REFRESH Task 6.3.3 Expert panel on the risk management of using treated surplus food in pig feed

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Authors

Dr. Karen Luyckx, FeedBack (REFRESH project)

With thanks to:

Prof. Pier Sandro Cocconcelli, Università Cattolica del Sacro Cuore, Milan, Italy

Carina Millstone, FeedBack (REFRESH project)

Prof. Helen Miller, Animal Bioscience, University of Leeds, UK

Dr. Scott Reaney, Animal and Plant Health Agency (APHA), UK

Dr. Erasmus zu Ermgassen, Department of Zoology, University of Cambridge, UK

Amy Wolff, Director Environmental and Resource Management Consultancy, UK

Dr. Hendrik –Jan Roest, Bacteriology and Epidemiology, Wageningen Bioveterinary Research, NL

Prof. Mart de Jong, Quantitative Veterinary Epidemiology, Wageningen University

Dr. Ed van Klink, Bacteriology and Epidemiology, Wageningen Bioveterinary Research

Prof. Marcel Zwietering, Food Microbiology Laboratory, Wageningen University (REFRESH)

Dr. Hasmik Hayrapetyan, Wageningen Food & Biobased Research (REFRESH)

Dr. Masja Nierop Groot, Wageningen Food & Biobased Research (REFRESH)

Dr. Marjolein van der Glas, Wageningen Food & Biobased Research (Facilitator)

Project coordination and editing provided by Feedback.

Panel coordination provided by Dr Nierop Groot.

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1 Preface

The report that follows describes the outcomes of an expert panel that took place under REFRESH Task 6.3.3 which will contribute towards REFRESH deliverable "D6.7 Technical Guidelines Food Waste Reprocessing" due by spring 2019. The technical guidelines will focus on feed for omnivorous non-ruminants as a high-potential valorisation route for retail, manufacturing and catering-sourced unavoidable surplus food that is no longer fit for human consumption and may contain traces of meat.

REFRESH project context

Before setting out the aim of the expert panel, it is worthwhile mentioning the other key research activities contributing to the REFRESH work on the use of surplus food in animal feed:

(1) Analysis of the UK government report "Assessment of risk management measures to reduce the exotic disease risk from the feeding of processed catering waste and certain other food waste to non-ruminants". This UK government study was carried out in 2014 by the UK Animal and Plant Health Agency. The results were further analysed by Wageningen University food microbiologists as part of REFRESH (Hayrapetyan et al, 2017).

(2) Review of available examples of the legal framework and practice in countries where it is currently permitted to feed heat-treated meat-containing food surplus to non-ruminants, particularly the United States (Broad Leib, 2016), New Zealand (New Zealand Government, 2016) and Japan (see pp. 13-15).

(3) Life Cycle Costing and Life Cycle Assessment studies to assess the economic viability of the use of treated surplus food as pig feed in the European context. These will bear in mind the findings of the European Commission's Product Environmental Footprint for farm animal feed. Given that the proposed model of licensed industrial treatment plants that are located off-farm does not currently exist in Europe, the US or New Zealand, the LCA and LCC studies will be estimating processing plant energy and running costs using data of existing plants in Japan as well as comparable industries in Europe, particularly the pet food industry.

(4) Mapping of risk management and traceability systems in comparable EU-based industries (such as the pet food industry) and industries that would form part of the supply chain (catering, retail and manufacturing) in collaboration with global standards experts and REFRESH partner GS1.

In addition to the above activities and given past experience of using surplus food in feed, REFRESH decided that it was important to deepen the risk assessment through cross-disciplinary expert input. We therefore called together an expert panel to expand the hazard identification in relation to the feeding of omnivorous non-ruminant livestock with meat-containing surplus food, rank the most relevant routes for introduction of these hazards, and explore potential risk management measures. The experts discussed the hazards and risk-management options during a day-long meeting after which they were invited to comment on various drafts of the enclosed report to ensure it correctly reflected their input.

The experts concluded that from a technical point of view, surplus food can be made sufficiently safe to feed to pigs (as non-ruminant omnivores) in terms of notifiable disease risks (see list p.9), provided the surplus food is heat-treated and possibly acidified through fermentation or adding lactic acid for example. Moreover, biosecurity measures would need to be employed to prevent cross-contamination between treated feed and untreated surplus food. The experts also provided recommendations for further areas of research to enhance the feasibility and safety of the proposed use of surplus food as non-ruminant feed.

To ensure these treatment and biosecurity measures are implemented to the standard required and to allow for adequate monitoring and enforcement of safety requirements, **the REFRESH working hypothesis is that in the European context it will be necessary to limit the production of feed from surplus food to licensed treatment plants that are located at a sufficient distance from any farm premises.**

Brief background on practice and legal framework in the US, New Zealand and Japan

In all three countries, meat-containing surplus food must be heat-threated to inactivate dangerous pathogens. In New Zealand, Japan and in those states of the US that have chosen to follow federal legislation, treatment of surplus can happen on farm. In the US a license needs to be obtained, but not in New Zealand. In both countries, households are permitted to feed own household garbage directly to own swine. Our research to date suggests that the US and NZ systems are quite like those of the EU prior to the ban.

Whilst acknowledging that Japan has faced its own challenges regarding its animal health and food safety policy frameworks[1], the creation of an industrial "surplus-food-to-pig-feed" treatment industry sets the country apart from other industrialised countries where it is permitted to feed treated surplus food to pigs. Japanese treatment plants operate separately from farm premises, similar to the former food processing industry in the EU. And the plants operate to specific biosecurity, treatment, segregation and monitoring requirements, as outlined in Japanese legislation.

As part of the wider work to develop risk management recommendations, REFRESH researchers are paying attention to the newly developed Japanese treatment plants *as an example* that, alongside our findings from studying comparable European industries, could supply lessons learned to inform an EU-specific system proposal. REFRESH also notes that in their recent report "Livestock solutions for climate change", the Food and Agriculture Organisation

[1] There was the 2010 Foot and Mouth Outbreak which was traced back to a water buffalo farm and then first spread to cattle farms, before affecting a wider group of livestock including pigs. The Japanese legislation has clear segregation requirements between ruminant and non-ruminant feed, and according to available academic literature the FMD outbreak was not linked to the feeding of surplus food. See Muroga (2012) for more information. There have also been problems regarding traceability and labelling more generally in the Japanese food supply chain.

(2017, p.6) specifically highlights Japan as a key example where “52% of waste from the food industry is now used as livestock feed, thanks to adequate policies and a certification system.”

The findings of the expert panel presented in this report, however, stand separate from any existing country examples. Similarly, any final REFRESH recommendations on the safe use of meat-containing surplus food in omnivore feed will be developed specifically for the EU context.

This preface was written after the remainder of the report was commented upon and signed off by the experts who participated in the panel.

2 Panel Outcomes

The experts analysed the risks of feeding all possible food waste, including meat and catering waste, to pigs without species segregation. After a discussion of the risks, risk management options were examined also with reference to existing Japanese and South Korean legislation and practice. The outcomes and next steps are presented first, followed by the meeting notes and a table of the pathogens considered.

2.1 Safety

1. The expert group agrees that **from a technical point of view it is possible to process food waste into feed that is sufficiently safe** for pigs.
2. To make food waste sufficiently safe for feeding to pigs, in terms of notifiable disease pathogen risks (see Table 1), the processing and treatment system must consist of:
    a. **Heat treatment,** potentially complemented with
    b. **Fermentation and/or other means of acidification** to inactivate pathogens less sensitive to heat such as Foot and Mouth Disease or spore-forming micro-organisms even for areas where such diseases are currently absent.

See Table 1 (p.19) for a summary of heat treatment and acidification sensitivity for each pathogen of concern and reference information on the heat treatment specifications required by law in Japan and the United States.

Further microbiological expert advice is needed to understand advantages or disadvantages in terms of nutrition, shelf life, stability, cost, and pathogen inactivation, of:

   c. Fermentation technologies, including whether pro-biotics support reduced antibiotics use as reported by industry in Japan (Japan Food Ecology Center, 2015).
   d. Other acidification options, such as organic or lactic acids, especially those already used routinely in the food or feed industries.
   e. Safety benefits resulting from producing a dry feed with additionally an improved shelf life in comparison to wet feed.

3. The processing system must also manage additional risks such as dioxins or heavy metals similar to the way those risks are managed in the current former food processing industry. See notes p.7 for full list.
4. All parts of the processing system and the waste-to-feed value chain must **prevent cross-contamination** of treated feed with raw food wastes or other contaminants, using biosecurity measures and proven logistical and Hazard Analysis and Critical Control Points (HACCP) measures for segregation in storage and transport such as zoning, one directional process flows, dedicated sealed storage containers, etc.

2.2 Economic viability

5. Safety and the prevention of cross-contamination must be central to the business case. In other words, **best practice processing must be motivated by a business interest to safeguard a reputation for feed quality and safety**, as opposed to legislative enforcement alone. The business interest for safety must apply to the processing facility and the CCP measures regarding handling, storage and transport during all parts of the feed value chain (food business to processing facility and from there to the farm).
6. Whilst feed cost savings in Japan and South Korea and conventional feed prices in the EU suggest that it may be possible to develop a flourishing waste-to-feed industry in Europe (see pp.5-6), **further Life Cycle Costing analysis** (LCC) is needed to fully understand **economic viability both for the feed industry and for farmers**. An LCC study will need to bear in mind:
    a. feed processing costs in comparison to the cost of conventional feed taking into consideration:
        i. the additional measures that will be necessary to ensure safe processing (energy costs), additional measures to ensure no cross-contamination of the finished feed with raw material, and additional logistical considerations such as sourcing/collection, chilled transport and storage, etc.
        ii. a comparison of like for like so cost of specific nutrient provision rather than just comparison with a complete conventional feed
    b. forecast scenarios of global agricultural commodity prices.
    c. potential benefits of the re-introduction of high quality animal-protein in diets of pigs as omnivores, additional to those that will become available through the authorisation of poultry Processed Animal Proteins (and insect derived PAP) in pig feed.
    d. need for technology, rapid methods to analyse feed composition and mixing with conventional ingredients to ensure nutrition balance and feed composition required in modern pig farming.
    e. geographic, safety and other conditions determining the advantages and disadvantages of dry versus wet feed systems.
7. Moreover, further research could consider particular pig breeds and farming models that would allow for some level of flexibility in nutrition balance in a context of reduced feed prices.
8. **Consumer research** needs to consider consumer acceptance of an "eco-pork" label as is currently done in Japan, so that a premium price for the final product can support a low-impact, low-antibiotics and high-welfare farming model. Further dialogue with the **pig farming sector** is necessary to ensure their concerns are addressed.

2.3 Traceability and ingredients

9. **Traceability** is central to the current feed chain and legislation and needs to be fully considered in any new legislation.
10. **An EFSA assessment of risk** will need to be sought and consider the legal and risk implications of using food ingredients and additives currently not approved for animal feed.

2.4 Enforcement and early-warning

11. A broader cost-benefit analysis needs to consider the resources needed for **adequate inspection and control of the waste-to-feed value chain**, alongside the potential economic, food / feed security, climate benefits, and the way in which reduced feed costs can make low-antibiotics, high-welfare pig farming more viable.
12. Sufficient resources should continue to be invested in early warning systems and **early crisis management** plans in relation to **notifiable diseases and emerging diseases**. Such early warning systems are important regardless of any changes in feed legislation. **However, the removal of the intra-species recycling ban for omnivorous non-ruminants would further support the need for robust disease monitoring systems especially on farms feeding food waste.** Prion disease comes to mind as an example**,** even if no evidence currently exists of natural occurrence of prion disease in pigs (EC SSC, 1999, Wells et al. 2003). However, it is more important to be vigilant for the "unknown unknowns"**.**
13. Further research is needed to identify appropriate enforcement approaches with respect to maintaining strict conditions that would prevent the further transmission of exotic diseases, the funding of enforcement and the role of penalties.

2.5 Further research – next steps

As part of REFRESH

14. Life Cycle Costing and Environmental Life Cycle Analysis as described.
15. Traceability technology with global traceability expert GS1.

With additional collaboration / funding

16. Further develop - and possibly **publish** - the **risk analysis** initiated by APHA and reviewed by WUR, by incorporating:

a. the best available estimates for infectivity and quantity of imports of infected meat (updated literature review and separate values for each notifiable disease from existing literature), including illegal imports in passenger luggage

b. an updated estimate of the probability of cross-contamination due to human error or mechanical failure, using data from the rendering sector, biohazardous waste management sector, pharmaceutical sector and Japanese and South-Korean waste feed sectors.

c. three separate scenarios:

   i. optimum baseline; current ban is fully enforced, and the baseline takes into account most recent disease prevalence data (eg. African Swine Fever in Eastern Europe)
   ii. current situation of routine breaking of ban by smallholders (especially in Southern Europe, but also elsewhere), taking into account the most recent disease prevalence data

iii. Japanese model applied in the EU with sufficient resources for adequate enforcement and awareness raising

17. Further research the role of fermentation, acidification, dry and wet feed processing in terms of safety, cost and health benefits
18. Verification of Japanese industry reports regarding the reduced use of antibiotics possibly due to the probiotics in fermented waste-based feed
19. Maintain a watching brief on
    a. Ongoing research on antimicrobial resistant (AMR) genes in Anaerobic Digestion, to analyse implications for waste to feed processing
    b. Wider research on cost-benefit, in terms of public and animal health, of increasing resources in customs border control to reduce imports of potentially infected food (Australian, New Zealand and US models)
20. Design and test pilot facility in Wageningen to further support the safety, Nutritional, LCA and LCC research.

3 Meeting notes

3.1 Presentation on wider environmental and economic context of feeding food waste to pigs – Erasmus zu Ermgassen

- The 9000 years old practice of swill was banned in the EU following the 2001 outbreak of Foot and Mouth which was started by a UK farmer illegally feeding untreated food waste to pigs. The outbreak cost the UK economy £8 billion pounds and more than 6 million animals were slaughtered.
- Currently only former foodstuffs such as bakery and confectionary foods that cannot be sold, are recycled into animal feed (EFFPA, 2017). It is estimated that in addition to the current volume of 3 to 5 million tonnes of former foodstuffs that are already recycled, a further 2-4 million tonnes of former foodstuffs could be fed to livestock, reducing land use for feed crops by ~1.2% (zu Ermgassen, 2016).
- If the EU were to authorise the feeding of heat-treated meat-containing surplus food to omnivorous non-ruminants, such as pigs and chickens, and this heat-treated EU food waste was recycled into animal feed at rates similar to current practice in Japan and South Korea, "the land requirement of EU pork could shrink by 1.8 million hectares. This represents a 21.5% reduction in the current land use of industrial EU pork production" (zu Ermgassen, 2016).
- Feeding meat-containing surplus to pigs also could "reduce demand for up to 268,000 hectares of soybean production, which could "mitigate ca. 2.6% of the forecast expansion of soybean, reducing pressure on high-biodiversity tropical biomes accordingly" (zu Ermgassen, 2016).

<u>Economic case</u>

- In December 2015, feed costs in 7 EU pig producing countries made up between 56% and 69% of total production costs (ADHB, 2015). In Japan and South-Korea, however, industrial food-to-feed recycling plants deliver safe waste-based feed at 40-60% of the cost of conventional feed.
- The use of food waste as animal feed as a percentage of the feed market has consistently grown in both countries (by 125% in Japan from 2003–2013, and by 35% in South Korea from 2001–06) (zu Ermgassen, 2016).

3.2 Interdisciplinary hazards panorama and ranking of relevance

The experts were asked to identify hazards and then were each given three sets of points (5,3,1 points) to allocate to each risk. The sum of the points resulted in a ranking of the hazards, here listed in the ranked order.

<u>3.2.1 Animal pathogens (31 points)</u>

Listed in Table 6 of the APHA report (Adkin, 2014). Additional to those listed in Table 6 - APHA: worm infections, notifiable diseases.

See separate table pp.20-24 „Pathogens of concern and inactivation options"

<u>3.2.2 Emerging diseases and zoonoses (20 points)</u>

- Zoonoses such as influenza, Hep E
- Emerging diseases such as TSE
- Unknown / novel diseases

<u>3.2.3 Toxins formed by spore-formers and other species (11 points)</u>

- *Clostridium sp.*
- *Bacillus sp.*
- Fungal toxins

<u>3.2.4 Chemical hazards (5 points)</u>

- Dioxins
- Heavy metals

<u>3.2.5 Anti-microbial resistant genes (3 points)</u>

may be a risk, but further research is needed to understand the level and uncertainty.

<u>3.2.6 Non-sporeforming bacteria (1 point)</u>

Not in Table 6 of APHA report (Adkin, 2014): non-sporeforming bacteria such as *Campylobacter, Salmonella, E.coli, Yersinia enterocolitica*,

<u>3.2.7 Additives</u>

- Food additives not authorised as feed additives (safety and legal issues)
- Contamination with foreign objects / non-edible components (cutlery, packaging

<u>3.2.8 Economic and environmental risks</u>

- Economic risks
- Effects on pork quality (see also zu Ermgassen et al. 2016)
- Increased farm emissions (see also Salemdeeb et al. (2016)
- Costs of installing feeding system
- Effects on feed efficiency + pig flow (see also zu Ermgassen et al. 2016)

3.3 Identification of risk factors and ranking of relevance

Experts were then asked to identify the risk factors / chance of a hazard occurring and rank the relevance.

3.3.1 Processing (29 points)

- Insufficient process control / monitoring
- Inadequate implementation of HACCP
- Lack of technical competence of operator
- Insufficient heat treatment
- Problems with the fermentation
- Faulty design process
- Use of preservatives in feed

3.3.2 Cross-contamination (34 points)

- Cross-contamination between treated product and raw material or other contaminants
- Contamination with airborne pathogens

3.3.3 Group discussion on risk management in processing and prevention of cross-contamination

- Technically it is possible to prevent cross-contamination, techniques and system design to ensure separation can be learned from the food industry and pharmaceutical industry. Zoning is an important control measure
- Air could be filtered to prevent air-borne transfer of infection; a cost/benefit analysis would determine whether this is necessary (this is not currently done in Japan).
- People visiting the production premises, such as technical service providers, also need to be instructed properly and provided with appropriate clothing and handwashing possibilities.
- There should be a requirement for technical competence of operators.
- One should consider how far the system design must go to ensure safety while being economically viable
- Ensure adequate certification
- Different risks, costs and benefits of on-farm or centralised processing
- Risk managers will have to weigh up the uncertainty of unknown, novel and emerging diseases in a wider risk analysis as we cannot manage these risks as such in the processing system. Further consideration is needed to understand whether early-warning systems can realistically play a role. Early crisis management is crucial and will need to be part of the risk management.
- Heat-treatment and acidification specifications should take into account all known pathogens even if those are not currently present in a certain area. This is important as otherwise the system becomes more vulnerable to exotic diseases (not currently present) and emerging diseases (not currently known). The latter is of course about the "unknown unknown" so you cannot prepare for those. It is hoped when we are resilient to all

known diseases we will be resilient to new unknown diseases.

- To conclude, prevention of cross-contamination is achievable, however a business case should be made to judge whether it is economically feasible and cost-effective. All the extra measures taken will increase the costs of production, which will also make it difficult to compete with other users of the same raw material, such as compost producers. However the challenge is not to overdo with too strict requirements. How far should control measures go? This is also difficult to estimate because of considerable uncertainty (there is still uncertainty about the effectivity of all options).
- Government subsidies can be considered to promote the production of feed from food waste

3.3.4 Regulation and enforcement (8 points)

- (In)sufficient regulatory controls or the risk of "uncertainty over what level of regulatory control would be sufficient"
- (In)sufficient resources for enforcement
- the risk associated with regulatory enforcement is not limited to within an individual Member State. For example, if one MS fails to adequately control a process and this results in an ASF outbreak in that MS then this will potentially increase the risk in neighbouring Countries. The key here is Sufficient and consistently applied (and audited – SANTE F) controls across all member states.
- Failure of regulation in practice either at the farm or processor
- Legal constraints resulting from conflicts between food and feed legislation

3.3.5 Communication / training (5 points)

- Lack of risk awareness amongst staff at food businesses, processing plants and farms as a result of poor communication / training

3.3.6 Transport / trade (9 points)

- Contaminated food is imported by tourists / passengers or in international catering waste because of insufficient border control
- Contaminated legal meat imports
- Farm visit transport

3.3.7 Initial contamination (4 points)

- Exposure: percentage of feed that comes from food waste
- Prevalence of contaminated meat and other food products
- Origins of food waste
- Lack of segregation / prevention of contamination with foreign objects at source (packaging, cutlery, glass, etc)

3.3.8 Fraud

- Intentional illegal feeding of unprocessed food waste
- Negligence
- Illegally imported contaminated meat

3.4 Presentation of Wageningen University and Research Analysis of APHA report. Hasmik Hayrapetyan

For points made in presentation, see report (Hayrapetyan, 2017).

3.4.1 Comments and discussion points

- UK pig population is much smaller than the NL and various other EU countries, and this difference needs to be considered in further risk assessments.
- Density of farms influences the transmission between farms.
- Need to further analyse pathogens such as Classical Swine Fever which has a very different initial load to African Swine Fever, or Foot and Mouth Disease
- The risk assessment methodology of the report tends to overestimate risk, but is good for comparative purposes (i.e. comparison of scenarios within a risk assessment).
- Given that the majority of diseases are rare, we only have estimates with significant uncertainty in the numbers
- Traceability is an important risk factor. Even to the ingredient level is required.

Other points that need to be considered in the full risk assessment

- Cross-protection as part of safety analysis of feed additives
- Need to further understand the circumstances and causes of FMD in South Korea. Current knowledge is that FMD enters South Korea via farm workers from China, and through airborne contagion with the North Korean border.

3.5 Presentation of Japanese legislation. Karen Luyckx

Discussion points

- Feed processor can be the farmer. This could solve the transportation issue but although economically attractive it is risky in terms of risk management.
- in UK production facilities for non-ruminant feed is separated from ruminant to prevent cross-contamination.
- Continuous monitoring does not exist and is not a basis for food safety management.
- Outbreaks occur in 1 in 60 years> the Japanese model is not in place long enough – one should be careful with drawing conclusions based on the Japanese model

<u>Summary of Japanese legislation on the prevention of TSE and the use of food waste in animal feed</u> Prepared by Karen Luyckx, Feedback, for informative purposes, in the context of REFRESH Task 6.3.3 on the use of food waste in animal feed

<u>Part 1: Prevention of BSE</u>

New Guidelines on Prevention of Intermixing of Animal Origin Proteins in Ruminant Feeds, issued by the Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan. 15 Shoan No. 1570 dated 15 September 2003). http://www.famic.go.jp/ffis/feed/obj/1509161570_eng.pdf

Objective: to prevent intermixing of animal origin proteins with ruminant feeds, at various stages of production, importation, distribution, storage, feeding, and handling of feeds and feed additives… to prevent the occurrence of transmissible spongiform encephalopathies such as bovine spongiform encephalopathy (BSE) and related diseases

Basic principles in the guideline:

- Create two separate farm animal feed categories:
  - <u>Category A</u>: Feedstuffs and their raw materials permitted for <u>ruminants</u>
  - <u>Category B</u>: All other farm animal feedstuffs and raw materials, only permitted for <u>poultry, pigs and fish</u>
- Definition of "Animal Origin Protein" is similar to ABPs currently prohibited in EU legislation. Animal Origin Protein:
  - Includes protein originating from mammals, poultry, fish and shellfish, including Animal Origin Protein in surplus food and food waste, ruminant fat
  - Excludes dairy and egg products, non-ruminant fat. Gelatine and collagen only if approved by MAFF
- Animal Origin Protein is prohibited in Category A (ruminant) feed
- Ruminant blood and bone meal is prohibited in Category A and Category B feed
- Overall principles to prevent Category A feed from becoming contaminated with Animal Origin Protein or Category B feed:
  - Applied to each stage of feed chain: production, importation, distribution, storage and feeding
  - Clearly holds the final feed manufacturer and farmer responsible to ensure that any subcontracted phase of feed production or transport is done safely
  - If there is even the possibility of Category A feed having become contaminated with Category B; this feed must automatically be downgraded to Category B
- Feed business operators are expected to have written operational procedures.
- Segregation procedures are not applicable to facilities dealing only with Category B feed and farms where there are no ruminants
- Procedures and measures to ensure full and continuous segregation are expected to cover:

- Use of fully segregated and closed areas for production, internal transport within feed manufacturing premises, packaging, reception and dispatch of raw ingredients and finished product: ie at all stages of production
- Transportation to be done in containers exclusively used for Category A feed with clear labelling and colour-coding. Containers can be allocated to Category A feed after being cleaned rigorously. Cleaning procedure is also defined.
- Handling and cleaning equipment should also be designated for exclusive Category A feed
- Containers, packaging, handling equipment and storage and transport bags for each feed category need to be stored separately when not in use

- Quality control and testing:
  - Category A feed needs to be regularly tested to ensure procedures are effective, a designated quality control officer needs to be appointed, and detailed records need to be kept

Part 2: Safe use of by-products, surplus food and food waste in animal feed

Guideline for Ensuring Safety of Feeds Using Food Residues. Shoan No. 6074. Issued by Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan on 30 August 2006. *Unofficial translation* provided by MAFF of the updated version including partial amendment Shoan No. 3615 of 22 December 2016. http://www.famic.go.jp/ffis/feed/obj/Guideline_for_Feeds_Using_Food_Residues.pdf

Heat treatment

Any by-products and former foodstuffs containing Animal Origin Protein, and all catering and kitchen waste:

- Must undergo heat treatment to inactivate pathogenic micro-organisms (30 minutes or more at 70 °C or for 3 minutes or more at 80 °C as set out in provisions for the prevention of Classical Swine Fever, available only in Japanese).
- a processor must not rely solely on the temperature settings of the treatment technology alone but should continuously monitor the actual temperature in the food waste under treatment

Food waste categories

The following categories of food waste are regulated for:

- By-products containing Animal Origin Protein (II.1.(3)), as defined in TSE guideline above
- Former foodstuffs (II.2)
- Catering kitchen waste (II.3-1) only from domestic sources (it is not permitted to use waste from international flights, ships or other foreign facilities)
- Household kitchen waste (II.3-2)
- Catering left-overs and plate scrapings (II.4-1) only from domestic sources (it is not permitted to use waste from international flights, ships or other foreign facilities)
- Household left-overs and plate scrapings (II.4-2)

Quality and hygiene responsibilities of food waste supplier

It is the responsibility of the supplier of the food waste for animal feed (referred to as "discharger" in the translation) to ensure that the above categories of food waste:

- are each stored and transported separately in a dedicated container, which must be cleaned or sterilised after each use, and kept in the best possible conditions to preserve freshness (cold storage if necessary and minimise the storage period) and to ensure the food waste cannot be accessed by birds, rodents, cats, dogs, insects and the like
- have clear recording and thorough monitoring of
  - status of separation / labelling of source of food waste

    - status of freshness (discard batches with fungi growth or which are decomposing)
    - absence of packaging and other foreign materials. It is only allowed to use catering left-overs and plate scrapings if the supplier has ensured all harmful materials such as toothpicks of cigarettes have been removed through thorough visual inspection
- It is not normally permitted to use household food waste, unless for food waste education purposes. If household food waste is used, thorough separation is required to avoid contamination with foreign matters such as pet food.

Responsibilities of the feed processor or farmer

The feed processor or farmer procuring the food waste for use in feed (referred to as "obtainer" in the translation) is required to:

- confirm that the food waste supplied meets the above requirements, and if it does not, take appropriate action. For example, if the food waste has started decomposing during transport, it must be discarded.
- Use additional mechanical means to ensure all foreign objects and packaging materials are removed (magnets, sieves in addition to visual inspection)
- if there is no refrigerated transport available, the food waste shall only be transported over very short distances
- process or use the food waste as feed as soon as possible
- apply heat treatment as described above
- comply with the segregation requirements regarding Category A (ruminant) and Category B (non-ruminant) feed as described in Part 1 of this summary
- have written operational procedures to ensure compliance with all legal requirements, including quality control
- keep extensive records on all aspects of feed treatment, transport, storage, handling, feeding etc, as detailed in the guideline

Additional responsibilities for the feed processor

- visit its food waste supplier periodically to confirm compliance of the contract
- provide training to the food waste supplier to ensure all requirements regarding separation, freshness, storage, removal of foreign materials etc are complied with
- label processed Category B feed with the wording: "This feed shall not be used for cattle, sheep, goats and deer" (penalties applicable) and "This feed shall be stored in such a way that it cannot contaminate feed or ingredients used in feed for cattle, sheep, goats and deer."

Quality and safety control

The feed processor is also responsible for sample testing and quality control as follows:

- samples shall be tested for mycotoxins, pesticide residues, heavy metals, pathogenic micro-organisms, lipid oxidation, salt, nitrate, volatile basic nitrogen. Analysis frequency and item shall depend on the product, as set out in the testing technical guidelines and methodology http://www.famic.go.jp/ffis/oie/sub1e_activity.html
- list the date of manufacturing, date of collection of samples, analyst, analysis result, measure which was implemented based on the analysis result, etc. in a quality control ledger and preserve it for 8 years.

Contract between supplier and processor / farmer

- The supplier and the processor or farmer must agree a written contract to ensure shared responsibility for the above requirements. If applicable, such contract must be extended to the third party involved in the collection and transport of the food waste.

Legal heat treatment requirements in the US:

US heat treatment specifications

The regulations in § 166.7 require that garbage be heated throughout at boiling (212 °F or 100 °C at sea level) for 30 minutes before being fed to swine. Requirements regarding the licensing of facilities that treat garbage for feeding to swine are contained in § 166.10. The requirement that the material be heated throughout at boiling takes into account a margin of safety to ensure that disease organisms of concern are inactivated. Although the scientific literature recognizes that heating meat throughout at 167 °F (75 °C) for 30 minutes is sufficient to inactivate the disease organisms, in many cases it is difficult on a practical level to determine precisely when every piece of meat in the garbage being treated has been heated to 167 °F throughout. Larger pieces of meat may take longer than smaller pieces to reach that temperature throughout. By requiring that garbage be heated at boiling throughout for 30 minutes, the regulations have provided a documentable and easily visible way to ensure that meat has been heated to a temperature sufficient to inactivate disease organisms of concern. (US Department of Agriculture, 2009)

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Table 1

FEEDING OF PROCESSED MEAT-CONTAINING FOOD WASTE TO NON-RUMINANTS

without species segregation

PATHOGENS OF CONCERN AND INACTIVATION OPTIONS

Table developed from the "Assessment of Risk Management Measures" by the UK Animal and Plant Health Agency (Adkin et al., 2014), further analysis by Wageningen University and Research (Hayrapetyan et al, 2017), REFRESH expert workshop in Wageningen (Nov 2017) and additional literature search by Feedback.

Reference information on the US and Japan heat treatment requirements:

In **Japan**, any by-products and former foodstuffs containing Animal Origin Protein, and all catering and kitchen waste, must undergo heat treatment to inactivate pathogenic micro-organisms (**30 minutes or more at 70 °C or for 3 minutes or more at 80 °C**). Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) (2006)

In the **US**, the regulations in § 166.7 require that garbage be heated throughout at boiling (212 °F or **100 °C** at sea level) **for 30 minutes** before being fed to swine (US Department of Agriculture, 2009).

				Processing criteria		
Pathogen – Common Name	**Acronym**	**Affected livestock**	**Mean risk of infection at 70°C for 30 min** (Adkin et al, 2014)	**70°C for 30 minutes** (Adkin et al., 2014 unless mentioned otherwise)	**100°C for 1 hour** (Adkin et al., 2014 unless mentioned otherwise)	**Acidification** (not considered by Adkin et al, 2014)
		Pigs				
Highly pathogenic - Porcine reproductive & respiratory syndrome	HP-PRRS	Domesticated and wild pigs	Low (1/14 years)	1 log reduction.	15 log reduction	"PRRSV is stable at pH 6.5–7.5, but inactivated at high or low pH levels."[2] Cited to: Zimmerman et al. 2012
Clostridium		Cattle, sheep, goats, pigs, horses[3]	Not covered in APHA study	6 log reduction of vegetative cells (Byrne et al. 2006)	6 log reduction of *C. perfringens* spores 36 s at 110 degrees C. Considered sufficient by Byrne et al.2006 for a cooking protocol for pork luncheon roll that would inactivate *B. cereus* and *C. perfringens* vegetative cells and spores.	Lactic acid injected into pork achieved a 4–6-log CFU/g reduction of spore germination & outgrowth. Acetic acid into roast beef 6–7-log CFU/g reduction of spore germination and outgrowth (Talukdar, 2016). This means that spores are dormant, and could be reactivated when conditions become favourable.

[2] http://www.cfsph.iastate.edu/pdf/shic-factsheet-highly-pathogenic-prrsv,

[3] http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/animal-diseases/beef-and-dairy-cows/clostridial-diseases-of-livestock

African swine fever	ASF	Domesticated and wild pigs	Medium (1/2 years), entirely due to cross-contamination (Hayrapetyan, 2017)	Inactivation	Inactivation	Inactivated by heat treatment at 70°C for 30 minutes, so pH inactivation not required
Highly pathogenic - Porcine epidemic diarrhoea	HP-PED	Domesticated and wild pigs	Very Low (1/700 years)	Inactivation	Inactivation	Inactivated by heat treatment at 70°C for 30 minutes, so pH inactivation not required
Classical swine fever	CSF	Domesticated and wild pigs	Low (1/60 years), entirely due to cross-contamination (inferred given inactivation)	Inactivation	Inactivation	Inactivated by heat treatment at 70°C for 30 minutes, so pH inactivation not required
Aujeszky's disease	AD	Domesticated and wild pigs	Negligible	30 log reduction	Not available. Assumed Inactivation	Assumed not necessary given negligible risk.
Swine vesicular disease	SVD	Domesticated and wild pigs	Negligible	Inactivation	Inactivation	Assumed not necessary given negligible risk
Foot and mouth disease	FMD	Cattle, sheep, pigs, goats, deer, camelids	Low (1/60 years). See Hayrapetyan, 2017 for role of cross-contamination	5 log reduction	Inactivation	Quickly inactivated by pH <6.0 or >9.0 (OIE, 2013b) in a serum free medium. More research needs to be done on the impact of acidification on viruses in waste streams with

						complex composition.
Brucellosis	*Brucella* sp.	Cattle, camels, sheep, goats, other ruminants, pigs	Negligible	Inactivation	Inactivation	Assumed not necessary given negligible risk
Anthrax	*Bacillus anthracis* spores	Most mammals and several species of bird	Low 1/9 years	No effect	Bone meal no effect; significant reduction in milk. Assumed to be 3 log reduction average	Inactivated at pH 5 using peracetic acid (Whitney, 2003). Peracetic acid is used in the food industry.
		Chickens. Please note that chickens were not discussed in the expert meeting, but included here given they were part of the APHA study (Adkin, 2014)				
Fowl typhoid	*Salmonella* (*S.* Gallinarum)	Domestic and wild birds	Negligible	Inactivation may not occur in high-fat foods. Assumed to be 3 log reduction	Inactivation	Assumed not necessary given negligible risk
Highly pathogenic avian influenza	HP-AI	Mainly domestic and wild birds	Medium (1/3 years) due to cross-contamination (inferred given same risk regardless of heating step)	Inactivated in meat. 2-3 log reduction in egg products: Eggs should be cooked as per current legislation	Inactivation	Assumed not necessary given inactivation in meat and existing requirement for eggs to be fully cooked.

Newcastle disease	ND	Domestic and wild birds	Medium (1/6 years) due to cross-contamination (inferred given same risk regardless of heating step)	21 log reduction in meat. 4 log reduction in egg products	Inactivation	Assumed not necessary given 21 log reduction in meat and existing requirement for eggs to be fully cooked. Inactivated by acid pH ≤ 2 (OIE, 2013d)
		Other animal diseases not yet further researched and not affecting pigs or poultry				
Infectious pancreatis necrosis	IPN	Primarily trout and salmon	Medium (1/2 years)	Assumed to be 2 log reduction	25 log reduction	
Sheep pox and goat pox	SPP & GTP	Domestic and wild sheep and goats	Negligible	Not available. Assumed to be inactivated	Inactivation	Susceptible to highly alkaline or acid pH (hydrochloric or sulphuric acid at 2% for 15 minutes) (OIE, 2013e)
Enzootic bovine leucosis	EBL	Cattle	Negligible			