Netherlands Food and Consumer
Product Safety Authority
*Ministry of Economic Affairs*

# Food safety risks associated with the circular economy; insects as feed and changing flows in the feed chain

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# Introduction

More and more re-use of (former) waste, e.g.

- Former feedstuff as food for insects
- Non-edible plant parts no longer source for feed, but for protein or energy

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# Advice on the animal and public health risks of insects fed with former foodstuffs as feed ingredient

Office for Risk Assessment and Research

# Questions

- What are the risks of the use of insects fed on former foodstuffs as feed for farmed animals on animal and public health?
- How can these risks be controlled?

# Scope

- Chemical and microbiological risks specific for insects cultured on former food stuffs
- Black soldier fly larvae, house fly larvae, yellow mealworm, lesser mealworm
- Former foodstuffs of vegetable and animal origin
- Insect as feed ingredient for farmed animals

# Substantiation

- Risk assessment
- Control measures
- Uncertainties

# Former foodstuffs

are foodstuffs, other than catering reflux, which were manufactured for human consumption in full compliance with the EU food law but which are no longer intended for human consumption for practical or logistical reasons or due to problems of manufacturing or packaging defects or other defects and which do not present any health risks when used as feed.



*Source: EU Regulation No. 68/2013 on the Catalogue of feed materials*

# EU legislation on use of insects as feed for farmed animals (TSE[1] and ABP[2] Regulations)

- Insects are not allowed as feed for farmed animals (except for aquaculture)
- Former foodstuffs of animal origin (except dairy and eggs) are not allowed as feed for insects

[1]TSE: Transmissible spongiform encephalopathy

[2]ABP: Animal Byproducts

# Methodology RA

- **Hazard identification:** chemical and microbiological hazards that can occur in (former) food(stuffs)

- **Hazard characterisation:** increase or decrease of hazards in the substrate composed of former foodstuffs, increase or decrease of hazards in insects, transmission of hazards from the substrate to insects, infectivity of microbiological in insects, vector potential of microbiological hazards

- **Exposure assessment:** frequency and extent of occurrence of hazards in insects

These are the basis for the:

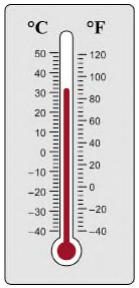
- **Risk characterisation:** estimation of the chemical and microbiological risks, including uncertainties, of the probability of occurrence of the hazards and severity of known or potential adverse health effects

# Production process insects

! **Chemical hazards:** veterinary medicines, pesticides, heavy metals, dioxins, polychlorinated biphenyls, polyaromatic hydrocarbons, mycotoxins.

! **Microbiological hazards:** micro-organisms and prions

**Former food stuffs** → **Substrate** → **INSECTS (vector)** → **Raw material for feed**




**Feed** → **Pet and fur animals**, **Farmed animals**, **Aqua-culture** → **Food**

# Risks and control measures

- **Chemical risks:** comparable to risks of (former) food (stuffs) and therefore negligible.
- **Microbiological risks:**
  Micro-organisms: negligible risks when end-product heat treated

  Prions: risks dependent on type of substrate and species of destination
- Substrate vegetable origin: no risk
- Substrate non-ruminant origin: risk negligible when species of destination is non-ruminant and does not coincide with species of destination (no intra-species recycling via passage in insects)
- Substrate ruminant origin: risk of propagation and amplification for prion diseases for all farmed animals

# Intra-species recycling

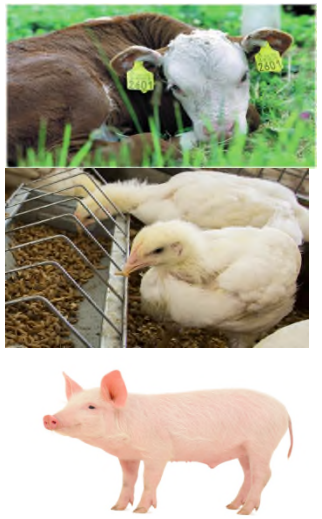
- Is a means whereby unusual infectious agents can accumulate and/or be amplified by virtue of the constant recycling in a susceptible species.

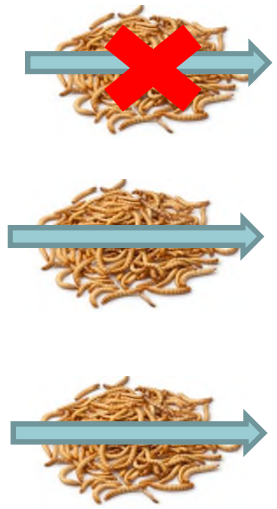
- Infectious agents can accumulate in animal populations by feeding back infected animals as former foodstuff to insects that are subsequently fed to animals of the same species.

- The probability of accumulation of infectious agents depends on the life span of the susceptible animal species, infectivity of the agent and the amount of infectious material that is fed back in an animal population

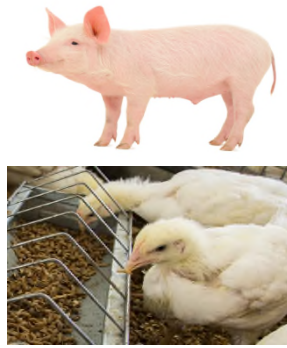
# Control measures prions

- Ban on ruminant proteins as feed for all farmed animals, including insects should be maintained
- Ban feeding non-ruminant proteins to insects can be lifted under the condition that the species fed to the insects is not the species receiving the insects as feed





All farmed animals



# Risk assessment of the production chain for animal feed in the Netherlands

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# Feed production chain

**7 partial production chains:**

- Fodder crops (grass, maize)
- Cereals and co-products
- Oilseeds and co-products
- Potato co-products
- Sugar crops co-products
- Fruit & vegetables co-products
- Feed additives and pre-mixes

**Feed type produced:**

On-Farm production and storage:
- Fodder and silage
- 16 Megatonnes/year

Industrial production:
- Compound feed
- 12 Megatonnes/year

On-Farm production:
- Compound feed
- 7 Megatonnes/year

# Purpose of the production chain risk assessment

## Advise to the Inspector General of the NVWA:

- Assessment of the risks in the animal feed production chain;
- With respect to social values within the remit of the NVWA
- To provide information for strengthening the risk-based supervision by the NVWA in the animal feed production chain

# Framework for the risk assessment (1)

## Hazards

- Chemical hazards (e.g. mycotoxins)
- Physical hazards (e.g. metal parts in silage)
- Microbiological hazards (e.g. salmonella)
- Regulated plant pests (e.g. *Popillia japonica*)

## Social values within the remit of NVWA

- Animal health
- Food safety
- Plant health

# Framework for the risk assessment (2)

## Risk assessment steps:

- Hazard identification
- Hazard characterization
- Exposure assessment
- Risk characterization

## Performed for:

- Relevant segments of each partial production chain, industrial production processes and on-farm processes for compound feed production
- All identified hazards
- The social values within the remit of NVWA

# Scope of the risk assessment

- Feed for food-producing farm animals
- Feed components of plant origin
- Operators registered in the Netherlands
- Including operators for transport, storage and handling
- Imported materials are assessed from the moment of entry into EU and subsequent processing

- Under current EU legislation
- Under current private quality systems (e.g. GMP+)

# Highlights (1)

- Legislation, official control and private quality management are effective in managing risks of heavy metals, pesticides and pharmaceuticals in feed ingredients.

- Intensive and continuous monitoring is required to manage risks of mycotoxins and plant toxins in feed ingredients.
- Uncertainty exists for the presence of dioxins, perfluorinated compounds and botanical in feed ingredients.
- Uncertainty exists about the correct application of antibiotics in on-farm produced compound feed, increasing the risk of antibiotic microbial resistance
- The micro-organisms *Listeria monocytogenes*, *Salmonella* spp., STEC and *Toxoplasma gondii,* when present in feed ingredients, pose a risk for food safety.

# Highlights (2)

- In the circular economy, co-products currently used for animal feed may be used for different processes with higher valorization such as energy or protein refinery. Replacement in feed by other co-products in feed from different markets or different origins may pose unknown risks.
- Tracking & tracing and quality management in the Netherlands feed production chain is generally good. However, the fate of material rejected for feed purposes is not well recorded. In combination with the high turnover rate of feed materials, and storage facilities handling both feed material and fermentation material, a risk of re-entry of hazardous materials in the feed chain occurs.