
**INTERNATIONAL CATERING WASTE
- A CASE FOR SMARTER REGULATION -**

UPDATED REPORT - AN OVERVIEW OF THE RISKS

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Abbreviations

ABP: Animal by-product
APHA: Animal and Plant Health Agency (UK)
APHIS: Animal and Plant Health Inspection Service (USA)
ASF: African Swine Fever
ASF: Aviation Sustainability Forum
BVD: Bovine Viral Diarrhoea
CFIA: Canadian Food Inspection Agency
CODEX: Codex Alimentarius
CSF: Classical Swine Fever
EBL: Enzootic bovine leukosis
EMPRES: FAO Emergency Prevention System
FAO: Food and Agriculture Organisation
FCC: Food Control Consultants Ltd.
FMD: Foot and Mouth Disease
GF-TAD: Global Framework for the Progressive Control of Transboundary Animal Diseases
HACCP: Hazard Analysis Critical Control Point
HTST: High temperature, short time pasteurisation
HPAI: High Pathogen Avian Influenza
ICW: International Catering Waste
IFSA: International Flight Services Association
IPPC: International Plant Protection Convention
NACC: The National Airlines Council of Canada
ND: Newcastle Disease
PPR: Peste des Petits Ruminants
PRRS: Porcine Reproductive and Respiratory Syndrome RRVF: Rift Valley Fever
SOP: Standard operating procedures
SPS: Sanitary and Phytosanitary Agreement
TAD: Transboundary Animal Diseases
TB: Tuberculosis
UHT: ultra-high temperature
VTEC: Vero cytotoxin-producing Escherichia coli
WHO: World Health Organization
WOAH: World Organisation for Animal Health, (formerly Office International des Epizooties)
WTO: World Trade Organization

Summary

Airlines are under pressure – both from an environmental and a financial perspective – to reduce the amount of cabin waste from their in-flight service and to increase the proportion that can be reused and recycled. A major impediment to change is the legislation regarding the management of waste from international transport that some governments implement to reduce the risk of animal and plant diseases and pests entering and threatening the health status of their agricultural industries. This second edition of the report provides an update on how cabin waste is generated and handled and the risks it poses to animal and plant health. It concludes that coordinated action by governments and the airline sector could provide opportunities for more waste to be reused and recycled, and proposes a number of options for actions by which this might be achieved.

About FCC

Food Control Consultants Ltd. (FCC) was established in February 1999 and works with a group of associate experts to provide consultancy services on veterinary matters covering animal health, animal welfare, veterinary public health and food safety. The company works principally with competent authorities responsible for the various stages of the food chain. FCC's expertise extends to areas including: veterinary legislation and official controls; animal identification, registration, and movement controls; traceability; animal health information; veterinary medicinal products; animal performance recording; IT systems; border controls; and animal feed. In recent years FCC has expanded its activities to include the design and development of animal health and food safety systems for national authorities and also at the enterprise level. At the same time, it has widened its geographical reach across the globe, including Africa, Asia, the Caribbean, South America and the Pacific region.

CHAPTER 1

Introduction

The airline industry has been subject to criticism for poor cabin waste management performance and, with continued global passenger growth, airline cabin waste volumes and management costs are set to increase significantly. Limited research by the International Air Transport Association (IATA) estimates that the sector generated 3.6 million tonnes of cabin waste in 2023 and with current passenger growth rates, this waste volume is set to double by 2040.

Cabin waste comprises two principal streams – cleaning and catering (galley) waste. Catering waste consists of both leftovers of meals as well as packaging materials such as cardboard, plastics and glass. The meals may contain food of animal origin (such as meat, milk, eggs, and fish) as well as food of plant origin (such as fruit and vegetables). Catering waste from international flights is often subject to strict inspection, handling and disposal controls including incineration due to animal health concerns. Although countries use different definitions, for the purposes of this report catering waste from an international flight will be termed international catering waste (ICW).

Although the preparation and serving of airline meals is a complex process involving multiple partners at differing locations, food safety is of paramount concern. Strict hygiene and ingredient sourcing procedures have been developed, that minimise the risk to human health. However, there are a number of animal health diseases that can be transmitted through food without causing ill effects or symptoms in humans. A number of countries have introduced legislation on the handling and disposal of catering waste from international flights specifically to address this potential pathway and this report will focus on this particular aspect.

Food Control Consultants Ltd. has been commissioned by IATA to assess the risks to animal health posed by the ICW and this report describes the finding of this research. The investigations have found no evidence that any regulatory impact assessments were undertaken prior to the adoption of legislation controlling the management of ICW. In fact, research in Australia (Nairn, M.E et al 1996) indicated that ICW from air transport does not represent a significant risk to human, animal or plant health and does not need specialised handling, treatment and disposal. The few incidents described in the literature on possible link of airline catering waste to outbreaks of animal disease are inconclusive and seem always to be linked to swill feeding... Moreover the specialised handling and disposal requirements imposed by these legislations and the resulting inspection charges places a significant financial burden on the sector. Different jurisdictions around the world have different methods of dealing with these animal health

hazards. The European Union, for example, has created a complex set of rules, which are stipulated in Regulation (EC) No 1069/2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002 and other legal acts regarding animal health, public health and the import of food of animal and plant origin. This legislation is harmonised across the European Union Member States and implemented in national legislation. However, it would appear that supporting guidance for airlines is either not available or has not been harmonised between Member States.

In this report update, the import regimes applied in different jurisdictions are examined and the measures imposed are discussed, ensuring protection against infectious animal diseases and human food-borne infections.

A literature research on biological hazards associated with international catering waste (ICW) from air transport has been undertaken, considering how the current procedures and practices of the airline industry affect the transmission of such hazards.

The main trans-boundary animal diseases¹ have been listed and the risk of these diseases being transmitted with airline cabin waste identified. Worldwide animal health status has been accessed through the WAHIS system of WOAHA, providing an updated status at any given time. A search has been carried out on risk assessments already performed by leading international or national risk assessment institutes and analysed and discussed. A number of visits were made in the UK to establishments including airports, airline caterers and waste recycling plants to observe current procedures and to interview operators.

A qualitative risk assessment has been carried out on airline catering waste with particular reference to infectious diseases, both animal and human, considering the following:

1. Evidence that infectious diseases are transmitted via airline catering waste.
2. The source of infectious disease using Foot and Mouth disease (FMD) as a model.
3. The epidemiology of transboundary animal diseases of major concern (e.g. FMD)
4. The pathway of the infection (discussion and assessment):
 - (a) Type of food, potential for harbouring disease agents,
 - (b) Infectious agents (their nature and survival in food during processing and storage),
 - (c) Recycling methods for different materials (glass, aluminium, plastics, cardboard, foodstuff),
 - (d) Infectious doses as parameter, and route of infection (e.g. oral, respiratory)
5. Spread of disease (contact, airborne, vehicles, vectors, other), epidemiology of diseases within susceptible animal populations has been discussed and the economic impact of disease outbreaks.
6. Existing measures for minimising the risk of entry of infectious animal diseases, including meat inspection procedures in different jurisdictions considering e.g.:
 - (a) systems for the procurement and supply of airline food
 - (b) control measures and legislation applied to airline cabin waste (identifying differences as applicable).
7. Possible alternatives to existing control regimes and methods

Recommendations and proposals have been developed including changes to logistics, procedures and practices, are presented in this report and have the potential to reduce the amount of ICW considerably. The measures proposed can to a large extent be implemented under current international legislation but in some cases a change in legislation would be required. The proposed measures are discussed and their cost and benefits categorised according to their practicability and applicability, (Donaldson 1997).

¹Trans-boundary Animal Diseases may be defined as those epidemic diseases which are highly contagious or transmissible and have the potential for very rapid spread, irrespective of national borders, causing serious socio-economic and possibly public health consequences.

The report also highlights concerns that current animal health regulations do not address the most significant risk posed by international aviation, the growing problem of illegal meat imports being concealed in passengers' baggage. It is recommended that airlines and regulators develop a coordinated response to this emerging challenge.

2.1 Cabin Waste Characteristics

Airline cabin waste comprises two primary waste-streams: catering (galley) and cleaning waste, as shown in Figure 1.

Cabin cleaning waste is generated by passenger service provision including newspapers, magazines, textiles (headrest protectors/blankets/pillows), amenity kits, headsets and drinks bottles (including full ones). This waste-stream can also comprise small quantities of food dropped on the floor or placed in seatback pockets and may include food brought onto the aircraft by the passenger. A sub-component of this waste-stream includes washroom waste which may include biohazardous waste from sharps (primarily used syringes). Cabin cleaning waste is generally collected in plastic bags and removed for disposal by the cleaning contractor through the airport waste management system.

Catering (or galley) waste is primarily generated through the provision of inflight meals/snacks and drinks distributed by the cabin crew. This waste-stream includes food, beverages (including part-consumed and untouched) and packaging which is returned to the galley carts (and/or to static and compactor boxes). This waste-stream can contain high volumes of liquid from unconsumed drinks and ice. Part-utilised alcoholic containers are collected in sealed bonded carts and returned to stores under supervision of customs authorities in bonded warehouses. Crew may additionally collect mixed or segregated recyclables including paper, aluminium cans and plastic bottles separately. The galley carts are removed and managed by the airline catering company. Catering waste may also be placed in static bins and compactor units and removed by the cleaning contractor.

A recent cabin waste composition audit, performed by the Aviation Sustainability Forum and supported by IATA, of 25 international flights arriving at Changi Airport in 2024, indicated that the cabin waste comprised 85% catering waste and 15% cleaning waste, with an average of 0.94 kg of waste generated per passenger.

2.2 Airline Catering Characteristics

The provision of airline catering is a complex and time-bound business with a small number of large providers dominating the market (e.g. LSG Sky Chefs, Gate Gourmet, Emirates Catering, etc.).

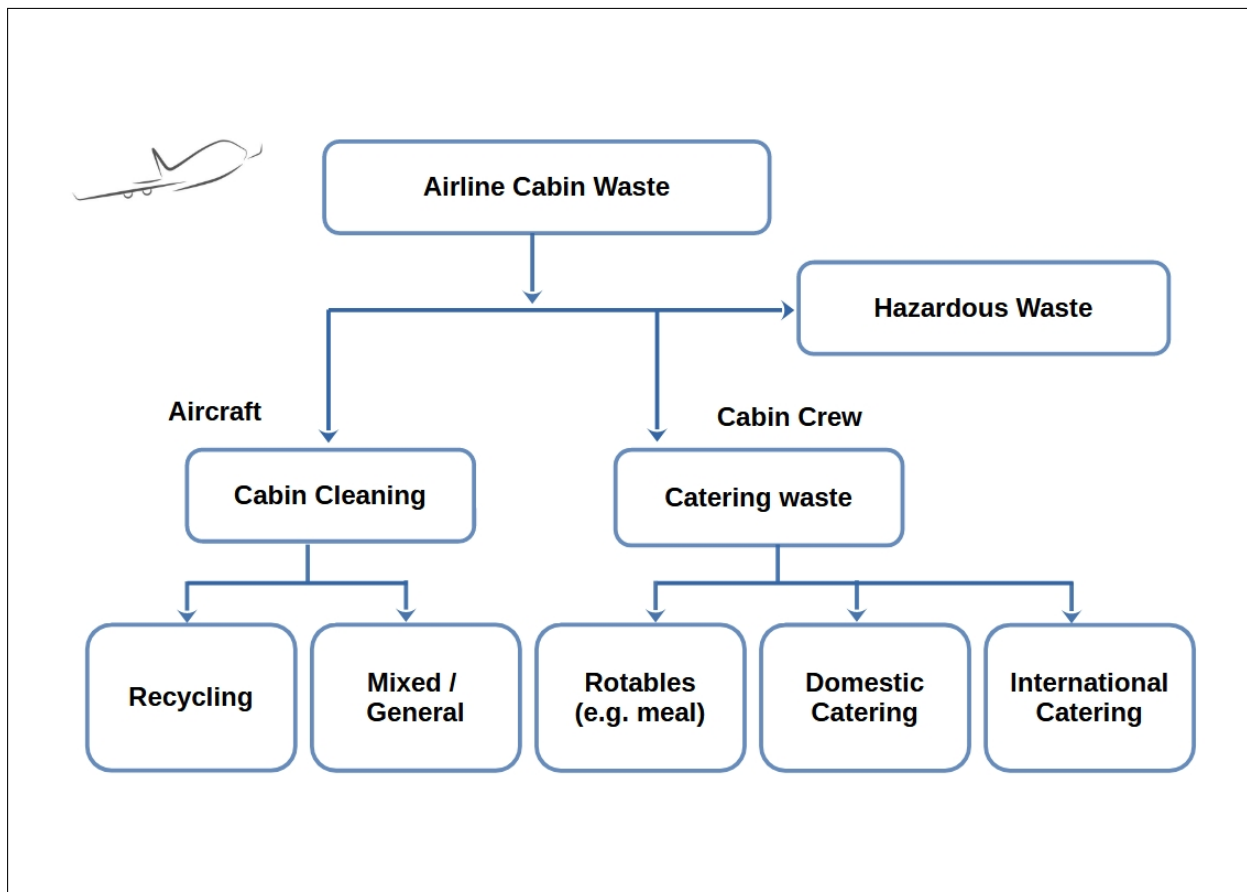


Figure 1: Typical categorisation of airline cabin waste

Catering companies at an airport may be dedicated to one airline or may provide services to a number of airlines. In many cases, contracts for the provision of catering services in the airports of departure and arrival of a flight will be held by different catering companies. In such cases, the company at the arrival airport will ‘de-cater’ materials and waste loaded onto the aircraft by a different company.

In some cases, airlines use double catering for short- and medium-haul flights – loading all meals for both outbound and inbound flights at the first airport of departure. The financial savings from using a single catering contractor are balanced against the additional fuel consumption and thus cost of carrying extra weight on both journeys. Decisions about the use of double catering may also be influenced by waste disposal arrangements and costs at intermediate airports.

Airline catering operations are based on the use of carts (trolleys) which are used to transport food, beverages and associated equipment onto aircraft. Food carts may be stowed on aircraft, or trays may be transferred to on-board storage compartments. Catering waste is generally removed from aircraft by the catering company in the same enclosed vehicles that are used to deliver the new catering provision for the next flight. Carts are delivered to the reception area of the catering premises where they are stripped. Crockery, cutlery, and other items that are reused (‘rotables’) are separated from food waste and are washed in industrial washing machines. Stripped carts are washed before being moved to the dispatch side of the premises for their next use. The segregation of materials for reuse and recycling is dependent on a number of commercial and legal factors. Responsibility for the correct management of catering waste is normally delegated to catering service providers as part of contractual arrangements with airlines.

Segregation of carts from different flights may be practised:

- Segregation of carts from domestic and international flights.
- Segregation according to airline to maintain separation of customised airline rotables.

Some catering companies cite lack of space and high throughputs at their processing establishments as obstacles to the segregation of carts and waste during de-catering operations. Effective separation between the waste reception and processing areas and the ‘clean’ areas of catering premises where food is prepared and dispatched is an important component of food safety management; this has concomitant benefits for animal and plant health reasons.

A number of airlines have implemented cabin recycling programs on domestic and international flights to destinations with no international catering waste (ICW) restrictions. The recycling programs are based either on the collection of mixed recyclables or segregated into separate recyclable streams (aluminium cans; plastic bottles; glass bottles; and, paper). Short-turnaround times and lack of on-board storage for segregated recyclables is frequently cited as an impediment. Also, given the complex, time-bound nature of flight operations segregating cabin wastes and recyclables from domestic and international flights can prove challenging and many airports or their respective animal health inspectors deem all cabin waste to be ICW.

2.3 International Catering Waste (ICW) Legislation: Definitions, Interpretations and Enforcement

Many developed countries have adopted a precautionary approach and implemented specific legislation on the management of catering waste arriving in their countries from outside their borders, which distinguishes it from domestic waste including waste from aircraft operating within the country. Different jurisdictions apply different terms to this classification of ICW, as well as different, but essentially similar, definitions. Countries which do not have an important livestock sector to protect tend not to have specific legislation about ICW.

2.3.1 European Union (EU)

The interpretation and enforcement of ICW legislation at both the national, policy level and the local, airport level is of critical importance for the reuse and recycling of cabin waste. Specifically, the interpretation of requirements for ensuring that waste materials are not contaminated with food, such that they may be excluded from being categorised as ICW. Some jurisdictions have published guidance on their legislation to assist in its interpretation.

The EU defines **International Catering Waste** as catering waste from means of transport operating internationally. The EU categorises ICW as a Category 1 Animal By-Product – the highest category (of 3) because of its perceived high risk for animal health. Although the term “operating internationally” is not defined in the EU legislation, it has been interpreted by a number of EU Member States as being only applicable to aircraft arriving from countries outside the EU. There is no EU-wide guidance on ICW and it is apparent that there may be inconsistency in interpretation between EU Member States. A number of Member States classify all waste material from aircraft as ICW, without any consideration of the origin of the waste, whereas others apply a more risk-based approach. A limited number of Member States have published guidance, as for example in Finland (Finnish Food Safety Authority Evira 2009)

2.3.2 United Kingdom

UK Animal and Plant Health Agency (APHA) and the Department for Environment, Food and Rural Affairs (DEFRA) (APHA AND DEFRA, 2021) have published guidance which states that “ICW

includes all food waste from planes, vehicles or ships travelling internationally and within EU territory. Food waste from planes, vehicles or ships is classified domestic catering waste when:

- *operating within the UK, Channel Islands and Isle of Man*
- *travelling from Northern Ireland to Great Britain*

In accordance with the Northern Ireland protocol, the EU classifies food waste from planes, vehicles or ships travelling from Great Britain to Northern Ireland as ICW”.

The following guidance is also provided:

“Recycling ICW and other materials

You must separate items for recycling before they are placed in a waste bin or plastic bag.

You cannot recycle items that have been mixed with pots of honey, milk or milk products, unless you can guarantee that the product has been treated in a treatment plant in the EU, e.g., a milk processing plant.

Plastic cups used for hot drinks that contain milk from treatment plants outside the EU must be disposed of as ICW.

You can recycle other items as long as they have not been mixed with catering waste. This includes:

- *Confectionery*
- *crisps and nuts*
- *drinks not containing milk”*

2.3.3 United States of America (USA)

Cabin waste from international flights is regulated by the United States Department of Agriculture (USDA) through its Animal and Plant Health Inspection Service (APHIS). The US legislation defines regulated garbage as all waste material that is derived in whole or in part from fruits, vegetables, meats, or other plant or animal (including poultry) material, and other refuse of any character whatsoever that has been associated with any such material, if the garbage is on or removed from a means of conveyance, if the means of conveyance has been in any port outside the United States and Canada within the previous two-year period. In addition, when Garbage, trash or other material not regulated by APHIS that is or has been commingled with regulated garbage is also deemed to be regulated garbage. Regulated garbage includes but is not limited to food scraps, table refuse, galley refuse, food wrappers or packaging materials and other waste material from stores, food preparation areas, passengers’ or crews’ quarters, dining rooms or any other areas on means of conveyance. Regulated garbage also refers to meals and other foods that were available for consumption by passengers or crew on an aircraft but were not consumed.

USDA - APHIS, 2016 has published an exemption, part of which is included below (USDA - APHIS 2016):

“APHIS regulated garbage is unconsumed fresh fruit, vegetables, and meats, or other plant or animal (including poultry) material, and other refuse of any character whatsoever that has been associated with any such material. The following items, if offloaded from a conveyance as part of its waste stream, may be recycled under conditions as specified below and would not have to be handled as APHIS regulated garbage. Note that neither separation nor sorting of regulated garbage and recyclable material is allowed outside the conveyance. Also cans or containers commingled with or visibly contaminated with APHIS regulated garbage will be handled as regulated garbage.”

“Cans, glass, and plastic containers (as long as they never held milk or other dairy products), if stored separately from food waste or other APHIS regulated garbage and are not required to be incinerated or sterilized.”

“Bottles, including bottles with processed fruit or vegetables. Note that bottles containing fresh fruit may not be recycled, except beer and other drink bottles containing small pieces of fruit.”

“Baled, clean, cardboard boxes or paper that are not contaminated with animal material and that are not meat, egg, or poultry containers if stored separately from APHIS regulated garbage. Boxes that are not recycled must be incinerated or sterilized”.

“Cardboard boxes that have held fresh fruits or vegetables, which have been stored separately from APHIS regulated garbage. Boxes that are not recycled must be incinerated or sterilized. Outer boxes, such as those that contained plastic milk jugs, are unrestricted and are not required to be incinerated or sterilized”

“Containers stored in the carrier separate from APHIS regulated garbage.”

“Broken crockery (dishes and plates) that has been cleaned and rinsed, if stored separately from food waste, which is not required to be incinerated or sterilized. Clean broken crockery may be also sent to a landfill.”

APHIS has furthermore published foodstuffs on aircraft exempted from removal as regulated Garbage.¹ This includes beverages such as Ultra-high temperature (UHT)-pasteurized dairy creamers (shelf stable) UHT-pasteurized milk and water; packaged snacks including cheese spread (without liquid) and processed food such as caviar, fully finished dry food products containing dry milk powder, drink mixes (including dried milk), hard cheese (which does not contain meat), pasteurized processed cheese (which does not contain meat) and smoked fish products (without cream sauces).

2.3.4 Canada

Canadian legislation defines aircraft garbage as waste that contains, or is suspected of containing, animal products or by-products that originated either as food taken on board or as a result of transportation of animals in an aircraft. This definition applies to waste from aircraft from any other country, including the U.S.

International waste refers to aircraft garbage, forfeited materials, manure and ship’s refuse as defined above. All international waste is handled, transported, stored, and disposed of in accordance with the Canadian International Waste Directive (CFIA 2012). It is worthy of note that Canada includes waste from aircraft from the USA in its definition of aircraft garbage, even though the US does not recognize waste from aircraft originating in Canada as regulated garbage.

The enforcement policy of the Canadian Food Inspection Agency (CFIA, 2012) is particularly robust; *all material removed from an international flight is waste that contains, or is suspected of containing, animal products or by-products that originated either as food taken on board or as a result of transportation of animals in an aircraft. Applies to waste from aircraft from any country, including the U.S.’ and must be disposed of in accordance with the Directive. CFIA does not permit recycling of any waste from aircraft operating internationally (including flights from the USA).* Segregation and recycling of domestic waste is permitted at most airports but not at the main international airport (Toronto Pearson), where cabin waste and catering waste from all aircraft, including those operating domestic routes, is treated as international waste.

It is reported that CFIA is amenable to a more risk-based approach to interpretation of the legislation on ICW and its application to all domestic flights arriving at Toronto Pearson, on the condition that airline operating protocols are produced and agreed with CFIA.

The National Airlines Council of Canada (NACC) has initiated the conversation with the CFIA surrounding the legislation on ICW and a Preventative Control Plan has been submitted to CFIA for

¹https://www.aphis.usda.gov/import_export/vrs/downloads/foodstuffs-exempted-as-rg.pdf

approval. A new consultation process is due to take place in Autumn 2024.

2.3.5 Australia

Australia has recently updated its biosecurity legislation, and in 2016 the Biosecurity Act (2015) replaced the Quarantine Act (1908). The term 'quarantine waste' was previously used for ICW; this has been replaced by 'biosecurity waste'. Biosecurity waste - All cabin, galley and hold waste on-board the aircraft must be collected, transported, stored and/or treated by a service provider that has entered into an approved arrangement with the department or under the department's supervision on a fee for service basis.

Biosecurity waste may be derived from:

- waste, sweepings, organic galley and accommodation refuse from aircraft;
- refuse or sweepings from the holds of aircraft;
- unconsumed prepared meals and other partly consumed food;
- any non-washable items, other waste or materials which may have come into contact with biosecurity waste;
- animal and plant materials (including floral arrangements and animal or plant waste); or
- materials used to pack and stabilise imported goods.

Australian legislation (Australian Government, DAFF 2016) requires other waste or materials which may have come into contact with biosecurity waste to be treated as biosecurity waste. Previous enforcement policy was that it is not possible to guarantee that contact with biosecurity waste has not taken place on board and all waste from international flights must be treated as biosecurity waste. Following its active involvement in an audit of aircraft waste, there is recognition by the Department of Agriculture that the risk of introduction of animal and plant diseases through aircraft cabin waste is relatively low and that with the right controls, some relaxation of its previous interpretation and enforcement of biosecurity legislation is valid, supported by formal, written waste handling protocols by operators.

2.4 Handling and Disposal of International Catering Waste

Countries that have adopted ICW legislation place stringent requirements on the handling and disposal of ICW. Only the following methods are generally permitted for the disposal of ICW:

1. Incineration
2. Pressure sterilisation/autoclaving
3. Deep landfill burial
4. Disposed off in an authorised landfill
5. Grinding into approved sewage system (USA)

In addition to stipulations on the permitted methods of disposal, conditions are usually applied to the transport and handling of ICW, with attendant record-keeping requirements.

In the USA, operators involved in the transport and disposal of regulated waste must have compliance agreements with APHIS. These agreements require operators to have appropriate equipment, standard operating procedures (SOPs) for all aspects of their business and to keep records of in-coming and out-going waste. The enforcement costs associated with compliance checks including inspections are recovered through passenger (\$3.83 per pax) and aircraft basis (\$225) charges (USDA APHIS 2023).

In Canada, CFIA requires ICW haulers to be approved and to use only approved routes, and landfill sites, incinerator plants and autoclave facilities to be approved and to be operated in accordance with waste legislation.

The costs of handling, management and disposal of ICW vary depending on location and technology, from US\$125/tonne at Schiphol Airport (AMS) to US\$500/tonne at Hartsfield–Jackson Atlanta International Airport (ATL). However, as these costs are escalated, there will be an increasing incentive to minimise the quantity of ICW that must be disposed of, including by diversion of waste for recycling.

Animal and plant health governance

Many countries devote considerable resources to the protection of domestic livestock and agricultural industries through the application of measures to eradicate and prevent the entry of diseases and pests. A very wide range of potential hazards may be the subject of import controls, depending on factors such as climate and geography and the economic importance of specific livestock or plant production enterprises. Under the World Trade Organization's (WTO) Sanitary and Phytosanitary Agreement (SPS Agreement) every country has the right to impose conditions on the import of animals, animal products, plants, and plant materials, providing these can be scientifically justified by an import risk analysis. It is not possible within the scope of this report, which addresses the global airline sector, to consider all animal and plant health hazards. Each country should conduct its own risk analysis specific to its own production and health parameters and examples of these are presented below.

Worldwide, the greatest risks from the importation of food, and thus from the inappropriate management of ICW, are the so-called Transboundary Animal Diseases (TADs). TADs are defined as those epidemic diseases of animals which are highly contagious or transmissible and have the potential for very rapid spread, irrespective of national borders, causing serious socio-economic consequences. In the context of ICW management, only those diseases that can be transmitted through food of animal origin are of relevance for hazard identification. TADs that can be transmitted in food products include Foot and Mouth Disease (FMD), Classical Swine Fever (CSF), African Swine Fever (ASF), Peste des Petits Ruminants (PPR), Rift Valley Fever (RVF) and Newcastle Disease (ND).

A UK risk analysis in Appendix 1 shows the significant animal diseases that can be transmitted in various animal products; similar Australian work presented in Appendix 2 indicates which diseases represent a 'quarantine waste risk' from ICW. FMD is often used as a model for import risk analysis and control measures for the prevention of incursion of animal diseases because of its highly infectious nature, its modes of transmission (including through animal products), its wide range of susceptible species (including cattle, sheep, goats and pigs) and its serious animal health and socio-economic impact.

3.1 Geographical Distribution of Animal Diseases

One hundred eighty three Members of the World Organisation for Animal Health (WOAH) must report regularly about their animal health status and report new outbreaks of disease. WOAH uses this information to publish disease information about each country and maps of disease distribution. Examples of such maps are provided in Figure 2, Figure 3 and Figure 4.

In addition to WOAH information, importing countries can make use of other sources, such as the joint WOAH/FAO Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs) and the FAO Emergency Prevention System (EMPRES) – which also covers plant health risks - to inform their import risk analysis activities.

Most developed countries with important livestock industries are free of the major transboundary animal diseases and consequently apply the most stringent conditions on imports of animals and animal products to reduce the risk of introducing these diseases, with their associated socio-economic impact.

Since animal and plant products will be present in the waste generated by the provision and consumption of meals on international flights and by food carried on board by passengers, the possibility that ICW may be a route for the incursion of diseases and pests into countries that were previously free should be considered and the risk assessed.

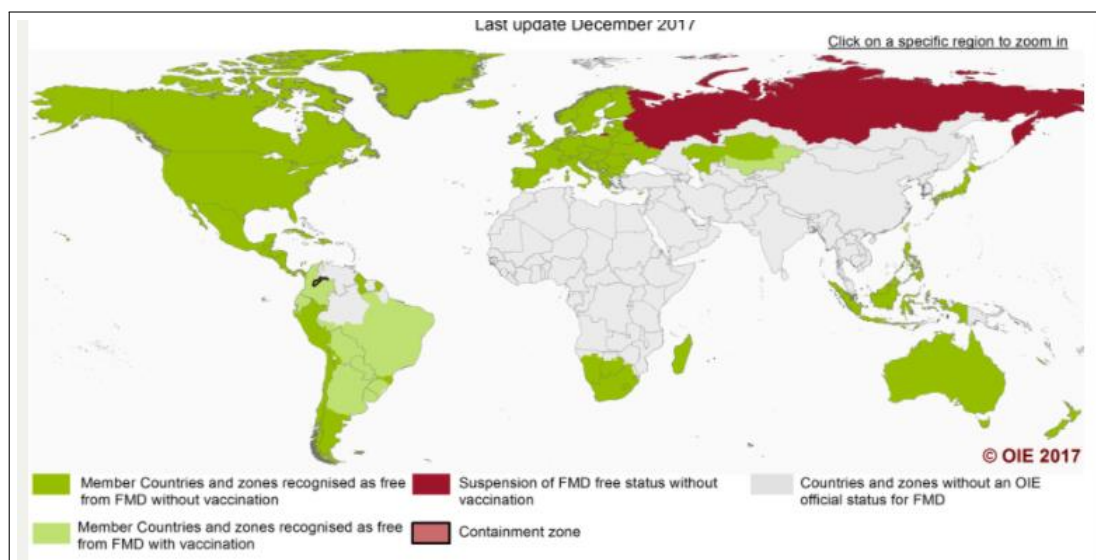


Figure 2: FMD status of WOAH Member Countries – updated December 2017

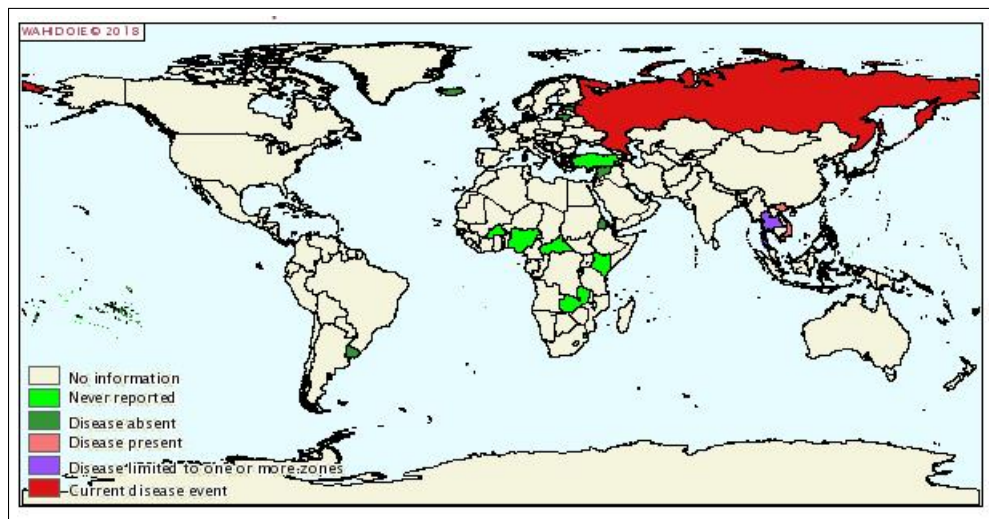


Figure 3: Example of World Animal Health Information Database (WAHID) global classical swine fever distribution map for July to December 2017

3.2 International Trade in Food

International trade in food can present food safety risks to consumers and risks to the animal and plant health status of importing countries. World trade in food is governed by the WTO's Sanitary and Phytosanitary Agreement (SPS Agreement) (WTO 1995), which states: "... to harmonise sanitary and phytosanitary measures on as wide a basis as possible, Members shall base their sanitary or phytosanitary measures on international standards, guidelines or recommendations."

The SPS Agreement names three international bodies for standard-setting:

- **Food Safety**

Food and Agricultural Organization of the United Nations (FAO) / World Health Organization (WHO) Codex Alimentarius Commission. The Codex Alimentarius is a collection of international food safety standards that have been adopted by the Codex Alimentarius Commission (the "Codex").

- **Animal Health**

The World Organization for Animal Health (formerly the Office International des Epizooties (WOAH)). The mission of the WOAH is to improve animal health globally, thereby ensuring a better future for all and, includes ensuring transparency in the global animal health situation and safeguarding world trade by publishing health standards for international trade in animals and animal products.

- **Plant Health**

FAO International Plant Protection Convention (IPPC). The IPPC is a multilateral treaty for international cooperation in plant protection. The Convention makes provision for the application of measures by governments to protect their plant resources from harmful pests (phytosanitary measures) which may be introduced through international trade.

Food safety is not the direct concern of this updated report since restrictions placed on ICW concern the potential risks to animal and plant health posed by food on aircraft. This report therefore focuses on animal health, but it should be noted that similar principles and approaches are applied to the control of plant diseases and pests as for animal diseases.

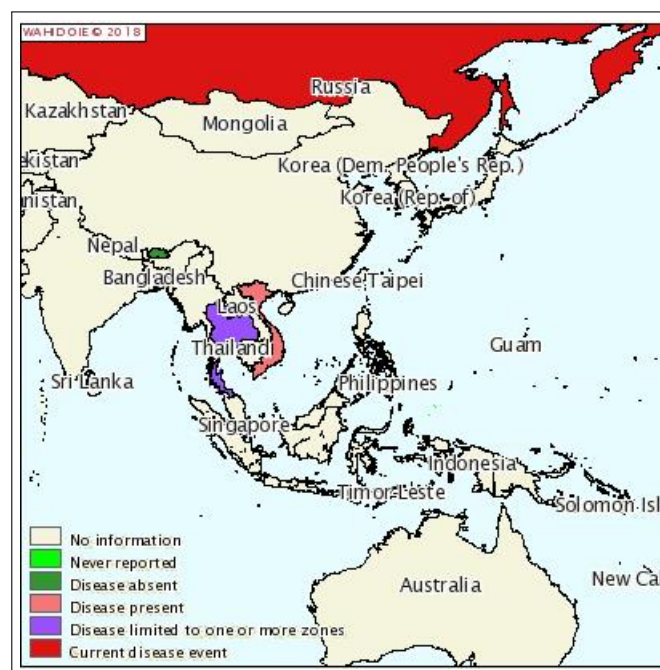


Figure 4: Example of World Animal Health Information Database (WAHID) classical swine fever Asia Abstract distribution map for July to December 2017

Airline meal preparation

The safety of food presented to passengers on aircraft is given a very high priority by airlines and their providers. The consequences of a food poisoning incident deriving from food consumed on an aircraft would be serious and could have a very adverse impact on the airline's reputation. Airline catering companies operate to very high food safety standards with sophisticated food safety management systems such as the HACCP system to control food safety hazards. These systems are subject to extensive audit procedures, and controls on microbiological hazards are verified by laboratory testing.

Guidance on aircraft catering can be found in the International Flight Services Association (IFSA) World Food Safety Guidelines for Airline Catering (IFSA 2023) which refers to the earlier version of this report. The IFSA's Guidelines describe effective food safety control procedures that are accepted by international airlines, with ground-based catering operations also subject to national food safety requirements. Airline catering operations that do not follow these stringent procedures may be subject to litigation in the case of a human health disease outbreak. For many foods of animal origin, heating is a critical control point for food safety hazards. Reduction of food safety hazards (e.g. Salmonellae, Verocytotoxigenic Escherichia Coli [VTEC] and Campylobacter) to acceptable levels requires specific temperature/time parameters to be achieved, and these will be monitored as part of a food safety HACCP system. Subjecting animal products to the heat treatments used in cooking for food aesthetics and food safety purposes will reduce the level of, or eliminate many animal health hazards.

4.1 Food and Ingredient Sourcing

The geographical area from which food and raw materials for airline meals are sourced has major implications for animal and plant health (see Figure 2, Figure 3 and Figure 4). A number of different arrangements or combinations of arrangements are used for the sourcing of food and raw materials for meal preparation, including the following scenarios:

- An airline may purchase food or raw materials itself and supply these to the caterer for incorporation in meals. Examples: one US airline exports US beef to its catering contractors and supplies pizzas produced in the US to catering companies at all European airports.
- An airline may stipulate the local producer(s) from which the catering contractor must source food or raw materials.

- Catering contractors may be free to make their own choice of suppliers subject to food quality (and price) specifications.

The method selected for sourcing food and raw materials is dependent on factors such as food safety, food quality, cost, cultural preferences, and differentiation from competitors. Locally-sourced food may be promoted as an inducement to attract premium and environmentally conscious passengers. In addition, many airlines source food and raw materials to conform to religious and cultural customs (e.g. Halal and Kosher food). Our discussions with a range of international airlines indicate that the animal and plant health concerns of destination countries are presently not a significant factor in the sourcing of food and raw materials.

4.2 Airline Meals

Cooked meals are usually served to passengers on long haul (> 6 hour) flights while sandwiches or similar are served on short haul flights.

Economy class meals and beverages may be served either in reusable (rotatable) containers or plates or in disposable plastic or paper plates or containers. A limited choice of meals may be offered. The number of economy class meals loaded exceeds the number of passengers by a small factor.

Business and First Class meals are served with crockery and cutlery (rotables) that is cleaned and reused. The number, choice, and quality of meals and drinks served in these classes are a source of intense competition between airlines. A wide menu choice will be available and, to ensure that each passenger may select their preferred options, the number of meals loaded greatly exceeds the number of passengers (i.e. a high loading factor). Unused meals become food waste on de-catering at the destination. Price competition on shorter flights is resulting in fewer cooked meals being served; in their place sandwiches and snacks may be offered, either individually or in boxes. Many low cost and holiday charter airlines do not provide any food to passengers but may sell snacks and meals on board.

Consequences of airlines transition away from providing complimentary meals may include:

- Decrease in catering waste volumes as passengers tend to consume meals and beverages that they have purchased or made themselves
- Increased amount of food waste left in seat back pockets and on the aircraft floor. This will result in a higher proportion of catering waste being removed in the cabin waste stream.
- Incentive for passengers to bring their own food onto aircraft. Passenger carried on food is outside the direct control of airlines; the consequences of this are considered later.

In summary, the presence or absence of airline-provided meals and the type of meals served by airlines will have an impact on the amount and nature of waste removed from aircraft.

4.3 Passenger-Related ICW

The increasing trend of replacing complimentary meals on short-haul flights with on-board food sales is resulting in significantly reduced waste but encourages passengers to bring their own food (purchased or made prior to embarkation) on flights.

Passenger-carried food may pose risks to animal health, and these are often cited in justification of the strict requirements of ICW, however, airlines have no control over this material. Many countries have systems to prevent passengers from carrying food from aircraft with them into the arrival country. These include mandatory on-board announcements (Australia) and prominent notices and amnesty bins at terminal buildings. Other measures include x-ray scanning technology and trained sniffer dogs. Some carried-on food waste is likely to be dropped on the floor or placed in seatback pockets for subsequent

collection by cabin cleaners. The cabin waste composition audits, conducted by ASF and supported by IATA, at Changi Airport in 2024 indicated that food waste comprised 3.2% by weight of the cleaning waste-stream and presumably the animal products fraction would be even lower.

We believe that the risks from carried-on food ICW from flights arriving from countries with similar animal and plant health status are overestimated because:

- Carried-on food and drinks are most likely to have been purchased in the country of origin, often at the airport, and the risks will be a reflection of the animal and plant health status of the country of origin
- Most food and drinks will have been subjected to heat or other treatment for food safety purposes, which will reduce or eliminate a potential animal health risks
- Passengers usually carry food and drinks on board with the intention of consuming them, not leaving them as waste.

International catering waste risk assessment

5.1 Import Risk Analysis

The handling and disposal of ICW poses the risk of products carrying animal and plant diseases into the territory of countries where the diseases are not present. Consequently, although ICW is not intended as a formal import into the country of arrival, its risks could be assessed by the relevant authorities of countries of arrival in a similar manner as for imports. In the context of this section, import is used synonymously with handling and disposal of ICW.

WOAH sets out a system for the analysis of import risks (see Figure 5). The principal aim of import risk analysis is to provide importing countries with an objective and defensible method of assessing the disease risks associated with the importation of animal products. The analysis should be transparent to ensure the exporting country is provided with clear reasons for the imposition of import conditions or refusal to import. In brief, the formal import risk analysis system comprises:

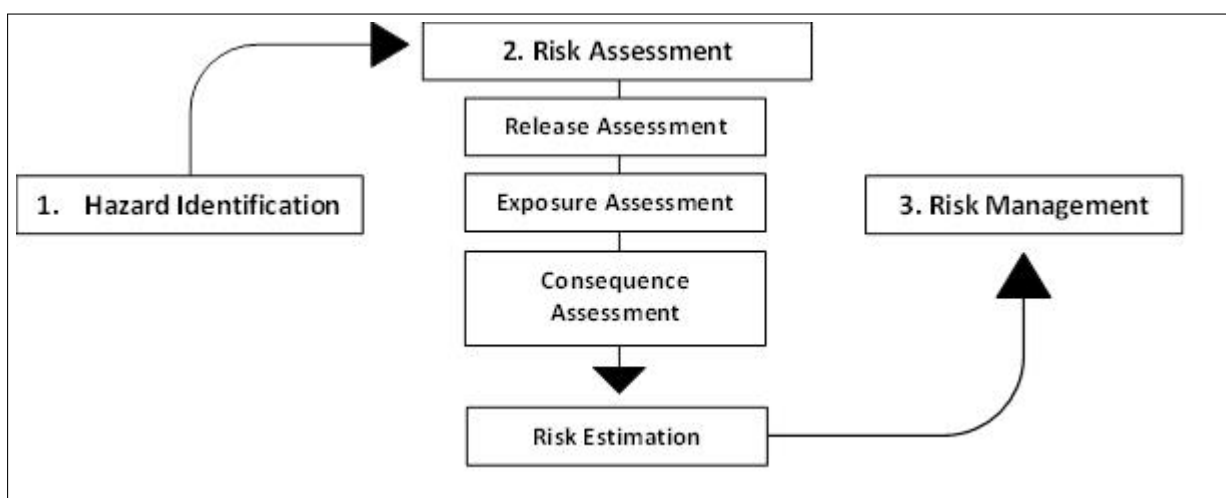


Figure 5: Import Risk Analysis Methodology

5.1.1 Hazard Identification

Hazard identification involves identifying the pathogenic agents which could potentially produce adverse consequences associated with the importation of a commodity. The potential hazards identified would be those appropriate to the species from which the commodity is derived, and which may be present in the exporting country (country of flight departure). It is then necessary to identify whether each potential hazard is already present in the importing country (country of flight arrival) and whether it is a notifiable disease or is subject to control or eradication in that country.

Each disease/commodity combination should be considered for hazard identification. Some diseases may be transmissible through food products e.g. FMD virus in fresh beef or untreated cows' milk, while others are not transmitted in this manner e.g. Bluetongue – a vector transmitted disease of cattle and sheep.

5.1.2 Import Risk Assessment

5.1.2.1 Entry Assessment

Entry assessment consists of describing the biological pathways necessary for an importation activity to result in the entry of pathogenic agents into a particular environment, and estimating the probability of that complete process occurring. The entry assessment describes the probability of the 'entry' of each of the potential hazards (the pathogenic agents) under each specified set of conditions with respect to amounts and timing, and how these might change as a result of various actions, events or measures.

5.1.2.2 Exposure Assessment

Exposure assessment consists of describing the biological pathways necessary for exposure of animals in the importing country to the pathogenic agents that enter through a given risk source, and estimating the probability of the exposures occurring.

Exposure assessment must take account of the infectious dose of the agent – the number of microorganisms required to cause infection in an animal. A single microorganism is seldom able to cause infection, and many diseases require thousands or more organisms to cause disease. Infection through food generally requires the food to be ingested by animals, and consequently, given their omnivorous nature, pigs play an important role in exposure pathways of diseases they are susceptible for.

5.1.2.3 Consequent Assessment

The animal health and socio-economic consequences of the major trans-boundary diseases to countries that are normally free of them are of such severity that those countries apply robust measures to prevent disease incursions. Several economic assessments have been made of disease outbreaks, however that topic is considered to be outside of this report.

5.1.2.4 Risk Estimation

Risk estimation consists of integrating the results from the entry assessment, exposure assessment, and consequence assessment to produce overall measures of risks associated with the hazards identified at the outset. Thus risk estimation takes into account the whole of the risk pathway from hazard identified to unwanted outcome. The components of risk assessment can be carried out qualitatively (in words; e.g. high, medium, low risk) or quantitatively (as a numerical estimate; e.g. x % probability per year of disease incursion or one disease introduction per year).

5.1.2.5 Risk Management

In the case of commercial import of food, the objective is to manage risk appropriately to ensure that a balance is achieved between a country's desire to minimise the likelihood or frequency of disease incursions and their consequences and its desire to import commodities. Risk management is the process of deciding upon and implementing measures to achieve the country's appropriate level of protection, whilst at the same time ensuring that negative effects on trade are minimised.

Every import of animal products carries a risk for the importing country; no trade is risk-free. For ICW, the balance is between the likelihood of disease incursions and the desire of airlines, government and society in general to reduce waste by recycling.

5.2 Risks Pathways for ICW

Applying risk analysis principles to the specific case of airline cabin waste recycling, the following pathway would be required for an outbreak of disease to be caused by the recycling of international catering waste:

Hazard identification:

- A pathogenic agent which must be transmissible through the commodity (e.g. meat, milk, eggs) by consumption as food.
- A disease present in the country of origin of the product.
- A disease present in the animal(s) from which the food product is derived.
- The pathogenic agent must be present in the product.

Entry assessment:

- The infected food product must be able to pass the inspection and control procedures in the country of origin.
- The pathogenic agent in the product must survive processing (e.g. cooking - heat treatment, if appropriate) and storage applicable to that particular product.
- The infected product must be present in the recycled material (food waste, aluminium cans/foil; glass bottles; paper/cardboard; plastic) as a contaminant.

Exposure assessment:

- Susceptible domestic animal species in the recipient country must be exposed to an infected product in unprocessed recycled material.
OR
The pathogen must survive recycling processes (heat and/or chemical) and susceptible domestic animal species must be exposed to the infected product in the processed recycled material.
OR
Susceptible domestic animal species must be exposed to an infected product in the waste products generated during processing (e.g. waste water, rejected materials).
- The pathogen must be present in sufficient numbers to provide an infectious dose in the quantities that may be eaten by domesticated animals.
- Animal demographics and production systems in the recipient country must enable infection in an individual animal to spread and cause an outbreak.

These risk pathways are illustrated in Figure 6.

An example of entry of an infectious agent and exposure of susceptible animals is the 2001 outbreak of FMD in the UK. Although it cannot be known for certain, there is strong evidence that the outbreak was caused by the following series of events: (1) the illegal importation of infected meat; (2) collection of

infected meat in waste food from catering establishments by a licensed waste food feeder; (3) failure to process the waste food as required by law (a heat treatment sufficient to kill the FMD virus); (4) waste food containing meat infected with FMD virus fed raw to pigs. A consequence of this outbreak is that feeding waste food of animal origin to pigs is no longer permitted in the UK and EU (Adkin et al. 2008).

Anecdotal evidence indicates that ICWs inclusion in the ABP regulations in the UK were introduced based on the unproven suggestion that ICW was the source of the FMD 2001 outbreak contrary to the strong evidence that the source was illegally imported meat. Further to this:

1. Newcastle International Airport (NCL) airport was a small regional airport at the time (farm was 5km from airport)
2. UK Civil Aviation Authority passenger data¹ indicates the only flights arriving at NCL in January and February 2001 arrived from Tunisia and USA (both were FMD free at the time/USA has not had an outbreak since 1926)
3. Other international airports are nearby (Manchester - 264 km / Edinburgh-170km) - but why would FMD contaminated pig swill be driven all the way to Burnside Farm, Heddon on the Wall as there would be farms in the vicinity of both airports.)

This example demonstrates that failure of control measures at more than one point may result either in disease incursion or overreaction, and highlights the importance of effective and correct enforcement of legislation and the use of proper risk assessment to underpin legislative control measures.

5.2.1 Risk Assessment for ICW

Assessment of the risks associated with disposal of ICW can be made either qualitatively – using descriptive terms such high, medium, low, very low, negligible – or quantitatively – providing a numerical estimate of the probability of risks occurring. By their nature, qualitative risk assessments involve a degree of subjectivity but, in many situations they will be adequate to allow risk management decisions to be made.

Quantitative risk assessment offers the advantage of enabling relative levels of different risks to be compared. Such comparative information can then be used to make risk management decisions that ensure that resources are used to the greatest effect. Quantitative risk assessment can also allow an estimate to be made of the sensitivity of the level of a risk to changes in the elements in the risk pathway; again promoting best use of resources by, in this case, targeting control measures at the most appropriate point. Quantitative risk assessments develop models and use the best available data to compute risk probabilities. In many cases accurate data is not available and assumptions and estimates must be used to populate the model. The results of risk assessments can be very dependent on the validity of such estimates.

Our research did not find evidence that qualitative and/or quantitative risk assessments were undertaken prior to the adoption of the EU legislation controlling the management of ICW and it would appear that the regulations were adopted based on a very risk-averse precautionary principle.

5.2.2 Individual Country Risk Assessments

5.2.2.1 Illegal import of meat

The risk of introducing exotic pathogens through personal consignments is a continuous threat as stated in 2019 by Beltran-Alcrudo et al., since considerable amounts of animal products might be involved originating from countries where TADs are endemic. Individual travellers carrying (smuggling) meat products, which could potentially be fed to susceptible animals, e.g. due to swill feeding or other

¹<https://www.caa.co.uk/data-and-analysis/uk-aviation-market/airports/uk-airport-data/uk-airport-data-1990-2014/>

improper disposal. The average traveller will not be aware of the potential risk of introducing TADs, highlighting the importance of awareness raising campaigns prior to and during travel (Beltran-Alcrudo et al. 2019).

Studies reported by Corso, B., in 1997 estimated the likelihood of introducing selected exotic diseases to domestic swine in the United States of America through uncooked swill from smuggled meat. The author reports in his article that between 50% and 90% of smuggled food of animal origin in passenger baggage escapes interception by control personnel at international airports in the USA (Corso 1997).

Origin and destination	Disease
To the UK 1967, smuggling of meat or meat products. Origin not known.	FMD (Pharo 2002)
To the Taiwan 1997, smuggling of meat or meat products. Origin not known.	FMD (Pharo 2002)
To EU several countries 2000. Illegal imports of pork or pork products followed by illegal feeding of swill to pigs. Origin not known.	CSF (Moennig, Floegel-Niesmann, and Greiser-Wilke 2003, Paton and Greiser-Wilke 2003)
To Mauritius 2007. Origin not known.	ASF (Lubisi et al. 2009)

Table 5.1: Illegal import, origin, destination and disease

5.2.2.2 Risk assessment on illegal imports

The risk of introducing diseases in association with illegal importation of meat and products is well recognised, however very few studies have evaluated that risk. Published studies that have explicitly considered illegal imports of meat and meat products highlight the difficulty of quantifying illegal movements of animals and animal products, (Bronsvort, Alban, and Greiner 2008), (Wooldridge et al. 2006). Both of these studies relied on expert opinion, which has its limitations as discussed above.

Beltrain-Alcrudo et al, reported in 2019 that the type and amount of informal imports are by definition difficult or even impossible to assess with certainty (Beltran-Alcrudo et al. 2019) which means that epidemiologists and risk analysts must work with limited quantitative data and even use informed guesses, estimates and proxies in their calculations, which leads to high levels of uncertainty. The authors list several studies estimating the amounts of illegally imported meat (including bushmeat) by individual travellers. In most cases they have extrapolated the frequency and quantities of seizures of illegal meat at the ports of entry, most often international airports (Beutlich et al. 2015, Anne-Lise Chaber et al. 2010, Falk et al. 2013, Jansen et al. 2016, Schoder et al. 2015 and Taniguchi et al. 2008) . Beltrain-Alcrudo et al, listed the amounts reported in each of these studies as follows:

- 2,800 tons (Frankfurt airport, Germany),
- 3,287 tons (Charles de Gaulle airport, France),
- 11,875 tons (all United Kingdom) and
- 1,013 tons (all Switzerland)

The US Customs also confiscated over 68,000 products and specimens derived from pigs between 2012 and 2016 (BROWN and BEVINS, 2018).

Harnet, E., et al. (2007) also state that reliable data on illegal imports are difficult to obtain due to the nature of the activity, but they made an attempt to quantify the risk of illegal import transmitting FMD into the UK (Hartnett et al. 2007). The total amount of illegal meat entering the UK each year is estimated on average to be 11,875 metric tonnes or between 4,398 and 28,626 tonnes per year (90% certainty); of which between 64.5 and 565 kg are infected with FMD. This was estimated to result in an outbreak of FMD from this source once every 66 years (90% CI: 19 – 600 years).

Solenne Costard et al. (Costard et al. 2009) presented a semi quantitative risk assessment study on illegal import of meat and meat products into the EU. The authors conclude that the introduction of diseases through illegal importation of meat and derived products is not negligible. A systematic check of luggage or parcels is difficult and expensive. Authorities try to address that problem by demanding travellers' signed declarations that they do not carry food products. Random luggage checks and the use of trained sniffer dogs to detect agricultural products are used in some countries in addition to fines where items are found. The most common and cost-effective prevention measure however is using awareness campaigns directed to travellers highlighting the risks associated with bringing meat and other agricultural products to the country of destination (Beltran-Alcrudo et al. 2019). The authors emphasise in particular the need for risk assessment in their conclusion by stating that information on outbreak sources and pathways is required to develop prevention, awareness and surveillance programs that correspond to the reality. In the case of formal trade however, risk assessment will allow the development of additional protocols and regulations to fill in the loopholes of the system.

Import risk assessments are specific for the unique factors in each individual country, such as animal and plant health status, domestic animal demographics and production systems, presence of wildlife, dietary habits and customs, disease control measures and legislation. Developed countries have systems for the continuing assessment of the import risks through all routes, and many have published their import risk assessments, both qualitative and quantitative. Possible routes identified for introduction of animal diseases are: live animals, genetic material (semen, embryos), food of animal origin, and animal products (see Appendix 1). Most published import risk assessments recognize ICW as a possible route of introduction, but generally consider ICW to be ranked low on the list of risks. A consistent conclusion however from import risk assessments is - that the illegal import of meat represents a high, if not the greatest risk, for introduction of animal disease. For example, a New Zealand risk assessment (Pharo 2002) concluded that the most likely route of introduction to New Zealand [of FMD] is illegally imported meat.

Prevention of illegal personal imports (in passenger luggage) is addressed with varying degrees of rigour in different countries. Australia and New Zealand in particular devote significant resources to this activity. Other researchers have highlighted the nature and scale of illegal meat imports being smuggled in the baggage of passengers. A study in 2010 estimated that up to 260 metric tonnes of bushmeat (wild animals) is smuggled in personal baggage through Paris Roissy-Charles de Gaulle airport each year (Anne-Lise Chaber et al. 2010), out of the total of 3,287 tons. A study into illegal bushmeat being smuggled into two international airports in Switzerland revealed at least 40 tonnes was confiscated in 2012 with an estimated real figure of between 500 and 1,500 tonnes (Wood et al. 2014). According to information from the French government in 2022 (personal communication), 250 metric tonnes of illegal meat were seized at CDG and Orly airports, including 850 kg of bushmeat.

The scale of the international bushmeat trade via Brussels Zaventem Airport in Belgium was observed in 2017 and 2018 (Anne-Lise Chaber et al. 2023) where a total of 1,013,754 passengers from sub-Saharan Africa across 4,887 flights arrived during that time. The luggage of all the passengers from Sub-Saharan Africa and all leaking luggage were seized and checked for were searched for both bushmeat and domestic livestock meat. The aim was to estimate the overall volume of illegal meat entering and transiting through Belgium via commercial flights from Africa. During the study period, a total of 687 kg of meat was found in 173 seizures. Based the estimations and calculations made, it is estimated that a total of 80,381.20 kg of bushmeat transited through Brussels airport over the course of the survey, equating to 3,876.42 kg of bushmeat arriving in, or transiting through, the airport on a monthly basis.

In addition to the threats to endangered species, one of the most serious issues in regard to the import of bushmeat is the health risk it poses to humans and also to domestic and wild animal populations in the importing country through the introduction of disease pathogens. Of the pathogens that cause new emerging infectious diseases, it has been shown that wildlife are the most likely source of infection

(Cunningham 2005); the majority of emergent disease events (>70%) originate in wildlife (Jones et al. 2008).

5.2.2.3 International catering waste

Our investigation of the animal health risks posed by international catering waste has not identified any recent animal disease outbreaks traced to ICW. An overview of earlier outbreaks focusing on pig diseases was provided by Beltran-Alcrudo et al. in 2019:

Origin and destination associated with airports	Diseases and year
Angola to Portugal in 1957.	ASF
Spain to Dominican Republic 1978 (probably through airport)	ASF (Alexander 1992)
Spain / Portugal to Brazil 1978	ASF (Moura et al. 2010, Lyra 2006)
Unknown to Sardinia, Italy 1968	ASF (L. Mur et al. 2016) From a port or a military airport.
Unknown to Sri Lanka	CSF reported by Beltran-Alcrudo et al in 2019
Unknown to South Africa 2004 (Air or seaport)	PRRS reported by Beltran-Alcrudo et al in 2019

Table 5.2: Origin and destination of ICW

Mur et al. collected and analysed expert opinions to identify potential ways of introducing ASF into Europe and listed examples from around the world by different pathways, such as Portugal in 1957, in the Caribbean sea (Cuba) in 1971, in South America (Brazil) in 1978, Belgium in 1985 or, recently, in Georgia in 2007 (Lina Mur, Martínez-López, and Sánchez-Vizcaíno 2012). The authors included the most common transport associated pathways including by air, using the number of commercial flights coming from ASF-affected areas as a risk factor for the volume of potential ASF-contaminated waste arriving by plane to the EU. The pathway representing the highest risk was returning trucks, being three to six times more important than waste from ships and planes, while ships' waste was two times higher than plane waste. While acknowledging that the results should be cautiously interpreted considering all the assumptions and uncertainties associated with the model structure and data used, the authors believe the approach being useful to evaluate the transport associated risk.

This approach should be considered taking due account of the limits associated with using expert opinions. The experts will be heavily influenced by their experiences and field of research as well as the information they had on the individual pathways. As far as can be judged from the article, waste from planes is considered in its totality without any differentiations between origin of the planes or the type and nature of the food served on the planes. Beltran-Alcrudo et al. 2019 assessed the risk associated with trade, both formal trade and informal and/ or illegal trade and concluded that the informal or illegal movement of animals and animal products from infected countries involve a much higher risk being the most common route of introduction of transboundary pig diseases.

The authors also discuss the disposal of catering leftovers from international means of transport stating that while the entry itself may be legal, the transmission of pathogens takes place when such leftovers are sold for swill feeding or otherwise improperly disposed against the airport or port waste management regulation. The authors also point out that the origin of many outbreaks is unknown. This is reflected in follow-up of outbreak reports where only 4.6% confirm a particular origin of the infection.

Wooldridge et al. 2006 described four main transport modes as pathways however does not include cabin waste from airlines in that list.

As far as we can ascertain based on the above listed research, no recent animal disease outbreak has

been attributed to the introduction of disease agents in ICW. An important study in the context of ICW was conducted by a UK team which estimated the risk of exposure of British livestock to FMD associated with the importation of ship and aircraft waste (Adkin et al. 2008). In accordance with the risk assessment principles described above, the process of estimating the risk was considered in terms of four underlying factors: the probable amount of waste imported per year and its relevant characteristics; the probability of the waste being contaminated with FMD; the probability that importation of the waste results in the exposure of livestock; and the probability that an animal exposed to the meat waste would become infected.

The main outcome of the study was:

In the model, the total weight of waste introduced that was contaminated with FMD was estimated to be 26 kg per year, with 90% certainty that it would be between 10 and 53 kg. As a result, it was estimated that there would be a mean of 1,429 years between outbreaks of FMD due to ship and aircraft waste, with a 90% certainty that the interval would be between 500 and 10,000 years.

A number of factors lead us to believe that the results of this work may be an overestimate of the risks from ICW from aircraft including the fact that the study included waste from both ships and aircraft and that it was assumed that 4% of all cabin waste was removed and fed illegally to backyard livestock (we consider this to be a very high estimate). A sensitivity study in the report on the source of waste indicated that aircraft cabin waste accounted for more than 70% of the total risk (aircraft cabin waste 70.7%, container ship waste 24.4%, aircraft galley waste 4.9%, and cruise ship waste negligible).

Our view is therefore that a true estimate of the risk of introduction of FMD into Britain through ICW from aircraft is less than that reported in this work i.e. a frequency of once in more than 1,429 years. Notwithstanding our views on this, comparison of the estimates for the frequency of introduction of FMD via the illegal meat route (once in 66 years) and via aircraft ICW (once in 1,429 years) provides clear evidence of the relative risk of these routes – risk from ICW is estimated to be twenty-fold less than that from illegal imports.

It must be noted that these figures apply only to FMD and to Britain. Other diseases and countries are likely to result in different outcomes.

5.2.3 Risk Assessment for Milk and Milk Products

Milk and milk products are frequently referred to in ICW legislation and guidance, and are claimed to be high risk for the introduction of animal diseases. Paper beverage cups that have held hot drinks that may have contained milk are generally excluded by enforcement authorities from any recycling protocols because of this perceived risk.

Milk and milk products originating from treatment plants outside the EU are considered high risk, due to the potential risk of presence of FMD virus in the milk. Single pasteurisation and single UHT treatment are not considered to be effective enough in inactivating the virus. Under the implementing regulation among several treatment options for milk/milk products, pasteurisation treatment carried out twice or drying and further heat treatment to at least 72°C are considered as effective for UHT and pasteurised milk. Hot water added to hot drinks on planes may not always reach effective virus inactivating temperatures.

No specific risk assessments for milk in ICW appear to have been published but there is much published work on the risks from milk in international trade. Milk is a recognized vehicle for the transmission of FMD and other pathogens (BVD, EBL, TB, Listeria, Brucella) and milk has been implicated in disease transmission in FMD outbreaks. Milk traded in national markets is generally subjected to heat treatment for public health reasons with two types commonly used: high temperature, short time (HTST pasteurisation); and ultra-high temperature (UHT). These treatments eliminate microorganisms of

human health concern and also kill most animal disease pathogens. IFSA World Food Safety Guidelines for Aircraft Catering recommend HTST pasteurisation of milk and milk products (IFSA 2023). The HTST treatment of milk fulfils the WOAHA criteria (terrestrial code Article 8.8.35) for inactivation of FMDV in milk as the pH of fresh milk is in the pH range of 6.5-6.7.

Single heat treatment of milk reduces the level of any FMD virus but is not guaranteed to eliminate it – although residual levels can often only be demonstrated by artificial means such as animal inoculation. It would appear that this lack of certainty about elimination of FMD virus by heat treatment has influenced the perception of milk as a high risk commodity. A paper by Donaldson published by WOAHA (Donaldson 1997) challenges this estimation of the risk of FMD from milk on the grounds that earlier work “... *exaggerated the risks by concluding that any residual infectious virus in milk and dairy products after manufacturing processes would pose a risk to livestock. In doing so, they overlooked the crucially important consideration of the infective doses of virus which are required to initiate infection in susceptible animals.*”

Donaldson estimated the effects on virus levels of dilution of infected milk during collection and processing, and of heat treatment. Taking account of the known infectious dose for FMD he concluded that: “... *for a high probability of infection, a single pig would have to ingest 125 to 1,250 litres of this milk to obtain an infective dose of virus and a calf would have to consume 1,250 to 12,500 litres. These are physical impossibilities.*” (Donaldson 1997). Furthermore, available evidence suggests that the risk of spread by pasteurised milk or dairy products derived from pasteurised milk is very low. This gives weight to earlier work by van Bekkum and de Leeuw who stated that, in the period that FMD was widespread on the European continent, no outbreak has ever been attributed to imported milk products, that had been submitted to any kind of heat treatment, although no restrictive measures on importation were taken as nobody was aware of an existing risk (De Leeuw, Van Bekkum, and Tiessink 1978).

We conclude that the risks of FMD from milk in ICW are negligible and that there is no justification for the measures in place in many countries for control of this perceived risk.

5.2.4 Risk Assessment for Honey

Bees are susceptible to a range of diseases caused by insects, fungus, viruses and bacteria, some of which may be transmitted in honey or other bee products. Normal processing of honey will destroy most bee pathogens but the spores of the bacterium that causes American foulbrood can survive processing. As for other animal and plant products, import controls are based on the bee disease status of the exporting and importing countries. Countries with a high bee health status, such as New Zealand and Australia, have strict controls on the import of honey and bee products.

Some jurisdictions make specific reference to honey in the definition or guidelines on ICW. In some cases the rationale for this may be questioned e.g. UK and the EU forbid recycling of items that have been mixed with pots of honey, but permits passengers to import up to 2 kg of honey for personal consumption, USA has no controls on personal import of honey for human consumption.

5.3 Drivers for change in ICW Management

Given the nature of the distribution of animal and plant diseases throughout the world, countries that have made investments to achieve high animal and plant health status are justified in imposing control measures on materials, including waste and passenger carried meat imports from international flights, entering their countries that may pose a threat to that status. This right of countries to apply measures to protect their agricultural industries from disease is enshrined in WTO rules, provided they can be scientifically justified.

Historically, most countries wishing to protect their animal and plant health status have applied a homogenous, blanket approach to the control of ICW, without any differentiation of risk based on the origin or last port of call of flights arriving in the country. For many years this highly risk-averse approach has had general agreement and acceptance but is now coming under challenge due to changing circumstances including increasing legal, social and environmental concerns regarding resource use. In addition, with the current levels of aviation traffic growth, the volume of cabin waste is set to double by 2040, combined with emerging environmental legislation on minimising food waste and bans on the landfilling of organic waste, it is clear that current ICW regulations are diametrically opposed to future environmental policies.

In light of these changed circumstances it is appropriate that better assessments of the risks posed by ICW are made and that these are used to inform risk management decisions. It is our view that effective risk management decisions require the active cooperation of all stakeholders, including the industry – airlines, catering companies, airline cleaning companies, aircraft manufacturers – and governments – policy makers and enforcement officers. We have been encouraged by the degree of cooperation between stakeholders we have observed during the cabin waste composition audit project supported by IATA and ongoing consultations between Air New Zealand and the Ministry of Primary Industries on the reuse of materials from international flights (Air New Zealand 2023), transatlantic Recycling Trials from the EU to the USA in coordination with US APHIS and US Customs and Border Protection (CBP) and CFIA consultation on International Waste.

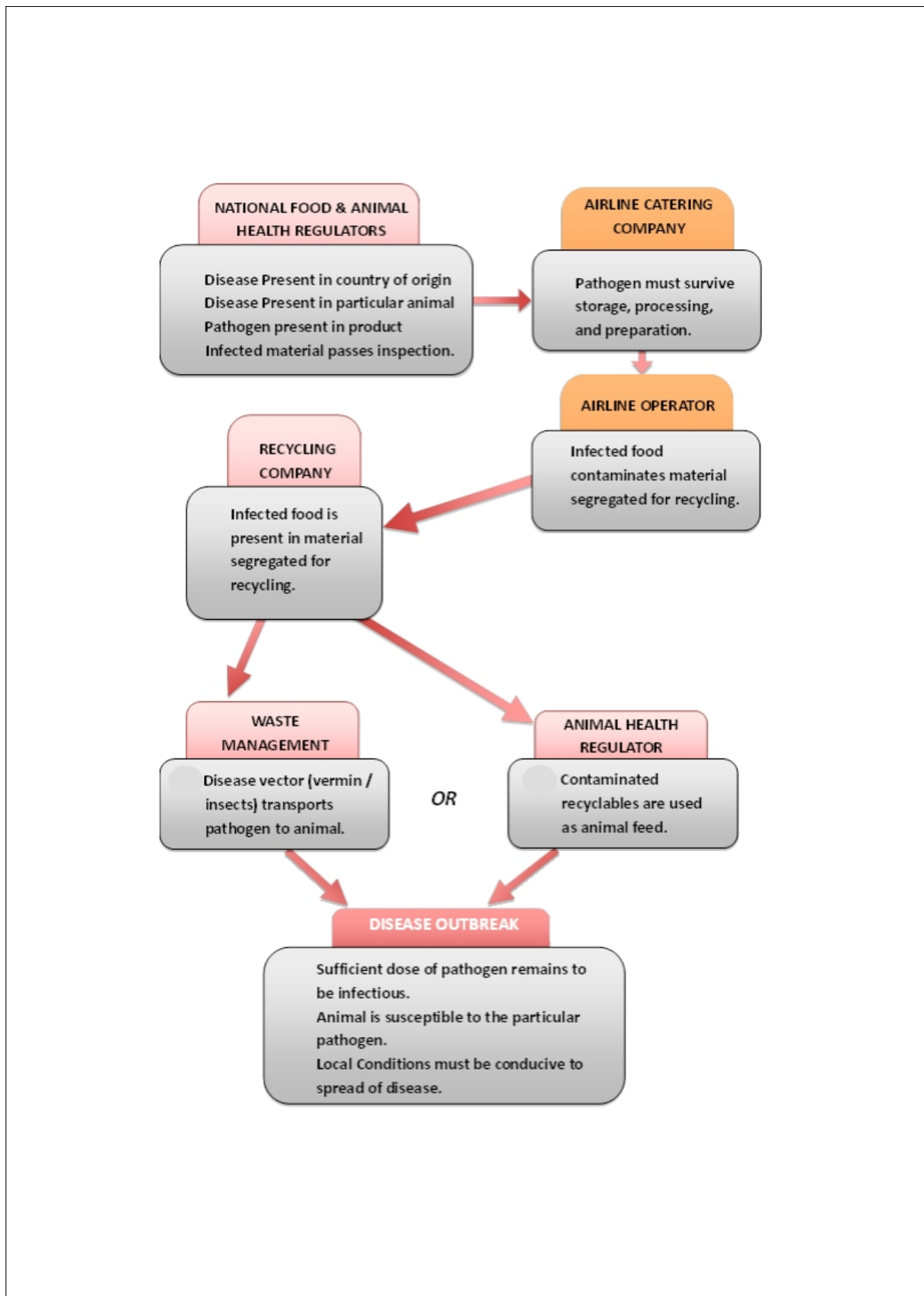


Figure 6: International catering waste (ICW) recycling risk pathways

Options for change to increase the amount of waste material that is recycled fall into the following categories:

1. Improved use of existing legislation, guidance and interpretation
2. Apply scientific risk assessments to guide risk management decisions concerning interpretation and/ or amendment of current legislation
3. Changes to legislation on the basis of risk factors affecting entry and exposure assessments.

6.1 Improved Use of Existing Legislation, Guidance, and Interpretation

6.1.1 On-board segregation of recyclables

A number of airlines currently segregate recyclable materials especially for domestic flights. Countries such as Finland, US and the UK have issued guidance that states that materials from international flights that are not contaminated by food can be reused or recycled. It is apparent that not all airlines make use of recycling possibilities in countries that exclude pre-sorted waste from the definition of ICW. There are therefore opportunities for airlines to introduce or expand on-board recycling procedures. Problems to be addressed to enable this include:

- Lack of storage space in galleys – aircraft galley design.
- Inconsistent recycled material handling legislation and facilities at destination airports. Airlines report that they wish to have common instructions for crews on all flights. Recycling may not be possible at many destinations because of prohibitive legislation or absence of recycling facilities. Airlines may therefore be reluctant to invest time and effort to collect recyclables separately until such time that there is a critical mass of their destinations where recycling is possible.

Where on-board segregation is practised, working instructions for crew must ensure that any waste contaminated with food is excluded from materials for recycling. Colour-coded bags are usually used for segregated materials to distinguish them clearly from other waste. IATA has published guidance for recycling from international flights that supports on-board segregation of recyclables from ICW.

6.1.2 Segregation of ICW in Cabin Cleaning Waste-stream

Cleaning waste comprises low amounts of food and beverage waste dropped on the floor of the cabin and in seatback pockets. The IATA waste audit at Heathrow indicated that food waste comprised 2.7% by weight of the cleaning waste-stream and presumably the animal products fraction would be even lower. Airports such as Auckland (AUCKLAND AIRPORT, 2016) and Heathrow have introduced cleaning waste recycling facilities in cooperation with the regulator with all waste being subject to visual inspection to identify and exclude ICW. This approach could be replicated at other airports.

6.1.3 Separation of Domestic and International Waste Streams

Many caterers provide waste disposal services (de-catering) for both domestic flights and international flights from the same premises. In countries that have specific legislation for ICW, it appears that most such catering operations treat all waste from their premises as ICW. Consequently none of this waste is currently eligible for recycling.

Separation of carts and other materials on arrival at the catering premises and during processing would enable recycling of domestic waste. We are aware of a small number of caterers who practise segregation in this manner. The incentives for segregating domestic and ICW waste streams and the method operation of a segregated system is dependent on the relative quantities of the two streams. A small amount of domestic waste provides little incentive for segregation; a small amount of ICW can be easily excluded from a large amount of domestic waste; a more even balance between the relative amounts will require an effective segregation system.

Different authorities may have different requirements for segregation e.g. a painted line, a rail or a solid barrier. Operators report the importance of a simple and reliable method for visual identification and labelling of carts to ensure correct handling of domestic waste and ICW.

If, as discussed below, the application of risk principles results in less material being classified as ICW, then an increase in the relative amount of waste eligible for recycling will provide additional incentive for segregated handling in catering premises. Some caterers appear reluctant to implement segregated waste handling, mainly for reasons of lack of space and increased complexity of operations that must be carried out under time pressure.

6.1.4 Salvage of Unopened Food and Beverages

Large quantities of unopened packs of confectionary products, crisps and nuts, condiments (jams, sugar, salt, etc.) and beverages (not containing milk) are currently classified as ICW and not reused (see Figure 7). The 2024 cabin waste composition audits at Changi Airport, revealed that 4.4% of total waste was comprised of unopened bottled water. These products may be salvaged for use on subsequent flights, in which case they do not leave the confines of the caterer/aircraft chain and, in our view, do not therefore fall into the definition of waste. A number of countries including the US (USDA APHIS 2023) and UK (APHA and DEFRA 2021) have issued guidance that supports this reuse.

There is inconsistency in policies for salvage and reuse of these products between caterers and airlines. We understand that caterers and airlines may have concerns about the provenance of salvaged products and their safety, but we are aware of instances where products are not salvaged for reasons of branding i.e. they are not the brand specified by the airline.

We believe there are opportunities for reducing waste by the salvage of unopened containers and food and beverages.



Figure 7: Image of unopened food and beverages found during catering facility visit (FCC, 2013)

6.1.5 Minimise the quantity of food and associated materials loaded onto aircraft

There is a clear financial incentive for airlines to keep to a minimum the quantity of catering materials – food, drink and equipment - loaded onto flights. Additional materials require more storage/transport carts. Unused materials have an intrinsic cost, add to the weight (and hence fuel requirement of the aircraft) and carry a cost for their disposal.

Despite this financial incentive, the IATA audit and our own observations show that it is common for significant quantities of unused materials to be removed from aircraft during de-catering.

We have identified an opportunity to reduce the quantity of all waste generated – including food and recyclables – by giving passengers (particularly in ‘premium’ classes) the option to pre-select meal choices at the time of booking or before an appropriate period before departure, and recommend airlines to investigate this opportunity.

6.2 Apply Risk Assessments to Guide Risk Management Decisions

6.2.1 Classification of Recyclables as ICW

As highlighted previously, there are marked differences between jurisdictions in the interpretation and classification of ICW. Some (e.g. USA, UK) are content to exclude waste pre-sorted on board from ICW, while others (e.g. Canada,) are currently not. A consistent approach – all jurisdictions excluding pre-sorted waste from ICW – would be beneficial for airlines to divert more materials for recycling. If airlines were confident that pre-sorted recyclables could be recycled at every destination there would be greater incentive to put this into action.

Airlines themselves can make a significant contribution to this aim by developing and implementing their own, or generic, standard operating procedures (SOPs), based on IATA’s guidance document. The main issue appears to be a judgement on what constitutes ‘contamination’ with food. We believe that cooperation between airlines and government authorities will enable clear guidelines on this to be developed.

6.2.2 Milk and Milk Products

We have presented above strong evidence to challenge the categorization by all jurisdictions of heat treated milk and milk products in aircraft waste as high risk commodities for animal disease. We do not believe that the evidence supports this classification. For public health reasons, all milk and milk products are subject to heat treatment. To give assurances to government risk managers in all countries, airlines should stipulate to their caterers that all milk and milk used for the manufacture of milk products is subjected to HTST or UHT treatment.

Removing milk from the ICW category would have a marked effect on the quantity of aircraft waste eligible for recycling.

We acknowledge that the some recent papers we have identified and referred to in this report are rather old. We recommend that risk assessment bodies (such as EFSA in the EU) or national risk assessment bodies give consideration to carrying out quantitative risk assessments based on contemporary data in order to verify the low risks posed by heat treated milk and milk products.

6.2.3 Honey

We consider that classification of honey as a high risk component of ICW is not justified for most routes. For those destination countries with high bee health standards we propose below that exclusion of honey from airline meals would be a simple means to eliminate any risk and to promote recycling of ICW. The EU has a derogation from their legislation on imports of products of animal origin allowing passengers to bring in their luggage up to 2 kgs of honey into the EU irrespective of where they are arriving from, while classifying honey in ICW as Category 1 material, i.e. high risk material.

6.2.4 Fish and fishery products

The EU likewise has a derogation from their import legislation regarding fish and fishery products, where passengers can, for their own consumption, bring in 20 kgs of fish and/or fishery products or a whole fish whichever weighs more as long as the fish is gutted, while fishery products in ICW are considered Category 1 material.

6.3 Changes to Legislation

6.3.1 Entry Assessment Factors

Options considered under this heading are those whose objective is to ensure that hazards for animal and plant health status of the country of destination are not present in or on food in aircraft and are therefore not present in any cabin waste from the aircraft.

6.3.1.1 Risk classification of international transport routes

The introduction to the report referred to the anomalous situation whereby large amount of raw meat in the hold of an aircraft might be permitted to be imported into the destination country, but same meat, having been cooked (i.e. heat treated) and incorporated into a meal served to passengers on the flight, was deemed to be high risk when present in waste from the aircraft.

Most jurisdictions apply the same rules to waste from all international flights, irrespective of the origin or last port of call of the aircraft. But the risks posed by flights between countries of similar animal and plant health status are likely to be low – and no greater than those from legal imports of food commodities. In general terms, the animal and plant health status of the USA, Canada, EU, Australia and New Zealand are similar; their normal situation is freedom from the transboundary animal diseases

of greatest concern. The majority of food commodities may be traded between these countries and, although there are some exceptions to this, the reasons often do not relate to animal or plant health issues (e.g. the dispute between US and EU over hormone-treated beef).

Clearly the risks from ICW arising from flights between these countries are less than those from ICW from flights arriving from countries with lesser animal and plant health status and no agreement on food safety and animal health. It is disproportionate to the risks to apply the same risk management controls across the board to all ICW from all destinations.

We recommend that there is a strong case for changes to be made to the legislation governing aircraft waste in many jurisdictions and for the categorisation of waste to be based on the origin or last port of call of each flight. On the basis of animal and plant health risks, there are four main types of international flight routes shown in Table 6.1 below.

	Departure Country	Arrival Country
1	High animal health status – includes domestic flights	High animal health status
2	Lower animal health status - export of certain commodities to destination country permitted under defined conditions	High animal health status
3	Lower animal health status No exports to destination country permitted	High animal health status
4	High animal health status	Lower animal health status
5	Low animal health status	Low animal health status

Table 6.1: Main types of international flight routes

6.3.1.2 High animal health status -> High animal health status

In this ‘best case’ scenario there is either the same legislation in force or an equivalence agreement between the two countries based on the WTO SPS agreement, where both countries have accepted each other’s animal health systems as equivalent. For example, there are formal agreements of equivalence between the EU and USA and Canada (European Commission 2023). The US has recognized the high animal health status of Canada in its definition and procedures for managing regulated garbage (ICW) (USDA-APHIS RG 2023).

It is most likely that all ingredients included in airline meals produced in these high animal and plant health countries is sourced in the country or from suppliers that have met strict import controls (including those covering animal health risks); airline catering companies would need to have systems in place that would enable them to give the appropriate guarantees .

In this case there should be no necessity to categorise and handle waste from aircraft on such routes differently to waste from domestic flights. Flights within the EEA and Switzerland as well as between USA, Canada, Europe, Australia and New Zealand are likely to fall into this class. Transatlantic flights account for 10% of global passenger traffic and so transatlantic mutual recognition of animal health controls could result in a declassification of ICW, yielding significant environmental and financial benefits.

In cases where there were specific animal or plant health hazards of concern on a route, legislation could include provisions to address these.

6.3.1.3 Lower animal health status -> High animal health status – export of certain products permitted

This level represents countries without an equivalence agreement but where the country with a higher level of protection has made an assessment of the other country and is content that its standards of legislation and controls give sufficient guarantees that animal health risks are acceptable with regard to food of animal origin. Usually only a number of designated establishments in the exporting country are approved to export specific food products to the country with the higher level of protection. Examples of such routes are flights from South Africa, Brazil and Argentina to the EU.

In this case it should be possible for airline catering companies to provide guarantees that they source all meal ingredients such that they fulfil the animal and plant health import conditions of the country of destination and thereby would not require airline waste to be categorised as ICW.

Most high animal health status countries have compiled and published lists of establishments in exporting countries authorised for export of food of animal origin to their countries. An example is the lists published by the EU for both individual third countries and specific commodities (European Commission 2023). The catering companies / airlines should ensure that food of animal origin is produced in an establishment which appears on such a list. This would require SOPs to ensure that only products from approved establishments are used for catering of airlines. In effect, the type of system required would be similar to the HACCP system used for food safety but with hazards to be controlled as the animal and plant health hazards discussed in this report. Airline caterers are very familiar with the operation of food safety management systems such as the HACCP systems and should therefore be capable of implementing SOPs which eliminate animal and plant health hazards for destination countries.

Further assurance could be provided to countries of destination by including catering companies in the lists of approved establishments – this would ensure that the catering companies fall within their countries' regime of approval and official controls.

Clearly this type of arrangement would require close cooperation and agreement between the competent authorities in the countries of origin and destination of flights, however this will be the case anyway where the countries concerned are approved for export to the destination country.

The IFSA World Food Safety Guidelines for Aircraft Catering (IFSA 2023) include an SOP for Hazardous Meal Ingredients – ingredients that should not be used in airline meals for reasons concerning food safety and the health of passengers. A similar approach could be applied to exclude from airline meals all ingredients that might pose an animal or plant health risk to the country of destination. An example of such a document is given in Table 6.2.

6.3.1.4 Lower animal health status -> High animal health status – export of food products not permitted

Destination countries with high animal status will categorise catering waste from aircraft arriving from countries with which they have no trade agreements for food and animal and plant products as high risk.

It may be feasible for catering companies to import meal ingredients of animal and plant health concerns from sources that are eligible to export to the country of destination if such establishments exist.

The option of taking actions to ensure that meals provided on board aircraft do not contain animal and plant health hazards of concern to the country of arrival could be extended to cover all countries of departure as a long term aim. This would require catering companies in countries with lesser animal and plant health status to procure their food and raw materials from sources with the appropriate, higher status and to prepare meals from them in conditions that would ensure that 'contamination' with food of

lower status was prevented. Until such an arrangement is put in place, ICW from those destinations could be segregated from other waste and disposed of as high risk material.

6.3.1.5 High animal health status -> lower animal health status

Routes of this type present no animal or plant health risks to the country of destination and it is likely that such countries do not place any specific controls on aircraft waste.

SOP: Hazardous Meal Ingredients – animal and plant health	
Standard	
Certain foods are deemed by nature, by processing or source, to pose a specific risk to animal or plant health in the country of destination. All food included in airline meals must be eligible for export to the destination country A list of foods needs to be established and considered in the menu design process, procurement and production.	
Purpose:	To prevent the introduction of animal or plant health diseases to destination countries
Scope:	To prevent the introduction of animal or plant health diseases to destination countries
Flight country of origin:	
Flight destination(s) where de-catering and aircraft cleaning is performed:	
Guidelines	
The following provides guidance as to meal ingredients that may contain possible hazards to animal and plant health (not exhaustive)	
Procedure	
Food type	Example of possible hazards
Bovine meat must be sourced from establishments specifically approved for export to destination country, unless subjected to a validated heat treatment	Foot and Mouth Disease
Ovine/caprine meat must be sourced from establishments specifically approved for export to destination country, unless subjected to a validated heat treatment	Foot and Mouth Disease
Porcine meat must be sourced from establishments specifically approved for export to destination country, unless subjected to a validated heat treatment	Foot and Mouth Disease Classical swine fever
Poultry meat must be sourced from establishments specifically approved for export to destination country, unless subjected to a validated heat treatment	HPAI Newcastle disease
Milk and dairy products must be sourced from establishments specifically approved for export to the destination country.	Foot and Mouth Disease
Eggs and egg products must be sourced from establishments specifically approved for export to destination country, unless subjected to a validated heat treatment.	HPAI Newcastle disease
Raw fruit and vegetables whose export to the destination country is not permitted must be excluded	

Table 6.2: Example of standard operating procedure for hazardous meal ingredients

6.3.1.6 Food preparation

An alternative – or adjunct – to the sourcing of food and raw materials to ensure that animal and plant health hazards are not present in or on food in airline meals, is to achieve these aims by food preparation methods. Any food commodities that are deemed to be a risk for animal or plant health could be excluded from the meals served on the flight. Examples: if the pig health status of the country of origin of a flight was considered to be a risk, all pork and other pigmeat products could be excluded; bone-in beef is a risk for carriage of FMD virus and could be excluded from menus.

Airlines and their catering companies could select menus that eliminate or minimise the risk of animal health disease transmission. On short haul flights passengers could be offered snacks, confectionary or vegan options that do not contain animal products. It has been established (Section 6.2.2) that milk products including butter and cheese, subject to HTST or UHT, pose negligible risk of FMD transmission. The dominant animal hosts for FMD viruses are ruminants and pigs, hence, airlines could adopt animal-based ingredients based on the hierarchy of viable animal disease transmission rates ranging from low (fish, chicken) (Kaleta 2002) to high (lamb, beef and pork).

WOAH has developed recommendations for the treatment of most foods of animal origin to eliminate disease agents from food in order to enable the export of food from countries that are not free from specific diseases. As an example, Chapter 8.8 of the WOAHS Terrestrial Animal Health Code (WOAH 2023) recommends a heat treatment (70°C for 30 minutes) for meat from susceptible animals. It is noted that IFSA World Food Safety Guidelines for Aircraft Catering stipulates at least 65°C core temperature for cooking of meats for airline catering (IFSA 2023).

Animal health hazards in airline meals could be eliminated by implementing HACCP-type SOPs specifically directed at animal health hazards, incorporating the recommended heat treatment as the critical control point.

SOPs must include prevention of post-processing contamination with unprocessed food. Heat treatments to eliminate both food safety (public health) hazards and animal health hazards are often similar and should not present particular difficulties. Where the customary treatments applied during cooking do not meet animal disease control requirements (e.g. rare steaks), such foods would need to be excluded from the menu.

An example of an SOP for animal health hazards and their elimination is given in Table 6.3.

A critical feature of all systems applying SOPs to eliminate potential animal and plant health hazards is that countries of destination would require assurances about the robustness of their validity and implementation. Airline catering companies have well-developed procedures for sourcing food as part of their HACCP-based food safety management systems and to extend these systems to cover animal and plant health hazards should not present undue difficulties. External audit of the catering companies' food safety management systems is routine in the industry. Audits are usually performed in accordance with internationally recognised standards. Audits of animal and plant health hazard controls could be carried out in a similar manner

Airline catering establishments in the country of origin would need to be included in the country's official control regime, and preferably be included in the list of establishments approved for export to the country of destination, to give the necessary guarantees to the veterinary and plant health regulatory authorities of the destination country about their operation.

SOP: Control of food processing – animal and plant health	
Standard	
Certain foods are deemed by nature, by processing or source, to pose a specific risk to animal or plant health in the country of destination. Where such foods are used, a list of foods needs to be established and the processes to which they must be subject to eliminate the risk.	
Purpose:	To prevent the introduction of animal or plant health diseases to destination countries
Scope:	Treatment of food during meal preparation Subsequent handling of treated food
Flight country of origin:	
Flight destination(s) where de-catering and aircraft cleaning is performed:	
Guidelines	
The following provides guidance as to meal ingredients that may contain possible hazards to animal and plant health (not exhaustive)	
Procedure	
Hazard	Critical Control Point
Presence of foot and mouth disease virus in meat products from susceptible animals	i) Heat treatment; ii) Core temperature of at least 70°C for a minimum of 30 minutes.
Presence of CSF virus in porcine meat products	i) Heat treatment at a minimum temperature of 70°C, which should be reached throughout the meat; ii) Fermentation/maturation; iii) Drying salting
Presence of NDV in poultry meat	Heat treatment
Presence of NDV in eggs and egg products	Heat treatment

Table 6.3: Example of standard operational procedure for eliminating animal health hazards

6.3.2 Exposure Assessment Factors

Under this option, we consider the factors that could result in an animal disease outbreak from exposure to contaminated recyclables from an international flight. The main material categories in cabin waste suitable for recycling include aluminium beverage cans, plastics (particularly PET and HDPE), paper and glass. The processing of all these materials involves the use of high temperatures and/or chemical treatments. Although it is beyond the scope of this report, it is likely that these treatments are sufficient to inactivate all the animal disease pathogens of concern that may be on or in the material. Specific studies to verify this assertion may be necessary. Robust quality controls are imposed by recycling processors with food contamination being cited as one of the main reasons for rejection (BBC 2016). Recyclables are often subject to visual inspection to ensure that contamination is kept to a minimum. In addition, it is unlikely that these recyclables would provide any nutritional benefit if deliberately fed to animals, hence, it is assumed that exposure would need to involve a disease vector such as rodents or insects. The transportation and storage of recyclables is often subject to regulatory control including the application of rodenticides, insecticide and the cleaning/disinfection of containers.

It is recommended that animal health agencies consult with their colleagues in waste regulation to determine the pest and vermin control procedures at national recycling facilities, and, hence, the potential risks to animal health.

6.4 Options for Change: Decision Analysis

The ICW decision analysis flow-diagram presented in Figure 8 on the next page provides a method for implementing the options for minimising ICW, as outlined in this Chapter, based on an iterative test-approach.

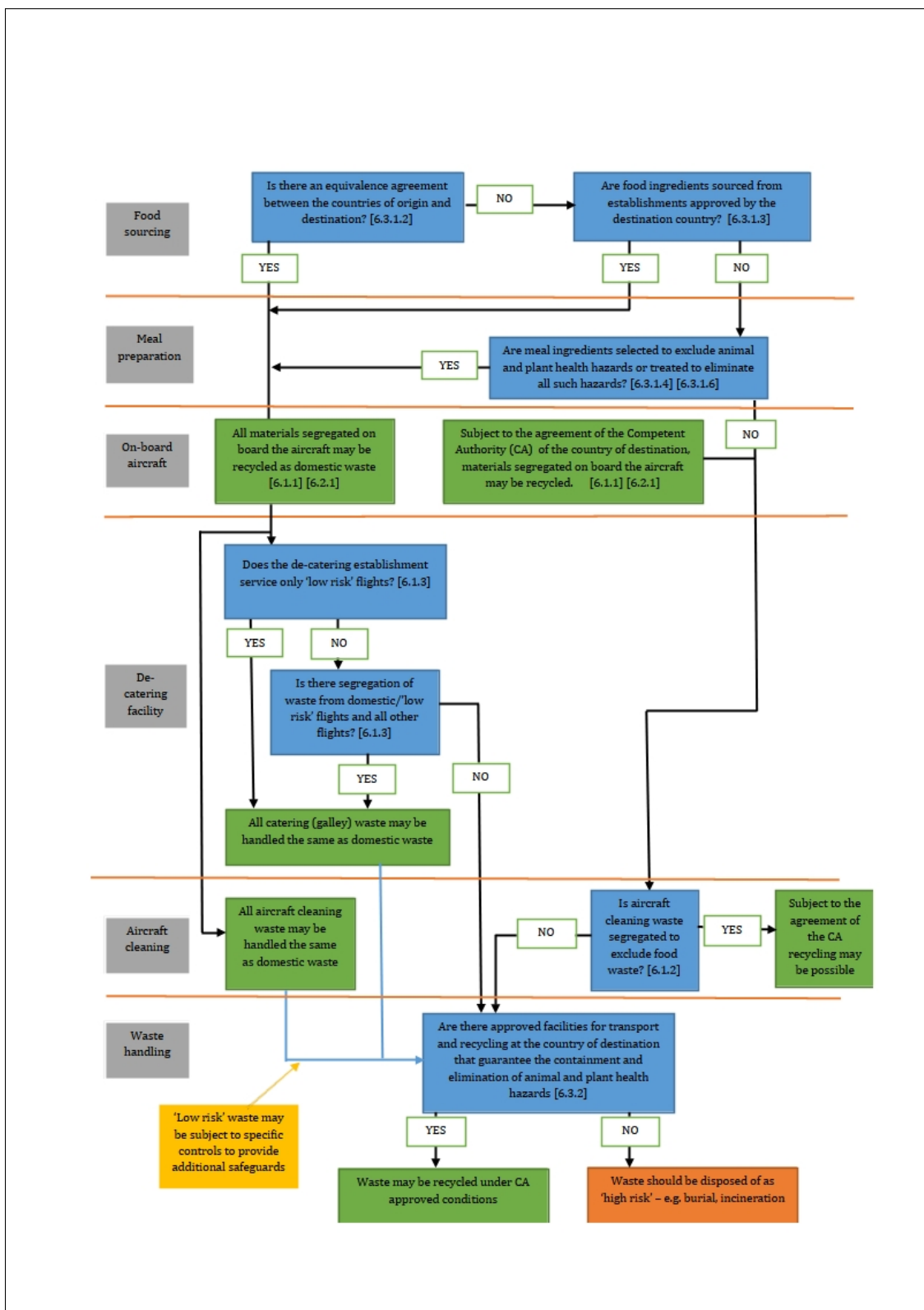


Figure 8: ICW Options for Change: Decision Analysis Flow-diagram. References to relevant sections of this report are included within [..]

7.1 Legislation

The most important changes in other jurisdictions that might influence the handling of ICW are that the US now considers composting as the preferred method for disposing of infected carcasses in disease outbreak situations which could open for more risk based approaches on ICW and its disposal.

7.2 ICW Biotreatment

ICW regulations allow a variety of different treatment and disposal methods including incineration, steam sterilisation (autoclave), deep landfill burial and disposal of in an authorised landfill, none allow biotreatment. Driven by passenger concerns and emerging single use plastic legislation, airlines are replacing inflight products including cutlery and crockery with reusable or biobased alternatives. However, the environmental benefits of such a transition are significantly reduced if the resulting waste cannot be biotreated through aerobic (composting) or anaerobic digestion. However, animal health regulations allow a variety of different treatment and disposal methods including incineration, and numerous scientific papers have been published in recent years on the effectiveness of biotreatment composting for decontamination of infected carcasses and biological materials.

Tiago Costa and Neslihan Akdeniz reviewed methods for inactivating infectious agents including several transboundary animal diseases (TADs). The TADs covered in the their review have caused serious outbreaks around the world over the years among other Highly Pathogenic Avian Influenza (HPAI), Foot and Mouth Disease (FMD) and African Swine Fever (ASF). The review covers several methods used where composting has proven to be an effective and safe method and is now the preferred method for decontaminating that has been used extensively for outbreaks with HPAI. According to the paper, biosecurity agencies in the US, Canada, Australia, and New Zealand have identified composting as a preferred disposal method for both routine and emergency management of animal mortalities (Costa and Akdeniz 2019). They recommended further evaluation of the effectiveness of composting as a method of decontamination of mortalities in African Swine Fever (ASF) outbreaks as serious outbreaks of ASF have occurred in recent years.

The United States Environmental Protection Agency (US-EPA) has published a paper on an Exposure

Assessment of Livestock Carcass Management Options During a Foreign Animal Disease Outbreak, where composting was considered as one option (Chattopadhyay 2018). The US-EPA stated that *thermal inactivation and biological decay eliminate the FMD virus before composting is complete*.

Hutchinson et al., demonstrated that ASF virus (ASFv) in dead stock was inactivated using static aerated composting as the carcass disposal method. Replicated compost piles with whole market hogs and two different carbon sources sawdust and rice hulls were tested. The ASFv was inactivated in material in the compost piles. The virus concentration identified through virus isolation was found to be below the detection limit by day 3 in rice hulls and by day 7 in sawdust. Given the slope of the decay, near-zero concentration with 99.9% confidence occurred at 5.0 days in rice hulls and at 6.4 days in sawdust. Additionally, the result of virus isolation also showed that the virus in bone marrow samples collected at 28 days was inactivated (Hutchinson et al. 2023) .

Likewise, Carrau et al., demonstrated that composting inactivated ASFv in both entire wild boar carcasses and pieces thereof in a time and temperature dependent manner. They concluded that while further studies are needed to explore potential risk factors (and their mitigation), such as destruction of composting piles by scavengers or harsh weather conditions, composting seems to present a valid method to inactivate the ASFV in wild boar carcasses where rendering or other disposal methods are not feasible. They summed the findings up by stating that composting provides a new tool in our toolbox of ASF control in wild boar and can be considered for carcass disposal (Carrau et al. 2023).

Quantitative risk assessments on possible introduction of TADs into countries could still not be identified. Quantitative risk assessments on introduction of ASF into different countries for instance Spain (Muñoz-Pérez et al. 2023) with formal trade from ASF endemic countries have been carried out. One of the risk factors identified is the possibility of meat and meat products derived from pigs slaughtered while in the incubation period of the disease and unprocessed meat products imported being a source of introduction. This risk appears to be low in in-flight meals as the timespan and the handling of the products to highest food safety standards minimises the above risk factor.

Because of the spread of African Swine Fever (ASF) to new parts of the world, many risk assessments have been carried out on the risk of introducing ASF into countries with trade and traffic. In general the risk is considered high. None of the assessments have focused on the introduction with ICW but have focused on formal and informal trade and smuggling for instance in luggage of travellers.

Conclusions

It is well understood that countries with economically important agriculture sectors, that have made considerable investment in obtaining and maintaining high animal and plant health status, take a very risk-averse approach to the disposal of waste from international transport. However, there are now additional environmental pressures being applied to the handling of all waste, including that from aircraft, and we believe that there is a strong case for changes to be made in the methods of classifying, handling, treating and disposing of aircraft waste in response to these changed circumstances.

Qualitative risk assessments, such as those cited in this report, should be used to determine the absolute and relative risks posed by ICW and the sensitivity of these risks to the risk mitigation measures discussed in the report. Most qualitative risk assessments carried out by national governments indicate that the risks from ICW are very low compared to those from illegally imported food and other animal and plant products.

A new US study has demonstrated that composting of contaminated material can be used to successfully dispose of diseased animals. We suggest applying the same method to the disposal of ICW.

We have proposed methods of improved source controls by which the presence of animal and plant disease agents in catering waste might be prevented. Implementation of such methods is dependent on catering companies applying HACCP-based procedures to address not only food safety issues but also animal and plant disease hazards; businesses subjecting their procedures to rigorous internal and external audit; and competent authorities in countries of flight departures giving those in destination countries confidence in their controls of catering companies. We have presented evidence that indicates cabin waste comprising milk and milk products, subject to heat treatment, represents a negligible risk to animal health.

It is apparent that there are differences between countries in their willingness to consider changes to the rules governing disposal of ICW. Effective reuse of materials and recycling of waste from international flights will require a consensus on these rules and their interpretation as well as constructive dialogue between governments and the airline sector.

We have identified several different scenarios where waste from international flights could be reclassified providing many additional possibilities for reuse and recycling. Mutual recognition of the animal health controls by countries with a similar status such as the EU and US could represent a

significant step forward in supporting the circular economy whilst minimising animal disease risk. Airports must be involved in this process providing the facilities required to segregate these waste-streams. Catering companies and their professional association (International Flight Services Association) have an important role in integrating animal health ingredient source controls into their food safety systems. Airlines could select menus that exclude animal product ingredients or are based on the hierarchy of animal health disease risk (e.g. cheese, fish, chicken, lamb, beef, pork). Airlines must encourage their catering companies to embrace these new ingredient source controls and support recyclable segregation on-board aircraft, and must be able to demonstrate effective implementation of risk mitigation measures to give legislators confidence that increased recycling of ICW will not result in increased risk to the animal and plant health status of their countries. We believe that there is an important role for IATA to develop industry standards and guidance to achieve this.

Appendix 1: United Kingdom risk analysis of transboundary animal diseases (DEFRA 2009).

	African horse sickness	African swine fever	Avian influenza	Bluetongue	Brucellosis (Brucella abortus)	Brucellosis (Brucella melitensis)	Classical Swine Fever	Equine Viral Encephalomyelitis	Equine Infectious Anaemia	Foot and mouth Disease	Goat Pox	Newcastle disease	Peets des petits ruminants	Rabies	Rift Valley fever	Sheep Pox	Swine vesicular disease	Vesicular stomatitis	West Nile Virus
Meat and Edible Meat Offal	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Dairy Produce, birds eggs	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Other edible products of animal origin	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Oil, seeds and grains; straw and fodder	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Animal fats, oils and waxes	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Preparations of meat e.g. sausages	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Preparations of a kind used in animal feeding	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Pharmaceutical (blood) products inc vaccines	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Fertilisers	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Albuminoidal substances	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Raw hides and skins	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Wool, horsehair, animal hair	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Pig, hog or boars bristles and hair; badger hair	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Horsehair and horsehair waste	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Skins and other parts of birds, their feathers or down	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Bones and horn-cores	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Sinews or tendons; waste of raw hides or skins	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Glands and other organs for organo-therapeutic uses	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Semen	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Guts, bladders and stomachs of animals	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red

■ = Risk ■ = the animal product is not known to carry the disease causing agent or cannot transmit the disease onwards

Figure 9: UK risk analysis of TADs 2009

Appendix 2: Diseases of ruminants and pigs, which could potentially be introduced to Australia, and their status in Australia (AQIS 1999)

Disease	Species	Method of spread	Australia status	Quarantine waste risk
Foot and Mouth Disease	Ruminants/ Pigs	Contact, ingestion	EXOTIC	Yes
Vesicular stomatitis	Cattle/pigs	Contact only. Virus not present in edible tissues.	EXOTIC	No
Swine Vesicular Disease	Pigs	Contact, ingestion	EXOTIC	Yes
Rinderpest	Cattle	Contact, ingestion	EXOTIC	Yes
Peste des petits ruminants	Sheep/ goats	Close contact, ingestion?	EXOTIC	Yes
Contagious bovine pleuropneumonia	Cattle	Contact only	EXOTIC	No
Lumpy skin disease	Cattle	Mechanical, insects, milk contamination	EXOTIC	Yes
Rift Valley Fever	Cattle / Sheep	Arthropod borne	EXOTIC	No
Bluetongue	Sheep, cattle	Arthropod borne	PRESENT - No clinical disease	No
Sheep pox and goat pox	Sheep, goats	Mechanical, insects, milk contamination	EXOTIC	Yes
African Swine fever	Pigs	Contact, ingestion	EXOTIC	Yes
Classical Swine Fever	Pigs	Contact, ingestion	EXOTIC	Yes
Newcastle disease	Avian	Contact, ingestion	EXOTIC	Yes
Avian influenza	Avian	Contact, ingestion	EXOTIC	Yes

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