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 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 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 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.

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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).
- 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.

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.
- Remove gloves and place 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.