Guideline 1
Several aspects of routine cleaning and disinfection should be taken into account:

- Programmes for routine cleaning and disinfection should take into account the volume of passengers (e.g. peak periods, heavily used areas) and the complexity of activities at the airports (e.g. hair salons and spas, food establishments and bathroom facilities) and personnel using the terminal and other facilities.
- Airport operators should be prepared to adjust their routine cleaning and disinfection programmes if a public health risk is detected and/or if advised to do so by public health authorities.
- The routine cleaning and disinfection programme should be conducted by, or be under supervision of, the competent authority.
- During high-volume periods within the airport, increased frequency of cleaning should be considered to remove excessive accumulation of waste and debris resulting from the increased use of the airport facilities, especially washrooms.
- Precautionary cleaning of certain targeted areas of the airport may be advised if diseases of concern (e.g. norovirus or cholera) are prevalent in the airport community or at the departure points of a significant number of travellers.
- A routine cleaning and disinfection programme should consider aspects that are specific to particular areas of an airport. Guidance can be found in Annex E.
- A routine cleaning and disinfection programme should be periodically reviewed and updated as needed.
Guideline 2 - Airports are designed and constructed in a manner which facilitates proper cleaning and disinfection.

Indicator for Guideline 2
1. Facilities are designed and constructed of suitable materials (e.g. impervious, smooth and without seams) to facilitate cleaning, and to reduce the risk of harbouring insects, rodents and other vectors.

Guidance notes for Guideline 2
Several aspects of airport design and construction should be taken into account:

- Proper design will minimize the amount of accumulated debris and waste, and reduce opportunities of survival for vectors and reservoirs of disease, such as rodents and insects.
- Washrooms designed without doors and with automatic faucets (taps) using “electronic eyes” are preferable as they will reduce contact with hands/fingers.
- Providing paper wipes for hand drying will reduce the risk of cross-contamination, especially when dispensed using ‘electronic eyes’ (hand dryers can promote spread of pathogens).
- Providing paper wipes for hand drying will reduce the risk of cross-contamination (hand dryers can promote spread of pathogens).

3.2.2 Airports: cleaning and disinfection after an event

Guideline 3 - Post-event cleaning and disinfection procedures are in place to prevent spread of disease and contain infection and contamination at the source.

Indicators for Guideline 3
1. Documented, updated and tested standard operating procedures (SOPs) are in place to provide adequate disinfection after an event, in a timely manner, in accordance with technical requirements.
2. Appropriate number of trained personnel is available, in relation to the volume and complexity of the airport facilities and need of post-event cleaning/disinfection procedures.
3. Personal protective techniques and equipment is used by personnel and related equipment and information (operational procedures for its use) are available.
4. Equipment and supplies should be available in relation to the volume and complexity of the airport facilities and disinfection procedures that may be needed after an event.
5. Cleaning equipment is identified, properly maintained and stored in a designated storage area for post-event use.

Guidance notes for Guideline 3
1. Disinfection procedure for flat surfaces e.g. floors, tables, sinks should be as follows:

- If required, control pedestrian traffic through the area by directing people away from the site, posting a sign or putting up barrier tape.
- Put on protective gloves.
- Wear eye protection if a danger from splashing exists.
- Prepare the sanitizing solution of bleach according to product specifications.
Open a biohazard bag and put near the spill site. If biohazard bag is not available, label the regular waste bag as ‘biohazard’.

Using paper towels or an absorbent material, clean up the soiled material and excess liquid and place into the biohazard bag.

Change gloves if they become visibly soiled

Clean the area (remove solids and soak up liquid waste). Pour detergent solution around the spill site, and use paper towels to move the liquid into the dirty area. Once the area is wet, use the paper towels to clean the area and discard into biohazard bag.

Cover the site with clean paper towels and pour the bleach solution onto the paper towels. Wait an appropriate time, as indicated in the product instructions.

Remove the paper towels to the biohazard bag.

Rinse with water and dry the surface. Put all paper towels into the biohazard bag.

Seal used biohazard bag and assure proper transport and final disposal.

Wash hands

3. Those responsible for cleaning up vomit and human excreta and other potentially infectious materials should protect themselves with appropriate personal protective equipment, according to SOPs, such as gloves and protective clothing.

4. The following materials should be preassembled in a spill cleanup kit:

- garbage bags and masking tape;
- disposable gloves;
- eye protection
- mop
- paper towels;
- detergent solution;
- water;
- sanitizing agent, such as bleach tablets (Presept, 0.5 g sodium dichloroisocyanurate tablets) or 5% domestic liquid bleach;
- signs, barrier tape (optional);

An example of a cleaning/disinfection protocol for hotel guest rooms contaminated with body fluids can be found in Annex F.

3.2.3 Aircraft: Routine cleaning and disinfection

Guideline 4 - Aircraft are kept in a sanitary condition at all times

Indicators for Guideline 4

1. A documented, tested and updated routine cleaning and disinfection programme is available, assuring that aircraft are regularly and hygienically cleaned and disinfected.

2. Appropriate number of trained personnel is available, taking into account cleaning procedures, the type e.g. passenger or cargo, size and ground time (stopover time) of aircraft.

3. Personal protective techniques and equipment is used by personnel and related equipment and information (operational procedures for its use) is available.
4. Cleaning equipment and supplies are available taking into account the type e.g. passenger or cargo, size and ground time (stopover time) of aircraft and cleaning procedures.

5. For aircraft safety and to protect aircraft equipment, the operator’s engineering department is contacted.

Guidance notes for Guideline 4

1. The following factors should be considered when designing a program for routine cleaning and disinfection:

   - Programmes for routine cleaning and disinfection should take into account the type e.g. passenger or cargo, size and ground time (stopover time) of aircraft.
   - An example of aircraft routine cleaning and disinfection schedule can be found in Annex G; the physical areas for which cleaning and disinfection is specified in Annex G should be so included in the aircraft operator’s cleaning and disinfection programme.
   - Agents that cause communicable diseases of public health concern are susceptible to inactivation by a number of chemical disinfectants readily available from consumer and commercial markets. However, many such disinfectants are unsuitable for use on board aircraft. The recommended attributes for such disinfectants are listed in Annex H. (See Annex H, infra, for Recommended Attributes of Aircraft Disinfectant).
   - Aircraft operators should be prepared to adjust their routine cleaning and disinfection programmes if a public health risk is detected and/or if advised to do so by public health authorities.
   - Information concerning aircraft cleaning and disinfection should be available to those concerned, upon request.
   - Precautionary cleaning of certain targeted areas of the aircraft may be advised by the public health authority if certain diseases of concern (e.g., norovirus or cholera) are prevalent at the departure points.

Note – An example of an aircraft routine cleaning and disinfection schedule can be found in Annex G.

5. Operator’s engineering departments grant technical approval for each cleaning product used, based on manufacturer’s recommendations (approved cleaning products are normally listed in the aircraft maintenance manual). The use of methods and materials recommended by the operator’s engineering department should be mandatory, and public health authorities should consider the aviation aspects when developing specific national standards and technical guidance, so to avoid safety related issues.

Guideline 5 Aircraft are designed and constructed in a manner that facilitates proper cleaning and disinfection.

Indicator for Guideline 5

1. Aircraft interiors are designed and constructed of suitable materials (e.g. impervious, smooth and without seams) to facilitate cleaning, and to reduce the risk of harbouring insects, rodents and other vectors.

Guidance notes for Guideline 5

1. Several aspects of aircraft design and construction should be taken into account:
Proper design will minimize the amount of accumulation of debris and waste, and reduce opportunities of survival for vectors and reservoirs of disease, such as rodents and insects.

- Washrooms designed with automatic faucets (taps) using “electronic eyes” will reduce contact with hands/fingers
- Providing paper wipes for hand drying and a method of disposal to reduce the risk of cross-contamination (hand dryers can promote spread of pathogens).

3.2.4 Aircraft: Cleaning and disinfection after an event

**Guideline 6 - Aircraft cleaning and disinfection procedures are in place to prevent spread of disease and contain infection and contamination at the source.**

**Indicators for Guideline 6**

1. Documented, updated and tested standard operational procedures are in place providing application of cleaning and disinfection procedures adequately, according to technical requirements, in a timely manner.
2. Appropriate number of trained personnel are available, taking into account the type e.g. passenger or cargo, size and ground time (stopover time) of aircraft and disinfection procedures.
3. Personal protective techniques and equipment are used by personnel and related equipment is available.
4. Disinfection equipment and supplies are available taking into account the type e.g. passenger or cargo, size and ground time (stopover time) of aircraft and disinfection procedures.

**Guidance notes for Guideline 6**

In general, routine cleaning of contaminated surfaces with soap, or detergent and water, (after use of a spill cleanup kit, if necessary) to remove soil and organic matter, followed by the proper use of disinfectants to inactivate any remaining organisms, constitutes effective environmental management of suspected agents. Reducing the number of infectious agents on a surface by these steps minimizes the chances of transferring them via contaminated hands. The agents that cause the communicable diseases of public health concern are susceptible to inactivation by a number of chemical disinfectants readily available from consumer and commercial markets. The recommended attributes for such disinfectants are listed in Annex H.

Only disinfectants (including detergent/disinfectants) that are nationally approved for use on aircraft against any of the agents of concern and have been approved by the original equipment (aircraft) manufacturer (OEM) should be used.

Body fluids/substances (e.g. vomit from the ill traveller) should first be taken up from overtly contaminated surfaces by using an absorbent material, which should then be disposed of. Large areas contaminated with body fluids/substances (e.g. covering most of a tray table) should be treated with disinfectant after removal with absorbent material, then cleaned and given a final disinfection. Since disinfectants are not registered for use on porous surfaces, seat covers and carpeting should be removed carefully, placed in a labelled, sealed, plastic bag and laundered in accordance with the manufacturer’s instructions, or destroyed after removal.
1. A disinfection procedure should include the following steps:

- Put on protective gloves.
- Wear eye protection if a danger from splashing exists
- Clean the surface
- Use a suitable disinfectant:

Studies of hydrogen peroxide-based disinfectants containing additives such as surfactants and chelators, have shown good results in scientific studies available and some industries already using these products are reporting excellent results. Ethanol has also been found to be and effective and suitable disinfectant for aircraft. However, other materials could be considered if they are approved or registered for surface disinfection and sanitization on aircraft by an appropriate government or independent organization.

[Note: this recommendation is currently under discussion, peer reviewers’ comments are encouraged]

The following surfaces should be cleaned and then disinfected at the seat of the suspected case(s) and at adjacent seat(s) in the same row, at adjacent row(s) and other areas as noted below

- **Seat area**
  - armrests;
  - seatbacks (the plastic and/or metal part);
  - tray tables;
  - seatbelt latches;
  - light and air controls, cabin crew call button and overhead compartment handles;
  - adjacent walls and windows;
  - individual video monitor;

- **Lavatory**
  - lavatory(ies) used by the sick traveller: door handle, locking device, toilet seat, faucet (tap), washbasin, adjacent walls and counter.

- Open a biohazard bag and put near the site of contamination. If a biohazard bag is not available, label a regular waste bag as ‘biohazard’.
- The area should be cleaned of soil (remove solids and soak up liquid waste). Apply the disinfectant according to procedures approved by the OEM and as instructed on the disinfectant manufacturer’s label Once the area is wet, use paper towels to clean the area and discard into biohazard bag.
- Gloves that become visibly soiled should be changed.
- Ensure adequate contact time between disinfectant and surface for destruction of microorganisms. Adhere to any safety precautions as directed (e.g. ensure adequate ventilation in confined areas such as lavatories and avoid splashing or generating unintended aerosols).
- Any affected portion of carpet should be removed.
- Rinse with water and dry the surface. Put all paper towels into the biohazard bag.
- Remove gloves and place into the biohazard bag.
Seal used biohazard bag and assure proper transport and final disposal.

When cleaning is complete and gloves have been removed, immediately clean hands with soap and water or an alcohol-based hand rub. Avoid touching the face with gloved or unwashed hands.

Do not use compressed air and/or water under pressure for cleaning, or any other methods that can cause splashing or might re-aerosolize infectious material. Vacuum cleaners should be used only after proper disinfection has taken place.

Operation of the aircraft’s environmental control system until at least the suspect traveller has disembarked or the disembarkation process is complete may also contribute to interrupting transmission and should be performed if consistent with safety factors. Otherwise, ventilation should be provided from a ground source.

3. Those responsible for cleaning up vomit and human excreta and other potential infectious materials should protect themselves with appropriate personal protective equipment, according to SOP requirements, such as gloves and protective clothing.

4. The following considerations should be made when determining cleaning equipment and supply requirements:

The following materials should be preassembled in a spill cleanup kit:
- biohazard bags; if biohazard bag is not available, label the regular waste bag as biohazard;
- disposable gloves (non-latex materials to avoid risk of allergic reaction can be considered);
- eye protection;
- paper towels;
- detergent solution;
- water;
- disinfectant;
- signs as necessary to isolate area;

Note: For the duration of the flight, used airsickness bags should be stored in the garbage bin of one toilet compartment. They should not be flushed down the toilet, and a notice to this effect should be placed in the toilet compartment. They should be removed from the aircraft by the toilet servicing team and disposed of along with the aircraft toilet wastes. If a specific receptacle is used on the aircraft for storage of used sickness containers, it should be thoroughly cleaned, washed and disinfected after each use, and treated in the same manner as portable toilet containers.
REFERENCES


Association of Port Health Authorities (APHA) United Kingdom


McMullan et al. (2007)


FURTHER READING

Some relevant supporting documents to the WHO Guidelines for Drinking-water Quality include the following:

Health Aspects of Plumbing
This publication describes the processes involved in the design, installation and maintenance of effective plumbing systems and recommends effective design and installation specifications as well as a model plumbing code of practice. It also examines microbial, chemical, physical and financial concerns associated with plumbing and outlines major risk management strategies that have been employed, as well as the importance of measures to conserve supplies of safe drinking-water.
Published in 2006 by WHO; available at http://www.who.int/water_sanitation_health/publications/plumbinghealthasp/en/

Safe Piped Water: Managing Microbial Water Quality in Piped Distribution Systems
The development of pressurized pipe networks for supplying drinking-water to individual dwellings, buildings and communal taps is an important component in the continuing development and health of many communities. This publication considers the introduction of microbial contaminants and growth of microorganisms in distribution networks and the practices that contribute to ensuring drinking-water safety in piped distribution systems.
Published in 2004 by WHO; available at http://www.who.int/water_sanitation_health/dwq/924156251X/en/

Water Safety Plans
The improvement of water quality control strategies, in conjunction with improvements in excreta disposal and personal hygiene, can be expected to deliver substantial health gains in the population. This document provides information on improved strategies for the control and monitoring of drinking-water quality.
Published in 2005 by WHO; available at http://www.who.int/water_sanitation_health/dwq/wsp0506/en/ [this one can probably be cited as Davison et al. (2005) in place of the WSP manual citation in the text]

Water Treatment and Pathogen Control: Process Efficiency in Achieving Safe Drinking-water
This publication provides a critical analysis of the literature on removal and inactivation of pathogenic microbes in water to aid the water quality specialist and design engineer in making decisions regarding microbial water quality.
Published in 2004 by WHO; available at http://www.who.int/water_sanitation_health/dwq/watreatment/en/

Other published documents or documents in preparation may be found on the WHO website at: ...............
Annex A: Example of a water safety plan for an airport

Water Safety Plan – Airport

1) Statement of goal(s)/objective(s)/purpose of WSP

2) What are the jurisdictional requirements to follow
   - Acts/Statutes
   - Regulations
   - standards
   - guidelines

3) Organization
   - Defining Roles and Responsibilities
     - who has overall responsibility for WSP
     - who does what, what department/section is responsible for each part of the plan
   - Defining stakeholders – internal/external and their roles and responsibilities within the plan
     - Water provider to airport – may be public or private
     - Airline operators
     - Water haulers
     - Airport food establishments
     - Responsible government authority
     - Who has responsibility/ownership of watering points for aircraft, water haulers etc.

4) Operational Plan
   - Planning, performing work, checking if work plan is working and continual assessment to improve the plan.
     - Conducting a sanitary survey including baseline sampling for chemical, physical parameters etc.
     - Prepare and create documents for traceability and set-up proper recordkeeping for all facets of the WSP and review at least on an annual basis
     - Developing Standard Operating Procedures (SOPs)
     - Following industry best practices
     - An up to date inventory of all water outlet points within the airport and specify watering points used by airlines and water haulers who supply water to aircraft
     - Define sampling parameters e.g. E. coli (or thermotolerant coliforms), turbidity, disinfectant residual, etc.
     - Using acceptable methodology for sampling
     - Monitoring of water outlets and watering points and sharing information with stakeholders
     - Providing adequate training to employees – identify training required per position, document, develop checklist for training etc.
     - Recordkeeping – using spreadsheets, developing database, retaining of records
     - Developing inspection and self-audit programmes and forms
5) Communication Plan
- have a communication plan in place with identified stakeholders – who to contact - internal and external for incidents and events such as adverse results, natural disasters, construction work on the distribution system, etc.
  ▪ prepare a sampling strategy communiqué
  ▪ have a sampling results communiqué
  ▪ have a notification communication plan for adverse results e.g. posting signs
  ▪ have a water avoidance communiqué in case of natural disasters or events
  ▪ prepare an inventory of e-mail addresses, telephone numbers of stakeholders – internal/external for notification

6) Incident and Emergency Plan
- Should be in place to respond to natural disasters, events or adverse results
  ▪ identify potential emergency situations and have a written response plan
  ▪ train employees and test procedure on the response plan
  ▪ prepare emergency contact list – internal/external
  ▪ have a contingency plan to provide potable water

7) Corrective Action
- all corrective action should be documented and the root causes should be identified

8) Documentation and Processes/Procedures review
- all aspects of the WSP should be documented and reviewed at least annually by the person responsible or when there is a change in process, procedure, equipment, etc.
Annex B: Example of a water safety plan for a transfer point

Water Safety Plan – Water Haulers/Transfer/Watering Points

1) Statement of goal(s)/objective(s)/purpose of WSP

2) What are the jurisdictional requirements to follow
   - Acts/Statutes
   - Regulations
   - standards
   - guidelines

3) Organization
   - Defining Roles and Responsibilities
     ▪ who has overall responsibility for WSP
     ▪ who does what, what department/section is responsible for each part of the plan
   - Defining stakeholders – internal/external and their roles and responsibilities within the plan
     ▪ Airport Authority
     ▪ Airline operators
     ▪ Water haulers – private and those owned and operated by airline
     ▪ Responsible government authority
     ▪ Who has responsibility/ownership of watering points for aircraft, water haulers etc.

4) Operational Plan
   - Planning, performing work, checking work and plan is working and continual assessment to improve the plan.
     ▪ Prepare and create documents for traceability and set-up proper recordkeeping for all facets of the WSP and review at least on an annual basis
     ▪ Developing Standard Operating Procedures (SOPs) e.g. coupling/decoupling to aircraft, water point, good hygiene practices to follow, etc.
     ▪ Following industry best practices
     ▪ A up-to-date inventory of all watering/transfer points used by airlines and water haulers who supply water to aircraft
     ▪ Having contracts with private water haulers
     ▪ A up-to-date inventory of equipment – trucks/carts, hoses, etc.
     ▪ Maintenance records of equipment
     ▪ Define sampling parameters e.g. E. coli, turbidity, disinfectant residual etc.
     ▪ Using acceptable methodology for sampling
     ▪ Monitoring of watering/transfer points and sharing information with stakeholders
     ▪ Providing adequate training to employees – identify training required per position, document, develop checklist for training, etc.
     ▪ Recordkeeping – using spreadsheets, developing database, retaining of records
     ▪ Developing inspection and self-audit programmes and forms

5) Communication Plan
   - have a communication plan in place with identified stakeholders – who to contact - internal and external for natural disasters, incidents and events such as adverse results, etc.
- prepare a sampling strategy communiqué
- have a sampling results communiqué
- have a notification communication plan for adverse results e.g. aircraft & airport
- prepare an inventory of e-mail addresses, telephone numbers of stakeholders – internal/external for notification

6) Incident and Emergency Plan
   - Should be in place to respond to natural disasters, events or adverse results
     - identify potential emergency situations and have a written response plan
     - train employees and test procedure on the response plan
     - prepare emergency contact list – internal/external
     - have a contingency plan to provide potable water

7) Corrective Action
   - all corrective action should be documented and the root causes should be identified

8) Documentation and Processes/Procedures review
   - all aspects of the WSP should be documented and reviewed at least annually by the person responsible or when there is a change in process, procedure, equipment, etc.
Annex C: Example of a water safety plan for an aircraft

Water Safety Plan – Airlines

1) Statement of goal(s)/objective(s)/purpose of WSP

2) What are the jurisdictional requirements to follow
   - Acts/Statutes
   - Regulations
   - standards
   - guidelines

3) Organization
   - Defining Roles and Responsibilities
     - who has overall responsibility for WSP
     - who does what, what department/section is responsible for each part of the plan
   - Defining stakeholders – internal/external and their roles and responsibilities within the plan
     - Airport Authority
     - Water haulers – private and those owned and operated by airline
     - Responsible government authority
     - Who has responsibility/ownership of watering/transfer points for aircraft, water haulers etc.

4) Operational Plan
   - Planning, performing work, checking work and plan is working and continual assessment to improve the plan.
     - Prepare and create documents for traceability and set-up proper recordkeeping for all facets of the WSP and review at least on an annual basis
     - Developing Standard Operating Procedures (SOPs)
     - Following industry best practices
     - A up-to-date inventory of all watering/transfer points used by airline and water haulers who supply water to aircraft
     - Where applicable having contracts with private haulers and companies who perform aircraft disinfection
     - A up-to-date inventory of equipment – aircraft, trucks/carts, hoses, etc.
     - A disinfection schedule for equipment - aircraft, trucks/carts, hoses, etc.
     - Maintenance records of equipment
     - Define sampling parameters e.g. E. coli, turbidity, disinfectant residual, etc.
     - Using acceptable methodology for sampling
     - Monitoring of watering/transfer points and sharing information with stakeholders
     - Providing adequate training to employees – identify training required per position, document, develop checklist for training etc.
     - Recordkeeping – using spreadsheets, developing database, retaining of records
     - Developing inspection and self-audit programmes and forms

5) Communication Plan
   - have a communication plan in place with identified stakeholders – who to contact - internal and external for natural disasters, incidents and events such as adverse results, etc.
6) Incident and Emergency Plan
   - Should be in place to respond to natural disasters, events or adverse results
     ▪ identify potential emergency situations and have a written response plan
     ▪ train employees and test procedure on the response plan
     ▪ prepare emergency contact list – internal/external
     ▪ have a contingency plan to provide potable water

7) Corrective Action
   - all corrective action should be documented and the root causes should be identified

8) Documentation and Processes/Procedures review
   - all aspects of the WSP should be documented and reviewed at least annually by the person responsible or when there is a change in process, procedure, equipment, etc.
Annex D: Example format for use by on-site inspectors in evaluating the sanitation status of the airline service area or transfer point

Watering Point Inspection Form

<table>
<thead>
<tr>
<th>Regulatory Authority</th>
<th>INSPECTION SUMMARY - AIRLINE SERVICE AREA OR WATERING POINT SANITATION</th>
</tr>
</thead>
</table>

**NOTE:** The items marked below identify deficiencies in operations or facilities which must be corrected within a reasonable time period or by such date as may be specified by the regulatory authority. Failure to comply with any time limits for correction specified in reference to this notice may result in cessation of acceptability of your operations, service or product for use on or by interstate conveyances.

<table>
<thead>
<tr>
<th>OWNER/OPERATOR AND ADDRESS</th>
<th>ESTABLISHMENT NAME</th>
<th>INSPECTION DATE</th>
<th>FEI NO.</th>
</tr>
</thead>
</table>

**CLASSIFICATION RECOMMENDED** (Check One)

- [ ] APPROVED
- [ ] PROVISIONAL (Expiration Date ___________________________)  
- [ ] NOT APPROVED

**REPORT PREPARED BY** (Name and Title)

**DEFICIENCIES ARE INDICATED BY AN "X" NOT OBSERVED BY AN "N", SATISFACTORY BY A "S".**

<table>
<thead>
<tr>
<th>WATER PIPING SYSTEM</th>
<th>DISPOSAL OF TOILET WASTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No cross connections*</td>
</tr>
<tr>
<td>2</td>
<td>No backflow connections*</td>
</tr>
<tr>
<td>3</td>
<td>Adequate pressure</td>
</tr>
</tbody>
</table>

**HYDRANTS**

<table>
<thead>
<tr>
<th>4</th>
<th>Location satisfactory</th>
<th>37 Smooth, impervious floors, sloped to drain</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Acceptable type, good maintenance</td>
<td>38 Room clean, good repair</td>
</tr>
<tr>
<td>6</td>
<td>Acceptable uses only</td>
<td>39 At least 20 p.s.i. water pressure</td>
</tr>
<tr>
<td>7</td>
<td>Quick-type coupling (or threaded for permanent hose connection)</td>
<td>40 Hot water or stream available</td>
</tr>
<tr>
<td>8</td>
<td>Outlets downward or horizontal</td>
<td>41 Suitable backflow preventer, properly installed*</td>
</tr>
<tr>
<td>9</td>
<td>Proper surface drainage</td>
<td>42 Soil cans emptied and cleaned after removal from aircraft</td>
</tr>
<tr>
<td>10</td>
<td>Drains from hydrant boxes or pits adequate to prevent flooding*</td>
<td>43 Carts emptied and flushed frequently</td>
</tr>
</tbody>
</table>

**WATER HOSE**

<table>
<thead>
<tr>
<th>11</th>
<th>Satisfactory material, smooth, no cracks or checking</th>
<th>44 Satisfactory storage of clean soil cans</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Quick-type couplings, where required</td>
<td>45 Refuse handled properly, no spillage</td>
</tr>
<tr>
<td>13</td>
<td>Satisfactory nozzle guard</td>
<td>46 Storage containers satisfactorily, covered</td>
</tr>
<tr>
<td>14</td>
<td>Hose properly protected and stored</td>
<td>47 Storage containers emptied frequently</td>
</tr>
<tr>
<td></td>
<td></td>
<td>48 Receptacles cleaned, not at soil-can cleaning installations</td>
</tr>
<tr>
<td>15</td>
<td>Hose handled properly, flushed before use</td>
<td>49</td>
</tr>
<tr>
<td>16</td>
<td>Nozzle different size or shape from waste connections</td>
<td>50</td>
</tr>
<tr>
<td><strong>WATER TANKS OR TANK CARTS</strong></td>
<td><strong>DISPOSAL OF REFUSE</strong></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Separate from toilet-waste and sewage-tank-flushing carts</td>
<td>51</td>
</tr>
<tr>
<td>18</td>
<td>Smooth, heavy-gauge, corrosion-resistant material</td>
<td><strong>SANITATION FACILITIES FOR EMPLOYEES</strong></td>
</tr>
<tr>
<td>19</td>
<td>Completely enclosed from filling inlet to discharge outlet</td>
<td>52</td>
</tr>
<tr>
<td>20</td>
<td>Vents, if provided, properly protected</td>
<td>53</td>
</tr>
<tr>
<td>21</td>
<td>Complete drainage possible</td>
<td>54</td>
</tr>
<tr>
<td>22</td>
<td>Inlet and outlet directed downward</td>
<td>55</td>
</tr>
<tr>
<td>23</td>
<td>Inlet and outlet provided with caps or closures with keeper chains</td>
<td>56</td>
</tr>
<tr>
<td>24</td>
<td>Water tanks labelled*</td>
<td><strong>OTHER</strong></td>
</tr>
<tr>
<td>25</td>
<td>Quick-type couplings, where required</td>
<td><strong>OTHER COMPANIES SERVICED</strong></td>
</tr>
<tr>
<td>26</td>
<td>If hose transported on cart, proper storage facilities provided</td>
<td>57</td>
</tr>
<tr>
<td>27</td>
<td>Proper transferral of water</td>
<td>58</td>
</tr>
<tr>
<td><strong>HANDLING OF TOILET WASTES</strong></td>
<td>59</td>
<td>Conveyance waste removal operations and procedures acceptable*</td>
</tr>
<tr>
<td>28</td>
<td>Personnel who remove wastes do not handle water or food</td>
<td>60</td>
</tr>
<tr>
<td>29</td>
<td>Soil cans enclosed or covered during transportation to disposal area</td>
<td>61</td>
</tr>
<tr>
<td>30</td>
<td>Waste tanks and flushing tanks labelled</td>
<td><strong>REMARKS</strong></td>
</tr>
<tr>
<td>31</td>
<td>Sewage removed without spillage</td>
<td>*CRITICAL Items Requiring Immediate Attention.</td>
</tr>
<tr>
<td>32</td>
<td>Construction and maintenance of toilet-waste carts satisfactory</td>
<td><strong>OTHER COMPANIES SERVICED</strong></td>
</tr>
<tr>
<td>33</td>
<td>Equipment available for flushing aircraft sewage-retention tanks (not by direct connection to water supply)</td>
<td></td>
</tr>
</tbody>
</table>
Annex E: **Guidance for cleaning of public areas at airport**

**Public areas and rooms**
1. Post hand-washing signs to encourage good hand-washing practices among all staff and guests.
2. Use disposable paper wipes for cleaning to avoid the possibility of cross-contamination.
3. Use the proper chemical sanitizing agent, following the manufacturer’s instructions concerning contact time.
4. Frequently clean and sanitize handrails, handles, telephones and any other hand contact areas, elevators and landings in all passenger corridors.
5. Frequently clean and sanitize all public rooms.
6. Clean carpets using a steam cleaner that achieves a minimum temperature of 71 °C unless the floor coverings are not heat tolerant (some carpets can be steamed only to 40 °C; otherwise shrinkage and colour runs may occur).
7. Frequently clean and sanitize garbage cans.
8. Clean and sanitize soft furnishings; steam clean if the items are heat tolerant.

**Public restrooms**
1. Post hand-washing signs to encourage good hand-washing practices among all staff and guests.
2. Frequently clean and sanitize door handles, toilet flushers, faucets, dryers, counters and any other hand contact areas.
3. Provide either an air-dryer or disposable paper towels for hand-drying (only single-use cotton towels should be utilised).
4. Check levels of soap and paper towels.
5. Use disposable paper wipes for cleaning to avoid the possibility of cross-contamination.
6. Use the proper chemical sanitizing agent following the manufacturer’s instructions concerning contact time.

**Bars and lounges**
1. Post hand-washing signs at each hand-sink to encourage good hand-washing practices among all staff and guests.
2. Require staff to wash hands frequently.
3. Provide hand sanitizers or to staff to complement good hand-washing practices.
4. Self-serve unpackaged items (e.g. peanuts, water) should not be available to guest
5. Provide snacks on request, in small individual containers.
6. Frequently clean condiment containers that are served by staff (recommended to clean between each customer use).
7. Use disposable paper wipes for cleaning to avoid the possibility of cross-contamination.
8. Clean and sanitize all tables and chairs with a detergent solution and sanitizer (with correct contact time) after each shift and after closing.

**Spas and salons**
1. Post hand-washing signs to encourage good hand-washing practices among all staff and guests.
2. Require staff to wash hands frequently.
3. Use disposable paper wipes for cleaning to avoid the possibility of cross-contamination.
4. Use the proper chemical sanitizing agent following the manufacturer’s instructions concerning contact time.
5. As per routine practices, ensure that common-use tools and materials are cleaned with detergent and sanitized after each use e.g. combs should be kept in sanitizing solution (that is regularly refreshed).

**Fitness centres**
1. Post hand-washing signs to encourage good hand-washing practices among all staff and guests.
2. Require staff to wash hands frequently.
3. Use disposable paper wipes for cleaning to avoid the possibility of cross-contamination.
4. Use the proper chemical sanitizing agent following the manufacturer’s contact time.
5. Frequently clean and sanitize all surfaces.
6. Post signs to remind users to wipe down equipment with provided sanitizing spray after use.
7. Clean and sanitize equipment at least once during each shift.

**Games rooms**
1. Post hand-washing signs to encourage good hand-washing practices among all staff and guests.
2. Require staff to wash hands frequently.
3. Use disposable paper wipes for cleaning to avoid the possibility of cross-contamination.
4. Use the proper chemical sanitizing agent following the manufacturer’s instructions concerning contact time.
5. Frequently clean and sanitize all surfaces.
6. Clean and sanitize equipment at least once during each shift; paying special attention to control sticks, handles, knobs and buttons.
Annex F: Routine cleaning and disinfection schedule for airport hotels

Disinfection protocol for guest rooms with vomiting and/or faecal contamination

The following measures are recommended to ensure that guest rooms are properly cleaned and disinfected:

- Trained staff should do the cleaning/disinfection; optimally a special team is assigned these tasks.
- All necessary equipment and supplies should be brought to the room at one time. Once the team enters the room, the members should not leave until all the work is completed.
- The team should wear protective clothing/equipment.
- All areas of the room should be cleaned and disinfected. Special attention should be focused on frequently touched items such as door knobs, light switches, telephones, remote controls, etc. and the garbage can.
- Dirty linen and towels should be bagged and taken directly to the laundry. Consideration should be given to using water-soluble bags and tagging as “heavily soiled”.
- Dirty linen and towels should be kept separate from clean, by placing each in different coloured bins (designate colour for clean and for soiled).
- Badly soiled linen and towels should be bagged and properly discarded or incinerated.
- All dishes, glasses, trays and ice buckets should be removed from sick rooms (even if they appear untouched) and taken to a designated location for immediate washing.
- The room should not be vacuumed (vacuuming creates aerosols that may contain bacteria or viruses that can cause illness). Carpets should be cleaned using a steam cleaner that reaches a minimum temperature of 71 °C [source required] unless the floor coverings are not heat tolerant.
- An adequate supply of clean towels, toilet paper and soap should be ensured.
- Drapes should be replaced and bagged for laundry or steam cleaning.
- All heavily soiled laundry and dirty dishes should be removed after the room is cleaned and taken directly to the laundry or kitchen area for handling.
- All dishes should be replaced in the room, even if they appear untouched.
Annex G: Routine aircraft cleaning and disinfection schedule

The information provided in this annex is an example of a cleaning and disinfection schedule for aircraft, which has been written to assist those responsible for routine cleaning and disinfection of an aircraft after a flight or during a night stop. The requirement differs somewhat from that of an aircraft that needs disinfection after transporting a suspected case of communicable disease, for which separate guidance is provided in the text of this chapter.

Cleaning and Disinfection Schedule

The aircraft operator’s engineering department shall grant technical approval for each type of cleaning and disinfecting product used. Approved cleaning and disinfecting products are listed in the Aircraft Maintenance Manual. Alternate cleaning and disinfecting products must be approved by the operator’s engineering department Prior to Use (See Annex H, infra, for Recommended Attributes of Aircraft Disinfectant)

1 General

1.1 Aircraft contamination

Should aircraft contamination be noticed (insects, liquids, etc.) inform the Station Agent. If an infective source is suspected, the source of infection e.g. passenger, should be contained in order to minimise the risk of infection to others.

Aircraft interior cleaning must be completed as follows:
- At least 45 minutes prior to estimated time of departure (ETD) for ground times over 60 minutes or overnight stops
- At least 20 minutes prior ETD for ground times under 60 minutes

1.2 Handling of flight irregularities

The specifics of each flight irregularity situation will determine the course of action to be taken. However:
- Never compromise on safety
- Co-ordinate actions taken with Station Agent

2 Interior cleaning

2.1 Classification of interior cleaning types

There are three types of interior cleaning depending on time available:
- A: Stopover times under 60 minutes
- B: Stopover times over 60 minutes
- C: Overnight

2.2 Cabin cleaning and disinfection

Cabin cleaning and disinfection shall start immediately after passenger disembarkation is completed.
If transit passengers remain on board, cabin cleaning shall be performed such as to minimize passenger disturbance.

Cleaning of cabin windows inside shall be done only with an approved cleaning product and a non-abrasive cloth. Once cleaned, rinse using a cloth with water and dry the surface.

Cloth covered seats shall be vacuumed. Sticky objects shall be removed with a spatula first, until they come loose, and vacuumed. Stains shall be removed only with an approved stain removal product.

Leather covered seats shall be cleaned using only an approved dusting product. Stains shall be removed only with an approved stain removal product.

Passenger seat control unit panels shall be cleaned and disinfected using only approved cleaning and disinfection materials and non-abrasive paper towels

In-seat monitors shall be cleaned using only approved cleaning materials and a micro-fiber cloth.

Carpet stains shall be removed only with an approved stain removal product.

### 2.4 Interior Cleaning and Disinfection Chart

The following chart shows applicable cleaning and disinfection activities required for each type of interior cleaning/disinfection.

“On request” cleaning and disinfection activities shall be performed if requested by the operator Flight Crew, Cabin Crew or Station Agent.

Symbols: ✓ Standard  + On request  D Disinfect

Ashtrays require emptying and cleaning only if not permanently blocked.

<table>
<thead>
<tr>
<th>Area</th>
<th>Services</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight deck</td>
<td>Empty waste boxes and ashtrays</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean crew tables and glass holders</td>
<td>+</td>
<td>✓D</td>
<td>✓D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean stowage areas and racks</td>
<td>+</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wipe seats</td>
<td>+</td>
<td>✓</td>
<td>✓</td>
<td>Remove stains</td>
</tr>
<tr>
<td></td>
<td>Clean floor / Vacuum carpet</td>
<td>+</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean flight deck windows inside</td>
<td>+</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean door and walls</td>
<td>+</td>
<td>+</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Cabin</td>
<td>Dispose of waste from closets</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dispose of litter and newspapers</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dispose of waste in seat pockets</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Collect and restow / replace magazines in racks</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Replace as required</td>
</tr>
<tr>
<td></td>
<td>Collect and restow pillows and blankets (first, business class)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Remove if soiled</td>
</tr>
<tr>
<td>Area</td>
<td>Services</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>Remarks</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>--------------------------------</td>
</tr>
<tr>
<td></td>
<td>Fold and re-stow blankets in overhead bins</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>Remove if soiled</td>
</tr>
<tr>
<td></td>
<td>Re-stow pillows in overhead bins</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>Remove if soiled</td>
</tr>
<tr>
<td></td>
<td>Empty ashtrays</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean tray tables and armrests</td>
<td>✓</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Clean cabin crew seat tables</td>
<td>✓</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Clean interphone surfaces</td>
<td>✓</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Clean cabin windows inside</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vacuum passenger and cabin crew cloth covered seats</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>Remove stains</td>
</tr>
<tr>
<td></td>
<td>Wipe passenger and cabin crew leather covered seats</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>Remove stains</td>
</tr>
<tr>
<td></td>
<td>Cross safety belts</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dispose of waste in overhead bins and wipe</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean overhead bins outside and latch handle surfaces</td>
<td>✓</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Clean PVC floors</td>
<td>✓</td>
<td>✓</td>
<td>A: As required</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vacuum carpet</td>
<td>✓</td>
<td>✓</td>
<td>A: As required</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Empty and clean ashtrays</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vacuum ashtray holders</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Collect and replace blankets</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Collect and replace pillows</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Collect and replace headrest covers</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean in-seat monitors</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean passenger seat/service control unit panels</td>
<td>✓</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Remove passenger seat cushions and vacuum</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Remove stains from carpets</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean seat rails, cabin fixtures, air inlets, ceiling, sidewalls, closets, doors, service panels and magazine racks</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galleys</td>
<td>Empty waste bins and insert waste bags</td>
<td>✓</td>
<td>✓</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean doors, latches, ceiling, ventilation grids</td>
<td>+</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean sinks, faucets and working surfaces</td>
<td>✓</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Clean retractable tables</td>
<td>+</td>
<td>✓</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Clean ovens inside and outside</td>
<td>+</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean service trolleys</td>
<td>+</td>
<td>✓</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Clean PVC floor</td>
<td>+</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Lavatories</td>
<td>Empty waste bins and insert waste bags</td>
<td>✓</td>
<td>✓</td>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>
### Area Services

<table>
<thead>
<tr>
<th>Area</th>
<th>Services</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean toilet bowl and seat</td>
<td>✓ D  ✓ D  ✓ D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean basin, faucets and surfaces</td>
<td>✓ D  ✓ D  ✓ D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean mirror</td>
<td>✓  ✓  ✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean change table</td>
<td>✓ D  ✓ D  ✓ D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean wall surfaces and interior and exterior door handles and locks</td>
<td>✓ D  ✓ D  ✓ D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean PVC floor</td>
<td>✓  ✓  ✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replenish soap dispenser</td>
<td>+  ✓  ✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replenish toiletry items</td>
<td>+  ✓  ✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crew Rest Areas</td>
<td>Dispose of waste from closets</td>
<td>✓  ✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dispose of litter and newspapers</td>
<td>✓  ✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Remove sheets, pillows and blankets from each sleeping berth</td>
<td>✓  ✓</td>
<td></td>
<td></td>
<td>This step followed by next two in sequence</td>
</tr>
<tr>
<td></td>
<td>Clean surfaces within each sleeping berth</td>
<td>✓ D  ✓ D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Place clean sheets on mattresses and clean pillows and blankets in each sleeping berth</td>
<td>✓  ✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean controls (for lights and ventilation, etc.) and interphone surfaces</td>
<td>✓ D  ✓ D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Empty ashtrays</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vacuum carpet</td>
<td></td>
<td>A: As required</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean any cabin crew seat tables</td>
<td>✓ D  ✓ D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean any cabin windows inside</td>
<td>✓  ✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*(Comments are encouraged, especially on recommendation in column A)*

If time does not permit completion of all of the above tasks, priority should be given to the removal of waste and cleaning and disinfection where indicated, especially of galleys, toilets, the outside of overhead bins and latch handles, and tray tables. To expedite cleaning and disinfection procedures and to reduce the amount of equipment required, disposable swabs impregnated with effective and appropriate cleaning and disinfecting agents can be purchased or prepared in advance, stored in polyethylene bags, and used for all wiping operations.

Galleys are extremely difficult to clean satisfactorily at times other than during maintenance checks, since they have many almost inaccessible areas in which foods and beverages—particularly the latter—can penetrate. The introduction of modules in wide-bodied aircraft is an improvement, but much more could be done to design a galley that would be easier to clean than the present type.

**Problem areas**

Aircraft cleaners need to pay particular attention to the following dirt traps and make sure that they are thoroughly cleaned out:

— Catering equipment runners.
— Bar box recesses.
— Floor of catering container compartments.
— Sink drain pipes (frequently blocked).
— Drinking-fountain wastes and bottle top remover recesses.
— Toilet compartment cupboards.
— First-aid stowage holds.
Annex H: Recommended attributes for aircraft disinfectant

1) **Safety of active ingredients for humans:** In spite of best practices in the decontamination of environmental surfaces, human exposure to microbiocidal chemicals cannot be prevented altogether; this is particularly the case in confined spaces such as aircraft cabins. Therefore, formulations with the safest possible ingredients must be selected for such use.

2) **Environmental safety:** Chemicals used virtually anywhere eventually end up in the water environment where they may prove unsafe for the ecology. Persistent chemicals can be particularly undesirable in this regard as they tend to accumulate in the food-chain with the potential for long-term damage. In view of this, chemicals that can perform the task of decontamination when/where applied and then breakdown into harmless by-products should be preferred.

3) **Spectrum of microbiocidal activity:** Many commercially available disinfectants are active against easy-to-kill vegetative bacteria only while several types of spores, viruses and fungi also have the potential to spread environmental surfaces. Since in field settings the target pathogen is often unknown, chosen formulations should have demonstrated activity not only against bacteria but also against viruses and fungi.

4) **Materials compatibility:** This is crucial when choosing disinfectants for decontamination of hard environmental surfaces in aircraft cabins. Any formulation selected for use in such settings must be safe for repeated applications and, as far as possible, must not reach other more sensitive and vital areas of the aircraft. Advice from the equipment manufacturer or aircraft operator’s engineering department should be followed.

5) **Transport, storage and inventory control:** Ideally, one type of ready-to-use formulation can eliminate issues with inventory control and dealings with different manufacturers. The product to be selected must also be packaged for safe storage onboard the aircraft.

6) **Directions for use:** The label directions must be as simple and easy to understand as possible to avoid misuse of the product.

7) **Speed of activity:** In most cases, the contact time between the targeted environmental surface and the applied product lasts from a few a few seconds to perhaps a minute or so. However, many commercial products sold for such use claim microbiocidal activity with a contact time of at least 10 minutes. This obvious disparity between label directions and actual field has the potential to generate a false sense of security in the mind of the user. Further, the application of a relatively weak formulation for a shorter-than-recommended contact time could result in the spread of microbial contamination over a wider area during the wiping of environmental surfaces. Therefore, products that can achieve decontamination in as short a time as possible should be preferred.

8) **Freedom from off-gassing and volatile organic chemicals (VOCs):** Pungent odours are obviously undesirable, but addition of even strong scents/perfumes to disinfectants is now discouraged because of increasing numbers of individuals with multiple chemical allergies. Formulations that may release corrosive gases (e.g. chlorine) and VOCs must be avoided because of potential exposure of sensitive and vital components of the aircraft. Advice from the equipment manufacturer or aircraft operator’s engineering department should be followed.

*(comments encouraged)*