INTERNATIONAL CATERING WASTE – A CASE FOR SMARTER REGULATION

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Contents

Abbreviations

ABP: Animal by-product, 9
AKL: Auckland, 27
AMS: Amsterdam Schiphol Airport, 12
APHA: Animal and Plant Health Agency, 10
APHIS: Animal and Plant Health Inspection Service, 10
ASF: African Swine Fever, 13
ATL: Hartsfield–Jackson Atlanta International Airport, 12
BVD: Bovine Viral Diarrhoea, 24
CFIA: Canadian Food Inspection Agency, 11
CSF: Classical Swine Fever, 13
EBL: Enzootic Bovine Leukosis, 24
EEA: European Economic Area, 31
EFSA: European Food Safety Authority, 29
EMPRES: FAO Emergency Prevention System, 13
EU: European Unionus, 6
FAO: Food and Agriculture Organisation, 13
FCC: Food Control Consultants Ltd., 5
FMD: Food and Mouth disease, 7
GF-TADs: Global Framework for the Progressive Control of Transboundary Animal Diseases, 13
HACCP: Hazard Analysis Criticla Control Point, 16
HPAI: Highly Pathogenic Asian Avian Influenza, 33
HTST: high temperature, short time, 25
IATA: International Air Transport Association, 6
ICW: international catering waste, 6
IFSA: International Flight Services Association, 16
IPCC: International Plant Protection Convention, 15
LHR: London Heathrow Airport, 17
NACC: The National Airlines Council of Canada, 11
ND: Newcastle Disease, 13
OIE: World Organization for Animal Health, 13
PPR: Peste des Petits Ruminants, 13
RASFF: Rapid Alert System for Food and Feed, 34
RVF: Rift Valley Fever, 13
SOPs: standard operating procedures, 12
SPS: Sanitary and Phytosanitary Agreement, 13
SYD: Sydney (Kingsford Smith) Airport, 12
TAD: Transboundary Animal Diseases, 13
TB: Tuberculosis, 24
the Codex: the Codex Alimentarius Commission, 15
UHT: ultra-high temperature, 25
UK: United Kingdom, 7
USA: United States of America, 9
VTEC: Verocytotoxigenic Escherichia Coli, 16
WAHID: World Animal Health Information Database, 14
WHO: World Health Organization, 15
WTO: World Trade Organization's, 13
YYZ: Toronto Pearson International Airport, 11

Summary

Airline operators are under pressure – both from an environmental and financial perspective – to reduce the amount of both cleaning and catering waste from their aircraft operations and to increase the proportion that is reused and recycled. A major impediment to change is the legislation regarding the management of catering waste from international transport that some governments implement to reduce the risk of animal and plant diseases entering and threatening the health status of their agricultural industries. This report provides an overview of how airline catering waste is generated and handled and of the risks it poses to animal and plant health. It concludes that coordinated action between governments and the airline sector could provide opportunities for more cabin waste to be reused and recycled and identifies several 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 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.

1. INTRODUCTION

The airline industry has been subject to criticism for poor cabin waste management practices, 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) indicates that the sector generated 5.7 million tonnes of cabin waste in 2017 and this waste volume could double in the next 10 years with similar passenger growth rates.

Cabin waste comprises two principal streams – cleaning and catering (galley) waste. Catering waste consists of both leftovers of meals and beverages 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 to minimize the risk to human health, however, there are several animal health diseases that can be transmitted in food without causing ill effects or symptoms in humans. Several 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 aspect.

Food Control Consultants Ltd. have been commissioned by IATA to assess the risks to animal health posed by ICW and this report describes the findings of this research. The investigations have found no evidence that regulatory impact assessments were undertaken prior to the adoption of legislation controlling the management of ICW. In addition, no evidence has been found which supports the theory that this route of infection has been the source of an outbreak of infectious animal disease, even prior to the adoption of such regulations. Moreover, the specialized handling and disposal requirements imposed by this legislation and the resulting inspection charges continue to place a significant financial burden on the sector but are not discussed in this report.

Different jurisdictions around the world have different methods of dealing with these animal health hazards. The European Union (EU), for example, has created a complex set of rules, which are laid down in Regulation (EC) No 1069/2009 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, supporting guidance for airline operators is either not available or has not been harmonized between Member States.

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

A literature research on biological hazards associated with catering waste from international flights has been undertaken that considers how current airline operator procedures and practices affect the transmission of such hazards.

The main trans-boundary animal diseases[1] have been listed and the risk of these diseases being transmitted with ICW identified. The regions and countries harbouring these diseases are also listed. Risk assessments undertaken by leading international or national risk assessment institutes have been analysed and discussed. Several visits were made in the United Kingdom (UK) to establishments including airports, airline catering companies and waste recycling plants to observe current procedures and to interview airline operators.

A qualitative risk assessment has been carried out on ICW with reference to infectious animal and human diseases considering the following:

1. Evidence that infectious diseases are transmitted via ICW.
2. The source of infectious disease using Food 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 ICW (identifying differences as applicable).
7. Possible alternatives to existing control regimes and methods

This report presents recommendations and proposals that include changes to logistics, procedures and practices that also have the potential to significantly reduce the amount of ICW being generated in-flight. The measures proposed can to a large extent be implemented under current international legislation but in some cases changes in legislation would be required. The proposed measures are discussed, and their cost and benefits categorised according to their practicability and applicability.

The report also highlights concerns that the current regulatory focus on ICW does not address the more significant risk to agriculture posed by international travel, the growing problem of illegal meat imports being concealed in passengers' baggage. It is recommended that airline operators and regulators develop a coordinated response to this emerging challenge.

[1] Trans-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.

2 AIRCRAFT CABIN WASTE

2.1 Cabin Waste Characteristics

Airline cabin waste comprises two primary waste streams: cabin cleaning waste and catering (galley) waste.

Cabin cleaning waste is generated by passenger service provision including newspapers, magazines, textiles (headrest protectors/blankets/pillows), amenity kits, headsets and beverage containers (including full ones). This waste stream can also comprise small quantities of food dropped on the cabin floor or placed in seatback pockets and may include including food brought onto the aircraft by passengers. A sub-component of this waste stream includes medical waste derived from used syringes placed in sharps boxes, washroom bins, and waste resulting from emergency medical treatment. 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 beverages distributed by the 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 beverages and ice. Part-utilized 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 waste audit commissioned by IATA of 17 international flights arriving at London's Heathrow Airport in 2013 indicated that the cabin waste comprised 80 % catering and 20 % cleaning waste, with an average of 1.43 kg 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.). Catering companies at an airport may be dedicated to one airline operator or may provide services to many airline operators. 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, airline operators 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 costs 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 destination airports.

Airline catering operations are based on 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 several 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 airline operators.

Segregation of carts from different flights may be practiced:

- segregation of carts from domestic and international flights
- segregation according to airline operator to maintain separation of customized 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.

Several airline operators have implemented cabin recycling programs on domestic and international flights to destinations with no ICW restrictions. The recycling programs are based either on the collection of mixed recyclables or segregated into separated 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.

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

Although most countries have introduced waste legislation that ensures domestic, commercial and industrial wastes (including cabin waste) are handled, stored and disposed appropriately, a number have introduced specific regulations associated with catering waste from international flights. Different jurisdictions apply different terms to the classification of waste from international flights, as well as different, but essentially similar, definitions. Countries which do not have an important agricultural sector to protect tend not to have specific legislation. The section below includes a summary of the requirements under European Union (EU), United States of America (USA), Canada and Australia, however, anecdotal evidence indicates that other countries have implemented similar legislation including Brazil, Chile, New Zealand and Taiwan (ROC).

The interpretation and enforcement of ICW legislation at both the local airport and national policy level is of critical importance for the reuse and recycling of cabin waste. A number of jurisdictions have issued specific guidance that facilitates the circular economy by allowing cabin products and recyclables from international flights, uncontaminated by animal products, to be reused or recycled. In the absence of such guidance, many enforcement authorities and the corresponding waste stakeholders deem all waste generated on an international flight to be ICW.

2.3.1 European Union (EU)

The EU defines **International Catering Waste** (ICW) as catering waste from means of transport operating internationally. The EU categorizes ICW as a Category 1 Animal By-Product – the highest category (of 3 categories) 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 several EU Member States as being only applicable to aircraft arriving from countries outside the EU. For example, the UK guidance (APHA and DEFRA, 2014) states *"ICW is a high-risk category 1 animal by-product (ABP), unless it's from planes, vehicles, or ships travelling in EU territory only."* There is no EU-wide guidance on ICW and it is apparent that there may be inconsistency in interpretation between

EU Member States. Many 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 Members States have published guidance; an example is the information published by the UK Animal and Plant Health Agency (APHA) and the Department for Environment, Food and Rural Affairs (APHA and DEFRA, 2014) which includes the following guidance:

> ***"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 if they have not been mixed with catering waste. This includes:*
> - *Confectionery*
> - *crisps and nuts*
> - *drinks not containing milk"*

2.3.2 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 (unless cleared in accordance with the APHIS procedures) (Office of Management and Budget, 2006). In addition, when garbage, trash or other material that is not regulated by APHIS, has been commingled with Regulated garbage, it 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.

APHIS (USDA APHIS, n.d.) has published an exemption, part of which is included below:

> *"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."*

2.3.3 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 because 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, 2013). It should be noted that Canada includes waste from aircraft from the US 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) is particularly robust; all material removed from an international flight is '.... *suspected of containing, animal products or by-products* ....' 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 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. Recent interactions indicate that CFIA may adopt a more risk-based approach to interpretation of the legislation on ICW and its application to all domestic flights arriving at Toronto Pearson International Airport (YYZ) , on the condition that airline operating protocols are developed and agreed with CFIA. The National Airlines Council of Canada (NACC) is consulting with the CFIA surrounding the legislation on ICW and a Preventative Control Plan has been submitted to CFIA for approval.

2.3.4 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 however this has been replaced by 'Biosecurity waste'. The Act prescribes that **Biosecurity Waste –** including all cabin, galley and hold waste on-board the aircraft must be collected, transported, stored and/or treated by a service provider that has been approved by the regulator.

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 encountered 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: Department of Agriculture and Water Resource, 2016) requires "…*other waste or materials which may have come into contact with biosecurity waste…"* to be treated as biosecurity waste. This differs to the previous enforcement policy which stated that, since it was not possible to guarantee that contact with biosecurity waste had not taken place on-board, all waste from international flights must be treated as biosecurity waste.

Following its active involvement in an audit of cabin waste, there is recognition by the Department of Agriculture that the risk of introduction of animal and plant diseases through 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.

One airline catering company has recently been granted changes to its conditions of approval at Sydney (Kingsford Smith) Airport (SYD) to permit recycling of specified items from all inbound international flights, including aluminium drink cans, plastic bottles and cups, glass, paper, plastic wrap, head rest covers, passenger clothing and amenity kits, provided they have been isolated from biosecurity waste. Food waste, disposable food service items and items in contact with milk are specifically excluded from the list of materials that may be recycled. This arrangement is operating at one airport only on a trial basis and is subject to regular audit by the competent authority.

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:

- Incineration
- Pressure sterilization/autoclaving
- Deep landfill burial
- 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 accompanying 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 ($3.96 per pax) and aircraft ($225) based charges (USDA APHIS, 2017).

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

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

3 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 subject to 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) 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. Each country conducts its own risk analysis specific to its own production and health parameters of which examples are presented below.

Globally, 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.

Foot and Mouth Disease (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

Most countries (178/196 United Nations member states) are members of the World Organization for Animal Health (OIE). A condition of OIE membership is that member countries must report regularly about their animal health status and report new outbreaks of disease. OIE uses this information to publish disease information about each country and maps of disease distribution. Examples of such maps are provided in Figure 1, Figure 2 and Figure 3.

In addition to OIE information, importing countries can make use of other sources, such as the joint OIE/Food and Agriculture Organisation (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 their associated socio-economic impact.

Since animal and plant products are present in the waste generated by the provision and consumption of meals on international flights and by food carried on-board by passengers, there is a possibility that ICW may represent a route for the incursion of diseases and pests into countries that were previously free.

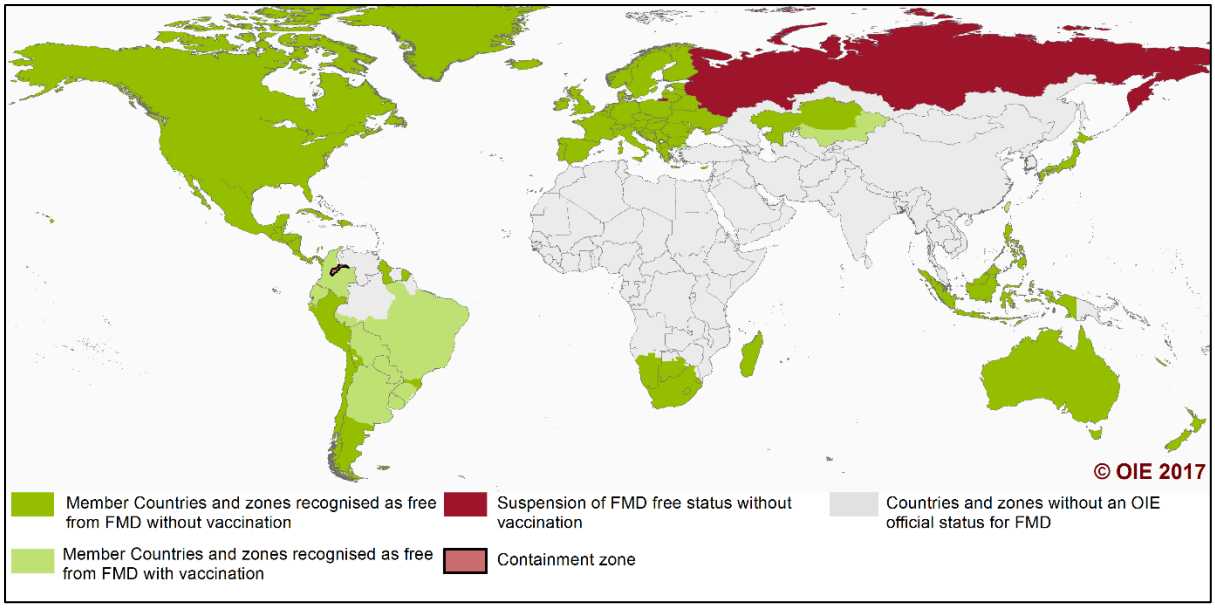


Figure 1 FMD status of OIE Member Countries – updated December 2017 (OIE, 2017)

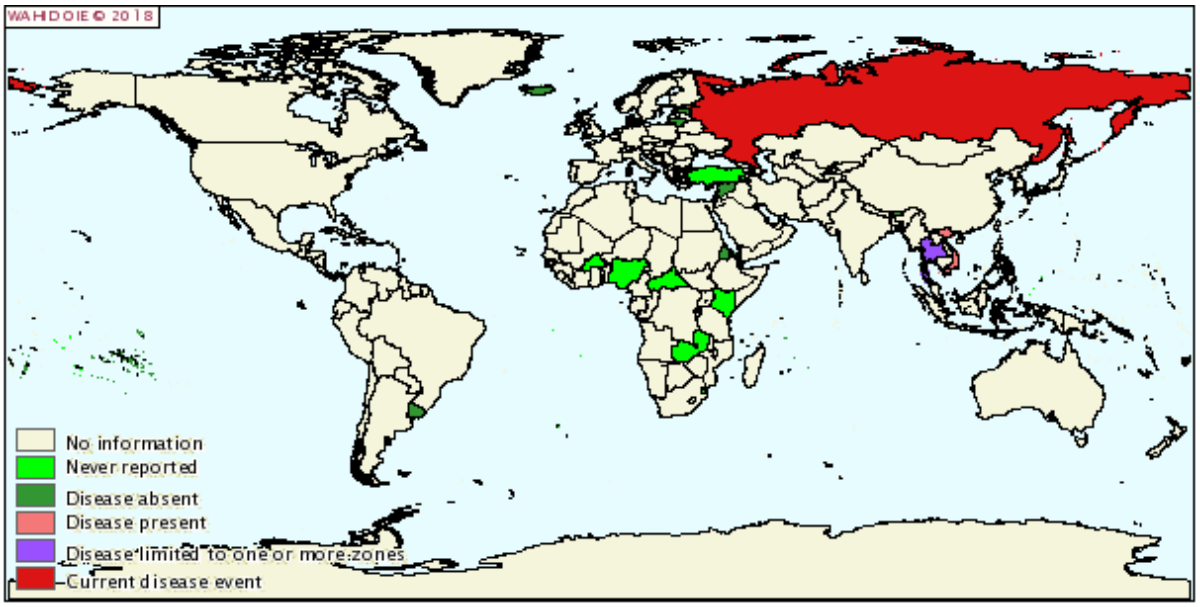


Figure 2 Example of World Animal Health Information Database (WAHID) global classical swine fever distribution map for July to December 2017 (OIE, 2018)

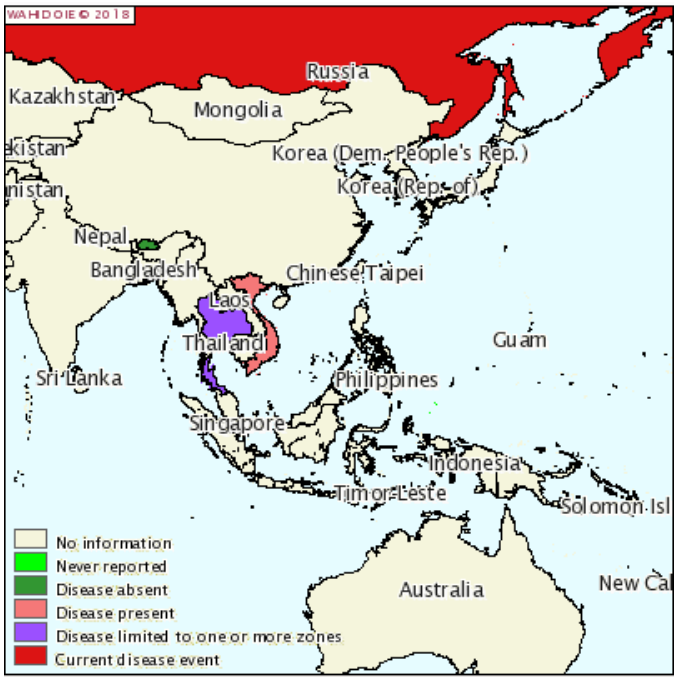


Figure 3 Example of World Animal Health Information Database (WAHID) classical swine fever Asia Abstract distribution map for July to December 2017 (OIE, 2018)

3.1.1 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 harmonize 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 (OIE)). The mission of the OIE includes ensuring transparency in the global animal disease 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.

The focus of this report is on animal and not plant health, however similar principles and approaches are applied to the control of plant diseases and pests as for animal diseases.

4 AIRLINE MEAL PREPARATION

4.1 Food Preparation

The safety of food presented to passengers on aircraft is given a very high priority by airline operators and their providers. The consequences of a food poisoning incident deriving from food consumed on an aircraft can be serious and have an adverse impact on the airline operator's reputation. Airline catering companies operate to very high food safety standards with sophisticated food safety management systems such as the Hazard Analysis Critrical Control Point (HACCP). 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, 2016). The IFSA's Guidelines describe effective food safety control procedures that are accepted by international airline operators, 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.

4.2 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 1, Figure 2 and Figure 3). Many different arrangements are used for the sourcing of food and raw materials for meal preparation, including the following scenarios:

- An airline operator may purchase food or raw materials itself and supply these to the catering companies for incorporation in meals. Examples: one US airline operator exports US beef to its catering contractors and supplies pizzas produced in US to catering companies at all European airports.

- An airline operator 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 supplier's 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 to attract premium and environmentally conscious passengers. In addition, many airline operators source food and raw materials to conform to religious and cultural customs (e.g. Halal and Kosher food).

The discussions held with a range of international airline operators indicate that the animal and plant health concerns of destination countries are not currently a significant factor in the sourcing of food and raw materials for airline meals

4.3 Airline Meals

Airline meals and beverages have traditionally been served to passengers on all flights with the associated catering costs included in the ticket price. *Cooked meals* are usually served to passengers on medium to long haul flights while sandwiches or similar are served on short haul flights.

Economy class meals and beverages are usually served in disposable plastic or aluminium food containers with plastic cups. A limited choice of meals may be offered due to price competition. The number of economy class meals loaded exceeds the number of passengers by a small factor.

Premium class meals are served with crockery and metal cutlery (rotables) that are cleaned and reused. The number, choice, and quality of meals and beverages served in these classes are a source of competition between airline operators. A wide menu choice is usually available and, to ensure that each passenger may select their preferred options, the number of meals loaded exceeds the number of passengers (i.e. a high loading factor). Un-used meals become food waste upon de-catering at the destination.

Low cost model airline operators have introduced the concept of "buy on board (BOB)" and the number of passengers preparing or purchasing their meals and beverages prior to boarding has subsequently increased. The move to BOB has led to the following consequences:

- Decrease in catering waste volumes as passengers tend to consume meals and beverages that they have purchased or made themselves at airports
- Increased amount of food waste left in seat back pockets and on the cabin floor. This will result in a higher proportion of catering waste being removed in the cleaning waste stream.
- Incentive for passengers to bring own food onto aircraft. Passenger carried on food is outside the direct control of airline operators; the consequences of this are considered in Section 4.4.

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

4.4 Passenger-Related ICW

The increasing trend of replacing complementary meals with on-board food sales is resulting in passengers bringing 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, airline operators have no control over the ingredients of these meals. Many countries have systems to prevent passengers from carrying food from aircraft with them into the arrival country. These include mandatory on-board announcements (e.g. 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 IATA waste audit at London Heathrow Airport (LHR) in 2013 indicated that food waste whether derived from airline meals or passenger-carried comprised only 2.7 % by weight of the total cleaning waste stream. It may be assumed that the animal product (meat, dairy products, honey) component of this food waste would be even lower.

It is likely that the risks of animal disease outbreak sourced from passenger-carried food on flights arriving from countries with similar animal and plant health status are over-estimated because of the following:

- Carried-on food and beverages are most likely to have been purchased in the country of origin, often at the airport, and the risks will be a direct reflection of the animal and plant health status of the country of origin
- Most food and beverages 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 beverages on-board with the intention of consuming them, not leaving them as waste.

5 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 entering 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 are 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.

OIE sets out a system for the analysis of import risks (see Figure 4). 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:

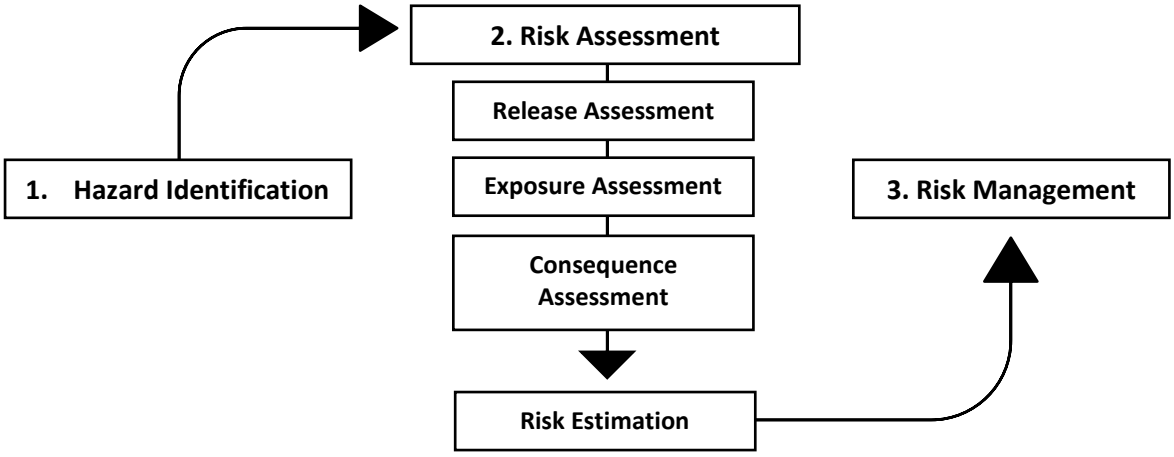


Figure 4 Import Risk Analysis Methodology

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 disease of cattle and sheep of current concern in the EU, which is transmitted by insect bites.

5.1.2 Import Risk Assessment

5.1.2.1 Entry Assessment

Entry assessment consists of describing the biological pathways necessary for 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 because 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 of microorganisms 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.

5.1.2.3 Consequence 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 this is out of scope 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 considers the whole of the risk pathway from hazard identified to the 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 *y* years).

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 minimize 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 minimized.

All imports of animal products carry a risk for the importing country; no trade is risk-free. For ICW, the balance is between the likelihood of disease incursions from ICW and the desire of passengers, airline operators, government and society to reduce environmental impacts by reusing and recycling waste.

5.2 Risk Pathways for ICW

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

Hazard identification:

- The pathogenic agent must be transmissible through the commodity (e.g. meat, milk, eggs) by consumption as food.

- The disease must be present in the country of origin of the product.
- The disease must be 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 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.
- The infected product must be present in the recycled material (aluminium cans/foil; glass bottles; paper/cardboard; plastic) as a contaminant.

Exposure assessment:

- Susceptible domestic animal species (especially pigs) in the recipient country must be exposed to 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 infected products in processed recycled material.
  OR
  Susceptible domestic animal species must be exposed to infected products 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 5.

An example of entry of an infectious agent and exposure of susceptible animals is the 2001 outbreak of FMD in 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 EU (Adkin, et al., 2008).

This example demonstrates that failure of agricultural and import control measures at more than one point may result in disease incursion and highlights the importance of effective enforcement of legislation.

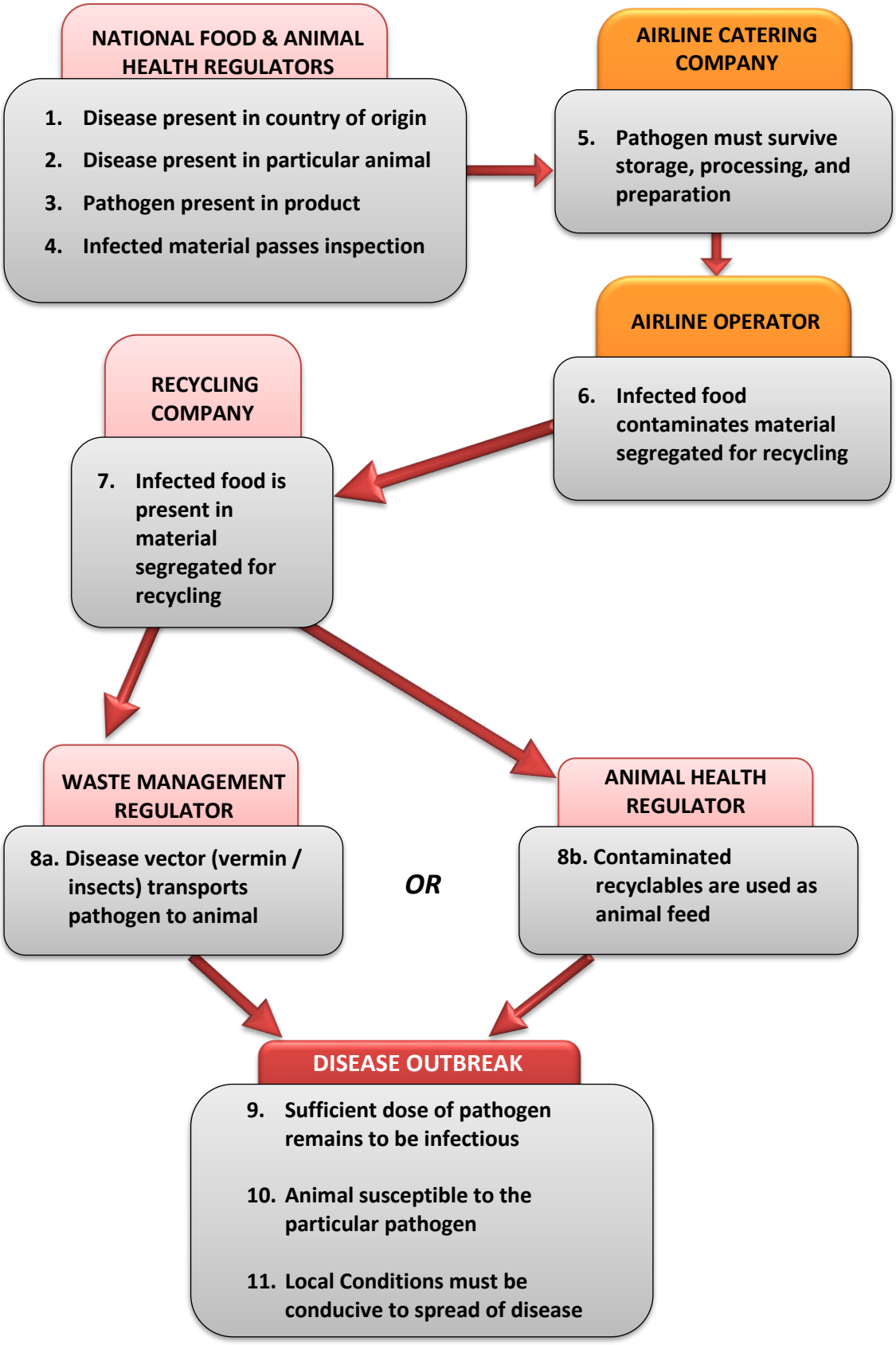


Figure 5 International catering waste (ICW) recycling risk pathways

5.3 Risk Assessment for ICW

Assessment of the risks associated with disposal of ICW can be made either qualitatively – using descriptive terms such as 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 assessments offer 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 assessments can also allow an estimate to be made of the sensitivity to changes in the specific elements within the risk pathway by computing risk probabilities using models. Risk probabilities promote the best use of resources by targeting control measures at appropriate points. Despite these benefits, the research did not find evidence that quantitative risk assessments were undertaken prior to the adoption of legislation controlling the management of ICW and it would appear that the regulations were adopted based on very risk-averse precautionary principle.

The investigation of the animal health risks posed by ICW has not identified any animal disease outbreaks traced to ICW, even prior to the adoption of prescriptive legislation.

An important study in the context of ICW was undertaken in the UK which estimated the risk of exposure of British livestock to Foot and Mouth Disease (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 model estimated that the total weight of waste introduced that was contaminated with FMD was 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 1429 years between outbreaks of FMD due to ship and aircraft waste with a 90 per cent certainty that the interval would be between 500 and 10,000 years.

The results of this work may be an over-estimate of the risks from ICW from aircraft for a number of reasons including the fact that the study was undertaken prior to the introduction of ICW legislation and that it assumes assumption that 4 % of all waste from aircraft and ships would be removed and fed illegally to backyard livestock (this is considered a very high estimate). A sensitivity study in the report on the source of waste indicated that aircraft cabin cleaning waste accounted for more than 70 % of the total risk (aircraft cleaning waste 70.7 %, container ship waste 24.4 %, aircraft galley waste 4.9 %, and cruise ship waste negligible).

A more accurate estimate of the risk of introduction of FMD into Britain through ICW from aircraft is likely to be less than that reported in the above study, meaning that outbreaks would occur less frequently than once every 1429 years.

5.3.1 Illegal import of meat

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 continual assessment of the import risks through all routes, and many have published their import risk assessments, both qualitative and quantitative. Possible routes 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 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, with Australia and New Zealand devoting significant resources to this activity.

A quantitative assessment of the risks from illegally imported meat contaminated with Foot and Mouth Disease virus to Great Britain (Hartnett, et al., 2007) reported that the total amount of illegal meat entering the UK each year is estimated on average to be 11,875 tonnes[2], of which between 64.5 and 565 kg are contaminated with FMD virus. This was estimated to result in an outbreak of FMD from this source once every 66 years).

Recent research has 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 tonnes of bushmeat (wild animals) is smuggled in personal baggage through Paris Roissy-Charles de Gaulle airport each year (Chaber, et al., 2010). 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 1500 tonnes (Wood, et al., 2014). In addition to the threats to endangered species, one of the most serious issues regarding the import of bushmeat is the health risk it poses to humans and 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 is the most likely source of infection (Cunningham, 2005) and that most emergent disease events (>70 %) originate in wildlife (Jones, et al., 2008).

5.3.2 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 Foot and Mouth Disease (FMD) virus in the milk. Single pasteurization and single UHT treatment are not considered to be effective in inactivating the virus. Under the implementing regulation, among several treatment options for milk/milk products pasteurization treatment carried out twice or drying and further heat treatment to at least 72°C are considered as effective for UHT and pasteurized milk. Hot water added to beverages on planes may not always reach effective virus inactivating temperatures.

It would appear that no specific risk assessments for milk in ICW have been undertaken, however, there is a significant volume of published work on the risks from milk in international trade. Milk is a recognized vehicle for the transmission of FMD and other pathogens (Bovine Viral Diarrhoea[(BVD], Enzootic Bovine Leukosis (EBL), Tuberculosis (TB), Listeria, Brucella Abortus) and has been implicated in disease transmission in FMD outbreaks. Milk traded in national markets is generally subject to heat

[2] The model estimates with a 90 % certainty that the total amount of illegal meat entering the UK each year is between 4,398 and 28, 626 tonnes per year. There is 90 per cent certainty that the interval would be between 19 and 600 years.

treatment for public health reasons with two commonly used treatments: high temperature, short time (HTST pasteurization); and, ultra-high temperature (UHT). These treatments eliminate microorganisms of human health concern and kill most animal disease pathogens. The World Food Safety Guidelines for Aircraft Catering recommend HTST pasteurization of milk and milk products (IFSA, 2016).

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. This lack of certainty about elimination of FMD virus by heat treatment has influenced the perception of milk as a high-risk commodity. A later paper by Donaldson published by OIE (Donaldson, 1997) challenges this estimation of the risk of FMD from milk because 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 of disease from pasteurised milk or dairy products derived from pasteurized 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 had ever been attributed to imported milk products subject to any kind of heat treatment, although no restrictive measures on importation were taken as nobody was aware of an existing risk (De Leeuw, et al., 1978).The risks of FMD from milk in ICW are, hence, considered negligible and that there is no justification for the measures in place in many countries for control of this perceived risk.

5.3.3 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 foul brood 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 does not allow the recycling of items that have been contaminated by honey but permits passengers to import up to 2 kg of honey for personal consumption, it couldn't be verified if that ban is based on EU rules or is specific for the UK. USA has no controls on personal import of honey for human consumption.

5.4 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 entering their countries that may pose a threat, including cabin waste

and passenger carried meat imports from international flights. 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 agricultural 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 in the next 10 years, combined with emerging environmental legislation on minimizing food waste and bans on the landfilling of organic waste, current ICW regulations are diametrically opposed to future environmental policies.

Considering 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. Effective risk management decisions require the active cooperation of all stakeholders, including the industry – airline operators, catering companies, airline cleaning companies, aircraft manufacturers – and governments – policy makers and enforcement officers. The degree of cooperation between stakeholders observed during the cabin waste audit project commissioned 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, 2017) are encouraging.

6 OPTIONS FOR CHANGE

Options for change to increase the amount of cabin waste materials that are reused and recycled fall into the following categories:

1. Improved use of existing legislation, guidance and interpretation
2. Apply risk assessments to guide risk management decisions concerning interpretation of current legislation
3. Changes to legislation based on 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

Several airline operators currently segregate recyclable materials, particularly on especially for domestic flights. Countries such as the 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 airline operators make use of recycling possibilities in countries that allow the reuse and recycling of cabin waste that has no animal product contamination. There are therefore opportunities for airline operators 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. Airline operators 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. Airline operators 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 Streams

Cabin cleaning waste has a high recyclable content (newspapers, discarded plastic bottles, menu cards) with corresponding low food waste content, as described in Section 4.1.3. Airports such as Auckland (AKL) (Auckland Airport, n.d.) and London Heathrow (LHR) have recently 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 catering companies provide waste handling services (de-catering) for both domestic and international flights at the same premises. In countries that have specific ICW legislation, many catering companies deem all waste to be ICW, irrespective of its origin, precluding any form of reuse and recycling. The separation and segregation of carts from international flights on arrival at the catering premises and during processing would enable recycling of waste from domestic (and intra-European) flights. Only a small number of catering companies practice segregation in this manner.

The incentives for segregating domestic and ICW waste streams and the system used for segregation is dependent on the relative quantities of the two streams. A small amount of domestic waste

provides little incentive for segregation whereas a small amount of ICW can be easily excluded from a large amount of domestic (and intra-EU) waste and 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 noted the importance of a simple and reliable method for visual identification and labelling of carts to ensure correct handling of domestic waste (and intra-EU) 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 catering companies 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

Figure 6 Image of unopened food and beverages found during catering facility visit (FCC, 2013)

Large quantities of unopened packs of dry goods including 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 6). For example, the IATA cabin waste audit at London's Heathrow Airport revealed that 5 % of the waste comprised unopened bottled water. These products may be salvaged for use on subsequent flights, in which case they do not leave the confines of the catering companies/aircraft chain and, therefore, do not fall into the definition of waste. A few countries including the US (USDA APHIS, 2016) and UK (APHA and DEFRA, 2014) have issued guidance that supports this reuse. Air New Zealand has recently teamed with their catering company and the Ministry of Primary Industries to reuse up to 40 inflight products from international flights that were previously deemed ICW and subject to steam sterilization and landfilling (Air New Zealand, 2017).

There is inconsistency in policies for salvage for reuse of these products between catering companies and airline operators. It is understood that catering companies and airline operators may have concerns about the provenance of salvaged products and their safety, however no instances could be found where products are not salvaged for reasons of branding i.e. they are not the brand specified by the airline operator. In some jurisdictions, food donation to charities is also not possible due to legal liability and taxation issues.

It is believed that there are opportunities for reducing waste by the salvage of unopened containers and food and beverages.

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

There is a clear financial incentive for airline operators to keep the quantities of catering materials such as food, beverages and equipment loaded onto flights to a minimum, as 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 waste management and disposal cost.

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

An opportunity to reduce the quantity of all waste generated was identified – 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 airline operators 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 uncontaminated recyclables pre-sorted on-board from ICW, while others (e.g. Canada,) are currently not. A consistent approach – all jurisdictions excluding pre-sorted uncontaminated materials from being classified as ICW – would be beneficial for airline operators to divert more materials for reuse and recycling. If airline operators could be assured that pre-sorted recyclables could be recycled at every destination, there would be greater incentive to put this into action.

Airline operators 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 and therefore airline operators and government authorities should work together to develop clear guidelines.

6.2.2 Milk and Milk Products

Strong evidence to challenge the categorization by all jurisdictions of heat treated milk and milk products in catering waste as high risk commodities for animal disease has been presented. Based on public health concerns, all milk and milk products are subject to heat treatment. To give assurances to enforcement authorities airline operators should stipulate in their catering contracts 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 cabin waste eligible for reuse and recycling.

It should be noted that papers identified and referred to in this report are not recent and it is recommended that risk assessment bodies (such as European Food Safety Authority [EFSA]) consider carrying out quantitative risk assessments based on contemporary data to verify the low risks posed by heat treated milk and milk products in ICW.

6.2.3 Honey

The classification of honey is considered as a high-risk component of ICW is not justified for most routes. For those destination countries with high bee health standards, it is proposed that the exclusion of honey from airline meals would be a simple means to eliminate any risk and to promote reuse and recycling of ICW.

6.3 Changes to Legislation

6.3.1 Entry Assessment Factors

Options considered 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.

6.3.1.1 Risk classification of international transport routes

Section one of the report referred to the anomalous situation whereby raw meat in the hold of an aircraft might be permitted to be imported into the destination country, but the 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 cabin waste.

Most jurisdictions apply the same rules to cabin waste from all international flights, irrespective of the origin or last port of call of the aircraft. However, 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 USA, Canada, EU, Australia and New Zealand are similar; their normal situation is freedom from the transboundary animal diseases of greatest concern. Most 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 USA 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. Risk management controls related to ICW should be implemented based on the actual risk in individual destinations, rather than taking a “one size fits all” approach based on the highest level of risk.

It is recommended that amendments are made to the legislation governing cabin waste in many jurisdictions and for the categorisation of waste to be based on the country of catering establishment, provisioning the flight.

Based on animal and plant health risks, there are five main types of international flight routes shown in Table 1.

Type	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 1 Main types of international flight routes based on animal health status

6.3.1.2 High animal health status → High animal health status (Type 1)

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 equal. For example, there are formal agreements of equivalence between the EU, USA and Canada (European Commission, 2018). The US has recognized the high animal health status of Canada in its definition and procedures for managing Regulated Garbage (ICW) (USDA APHIS, 2017).

It is most likely that all ingredients included in airline meals produced in these high animal and plant health countries are 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 assurances/guarantees. In such a case, there should be no necessity to categorise and handle cabin waste on such routes differently to waste from domestic flights.

Flights within the European Economic Area (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[3] (IATA, 2018) and so transatlantic mutual recognition of animal health controls could result in a declassification of ICW, yielding significant environmental and financial benefits, with no corresponding increase in risk to animal health status. In cases where there were specific, time-bound 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 (Type 2)

This level represents countries without an equivalence agreement but where the country with a higher level of protection has assessed 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 few 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 cabin waste to be categorized as ICW.

Most high animal health status countries have compiled and published lists of establishments in exporting countries authorized 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, 2018). The catering companies / airline operators should ensure that food of animal origin is produced in an establishment which appears on such a list.

This would require Standard Operating Procedures (SOPs) to ensure that only products from approved establishments are used for airline catering. Airline catering companies 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. In effect, the animal and plant hazards would be integrated in to the existing HACCP systems or standalone systems would need to be developed. Further assurance could be provided to countries of destination by including catering companies in the lists of approved establishments – this would

[3] IATA Statistic based on Europe-North America revenue passenger kilometers (RPKs) data from January-December 2017

ensure that the catering companies fall within their countries' regime of approval and official controls. Clearly this type of arrangement would require close co-operation and agreement between the competent authorities in the countries of origin and destination of flights.

The IFSA World Food Safety Guidelines for Aircraft Catering (IFSA, 2016) 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 2.

6.3.1.4 Lower animal health status → High animal health status – export of food products not permitted (Type 3)

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 concern 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 arrangement is put in place, ICW from those destination 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 (Type 4)

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 cabin waste beyond the normal waste controls.

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	• Menu design and planning • Procurement of raw, semi-finished or finished products
Flight country of origin	
Flight destination(s) where de-catering and aircraft cleaning is performed	
Guidelines	
Procedure	*The following provides guidance as to meal ingredients that may contain possible hazards to animal and plant health (not exhaustive)*
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	Highly Pathogenic Asian Avian Influenza (HPAI) Newcastle disease
Milk and dairy products must be sourced from establishments specifically approved for export to 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
Honey must be excluded [limited destinations only]	American foul brood
Raw fruit and vegetables whose export to the destination country is not permitted must be excluded	

Table 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 no presence of animal and plant health hazards 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 a risk, all pork and other pig meat products could be excluded; beef on the bone is a risk for carriage of FMD virus and could be excluded from menus.

Airline operators 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, airline operators could also 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).

OIE has developed recommendations for the treatment of most foods of animal origin to eliminate disease agents from food to enable the export of food from countries that are not free from specific diseases. As an example, Chapter 8 of the OIE Terrestrial Animal Health Code (OIE, 2015) recommends a heat treatment (70 °C for 30 minutes) for meat from susceptible animals. Animal health hazards in airline meals could be eliminated by implementing HACCP-type SOPs specifically directed at animal health hazards, incorporating the recommended treatment as the critical control point. SOPs must also 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 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 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. The airline operators moreover follow information from internal notification systems, such as the Rapid Alert System for Food and Feed (RASFF) (European Commission, 2018).

External auditing of the catering companies' food safety management systems is routine in the industry and 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 to give the necessary guarantees to the veterinary and plant health regulatory authorities of the destination country.

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		
Procedure	*The following table, which is not exhaustive, provides guidance as to meal ingredients and possible hazards to animal and plant health:*	
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 3 Example of standard operational procedure for eliminating animal health hazards

6.3.2 Exposure Assessment Factors

The factors that could result in an animal disease outbreak from exposure to contaminated recyclables from an international flight have been considered. The main material categories in cabin waste that are 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 however 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 agencies 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 7 provides a method for implementing the options for minimizing ICW, as outlined in this Chapter, based on an iterative test-approach.

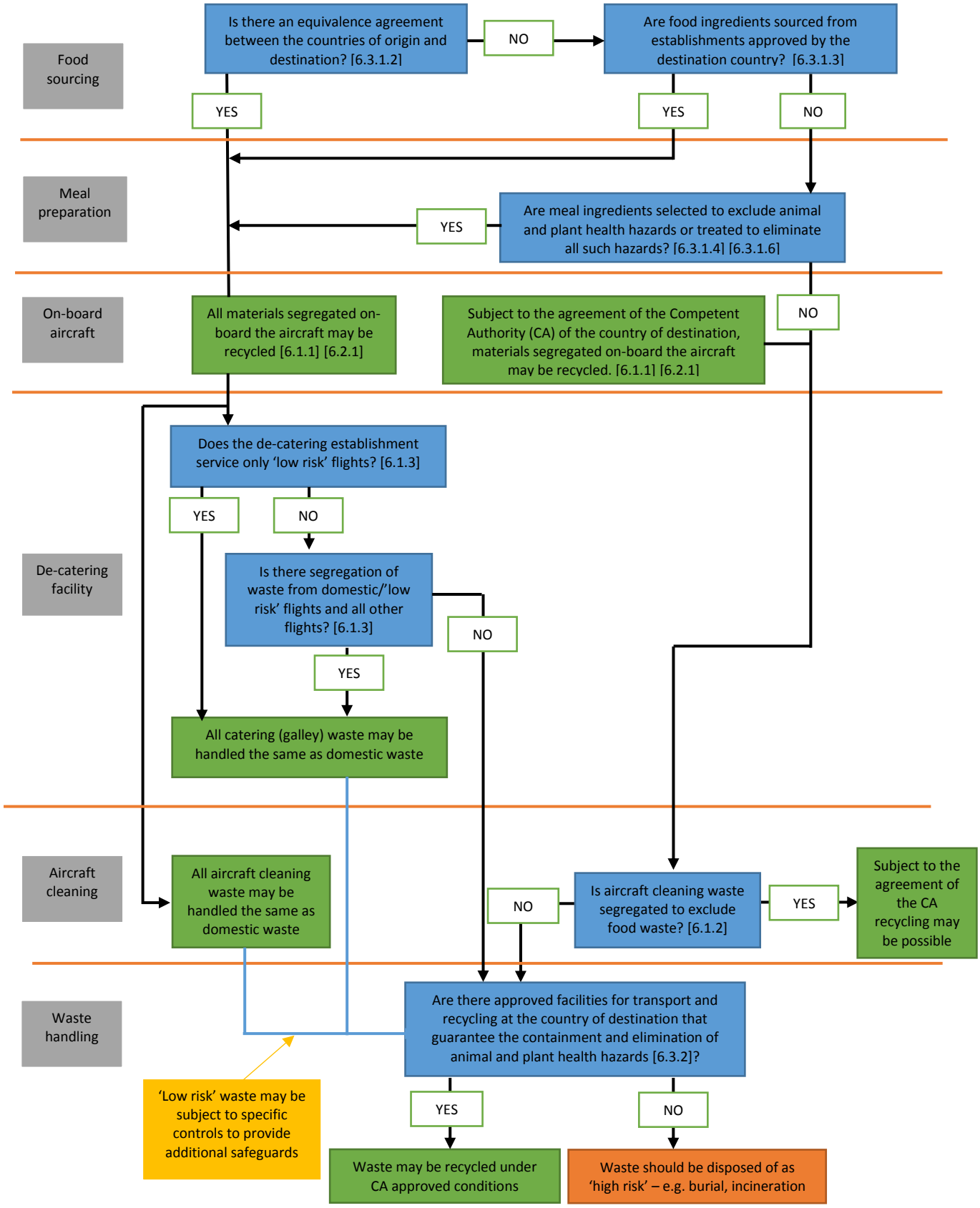


Figure 7 ICW Options for Change: Decision Analysis Flow-diagram. Reference to relevant section is included in [ ].

7 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 management and disposal of waste from international transport. However, these agricultural health controls are diametrically opposed to the new environmental challenges of introducing the circular economy and drastically cutting food waste. It is believed that there is a strong case for changes to be made to regulating and managing cabin waste that reflects these changing circumstances, whilst maintaining agricultural health status.

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.

Methods of improved source controls by which the presence of animal and plant disease agents in catering waste might be prevented are proposed. 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. Evidence is presented which indicates cabin waste comprising milk and milk products, subject to heat treatment, represents a negligible risk to animal health.

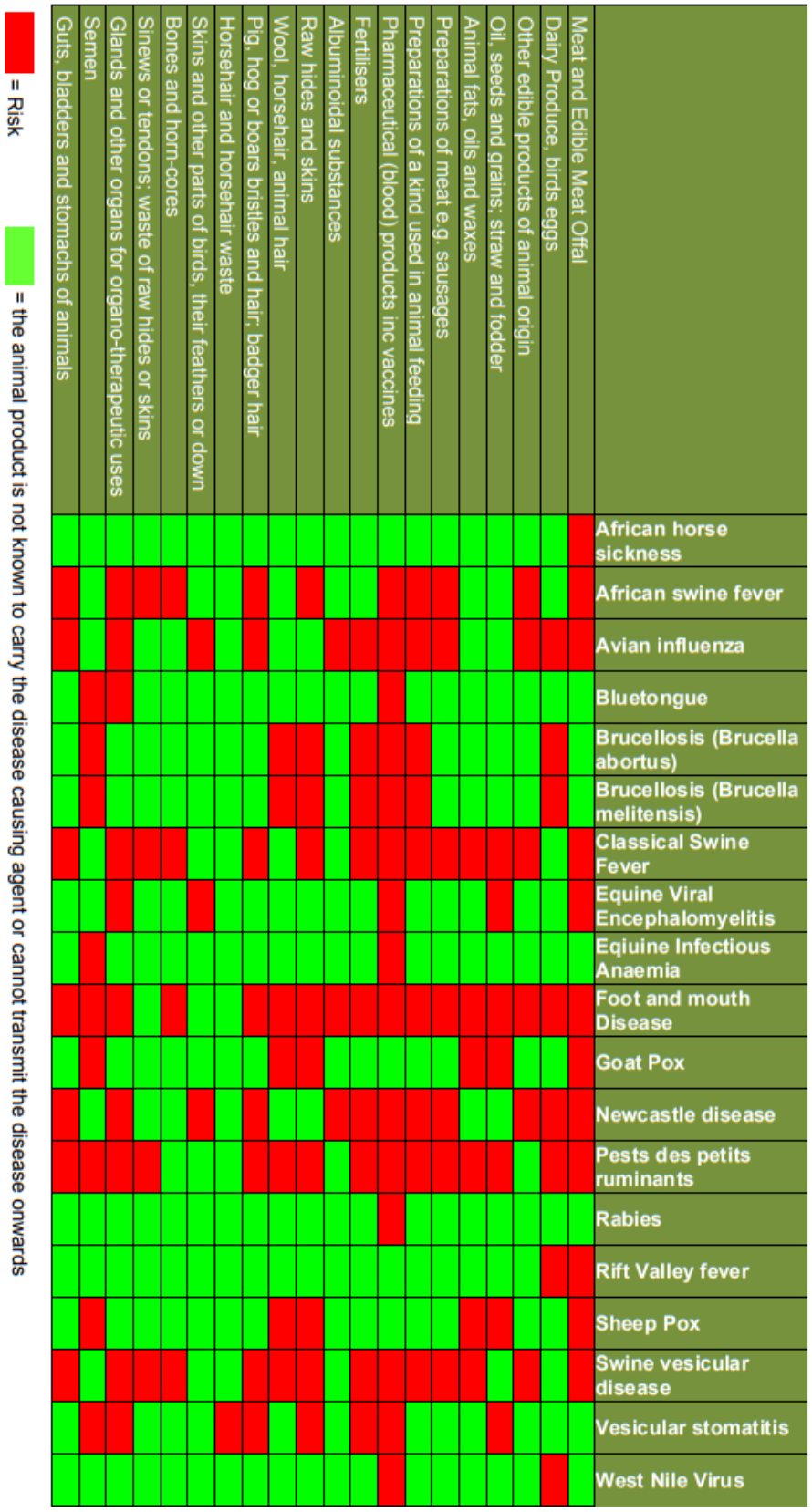
It is apparent that there are differences between countries in their willingness to consider changes to the rules governing disposal of ICW. Effective reuse of materials and recycling of waste from international flights will require a consensus on these rules and their interpretation as well as constructive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

Several different scenarios have been identified where cabin 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 minimizing 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) and their Trade Association (Airline Catering Association) have an important role in integrating animal health ingredient source controls into their food safety systems. Airline operators 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).

Airline operators 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. It is believed that there is an important role for IATA to develop industry standards and guidance to achieve this.

8 APPENDICES

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



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

Disease	Species	Methods of Spread	Australian 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, contamination of milk	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, contamination of milk	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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