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Identifying and describing risk
pathways in a risk assessment



**Regional training course (Africa)
Import risk analysis for African swine fever
9 November – 14 December 2021**



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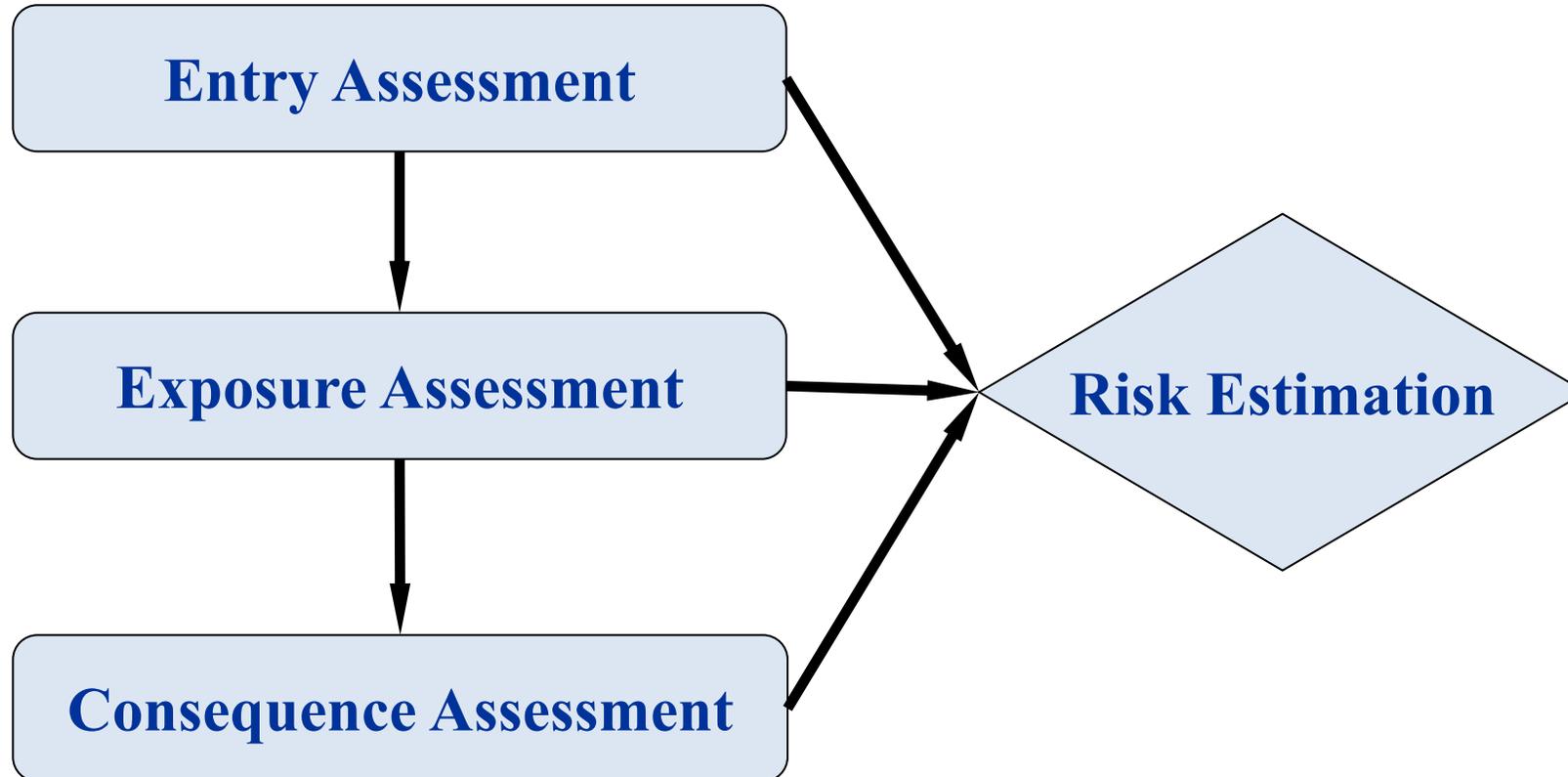
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Topics for discussion

- Identifying and describing risk pathways using scenario trees
- Examples scenario trees for PRRS and African Horse Sickness virus

A reminder: a risk assessment consists of four inter-related steps



Prior to embarking on the risk assessment, it is important to ...

- identify potentially susceptible species
 - ensures that all the appropriate risk (biological) pathways are considered in the risk assessment
 - include terrestrial and aquatic animals that are reared on farm or in captivity or are in the wild, as well as humans if the hazard has zoonotic potential
- map out the risk pathways that could lead to susceptible species being exposed to a hazard and the associated outbreak scenarios that could arise

To help with identifying risk pathways leading to ...

- the commodity harbouring the hazard when imported
- susceptible animals and/or humans being exposed
- potential “outbreak” scenarios
- it can be helpful to draw a scenario tree*

* Also known as probability or event trees

A scenario tree is a graphical depiction of the risk pathways ...

... that provides a useful conceptual framework to

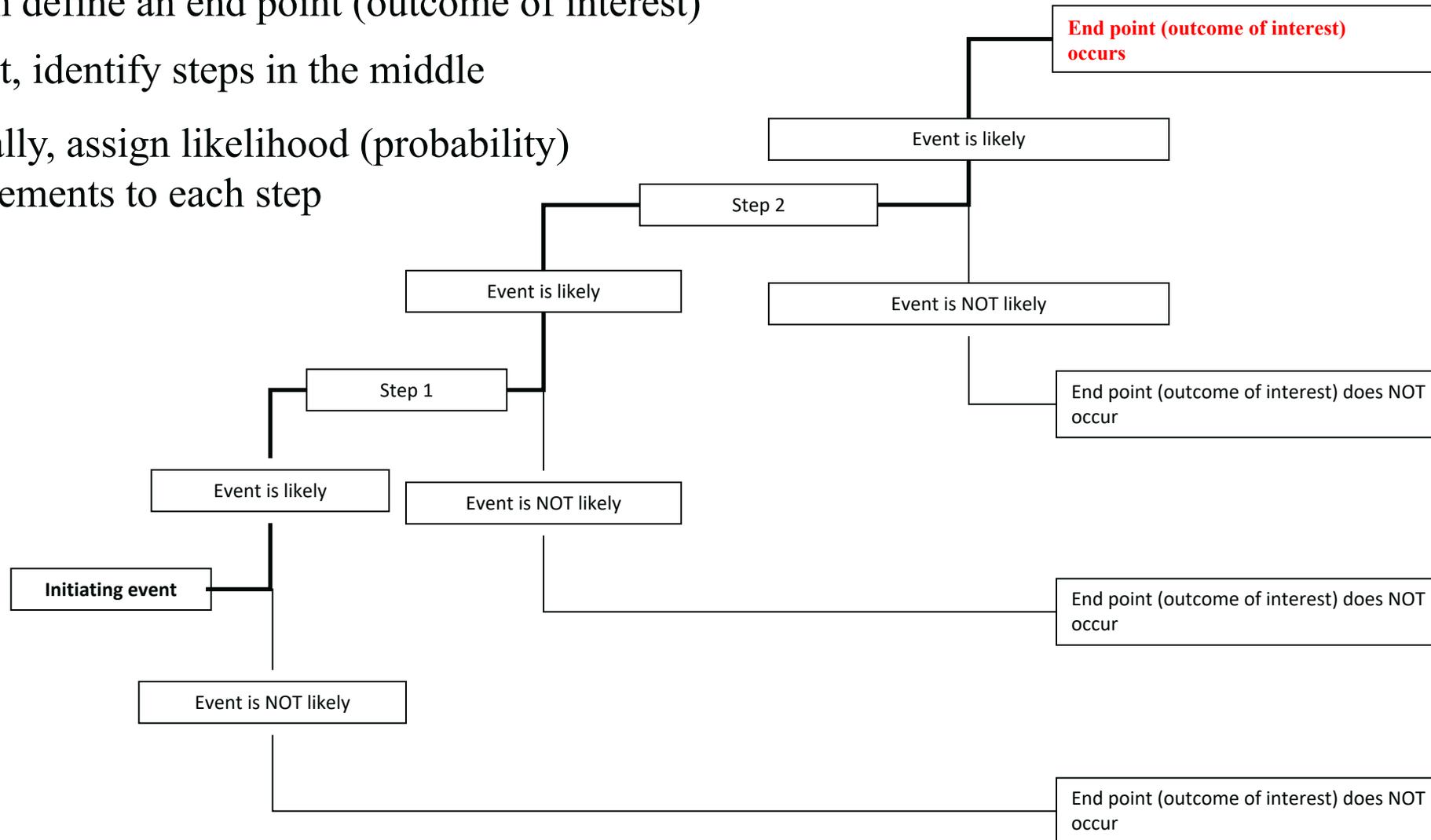
- identify and convey the range and types of pathways considered in a simple, transparent and meaningful fashion
- identify information requirements
- clarify ideas and understanding of the problem
- ensure a logical chain of events in space and time
- assist with identifying sanitary measures
- underpin the framework for a quantitative model and ensure the correct probability estimate is calculated
- assist with communicating the structure and results of a risk analysis

It is important to note that the risk pathways ...

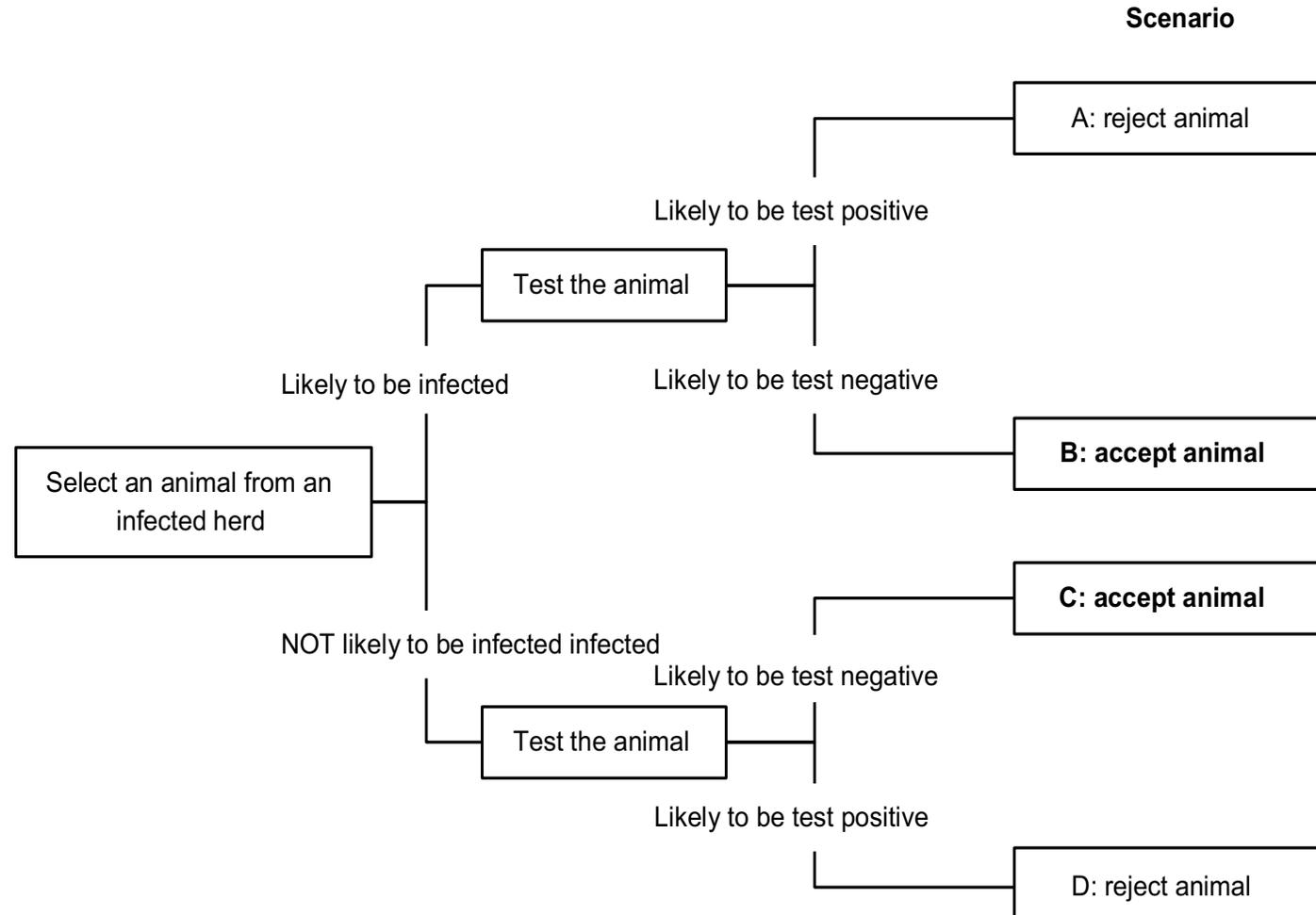
- must be plausible
- some pathways may be hypothetical rather than plausible
 - it is not appropriate to consider such pathways in a risk assessment

A scenario tree starts with an initiating event ...

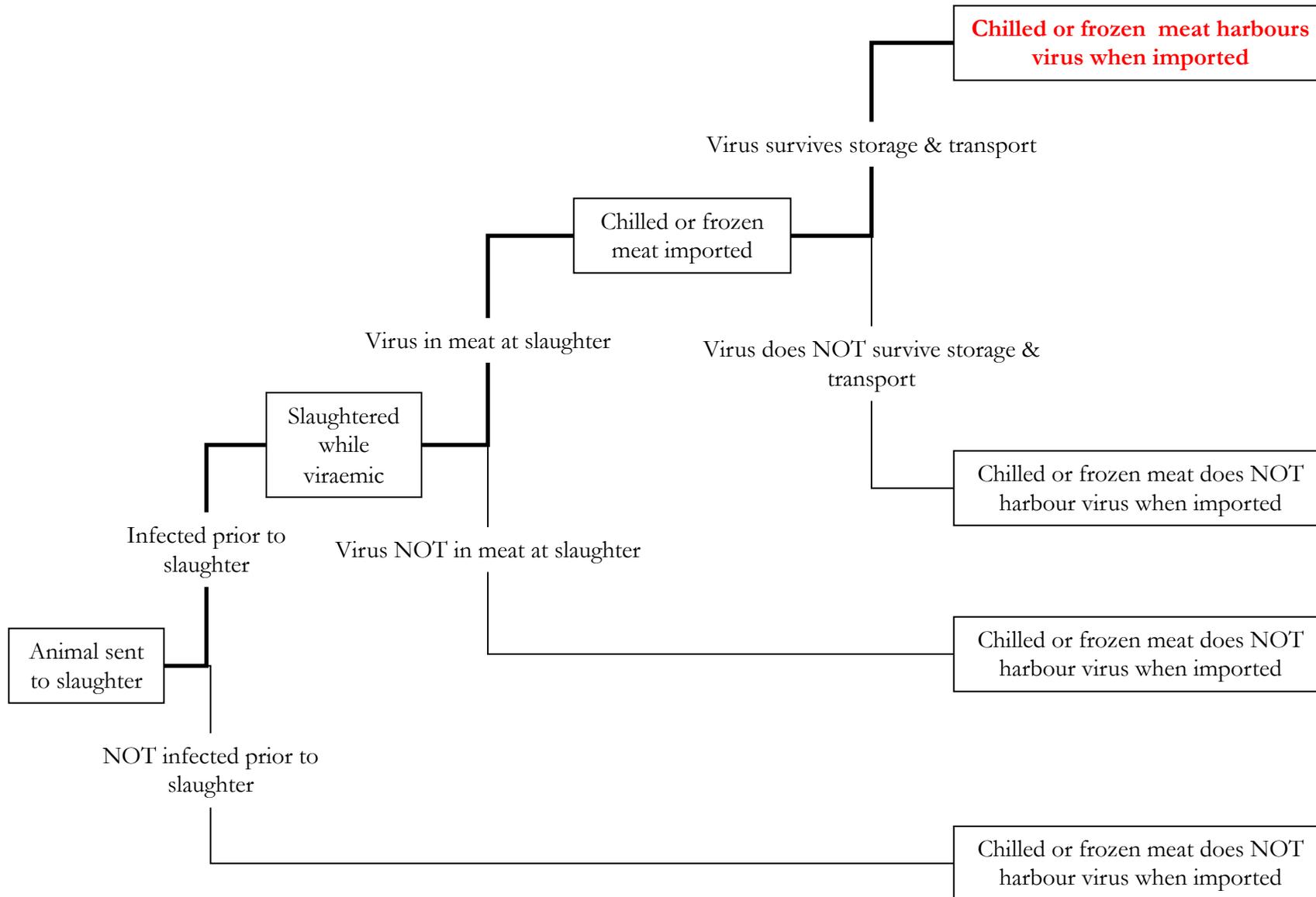
- then define an end point (outcome of interest)
- next, identify steps in the middle
- finally, assign likelihood (probability) statements to each step

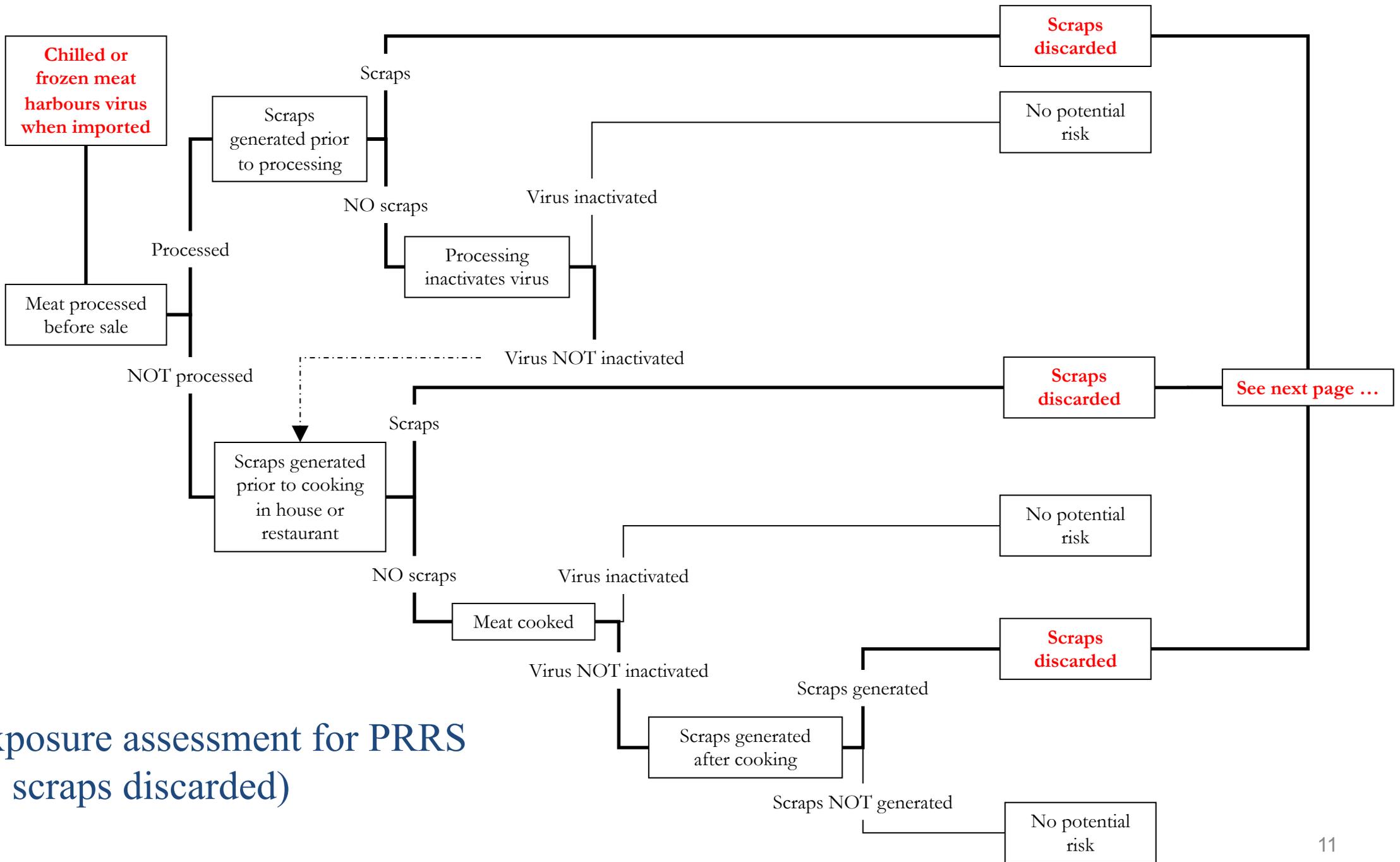


A scenario tree outlining the biological pathways leading to an animal, selected from an infected herd, being either accepted or rejected after it has been tested



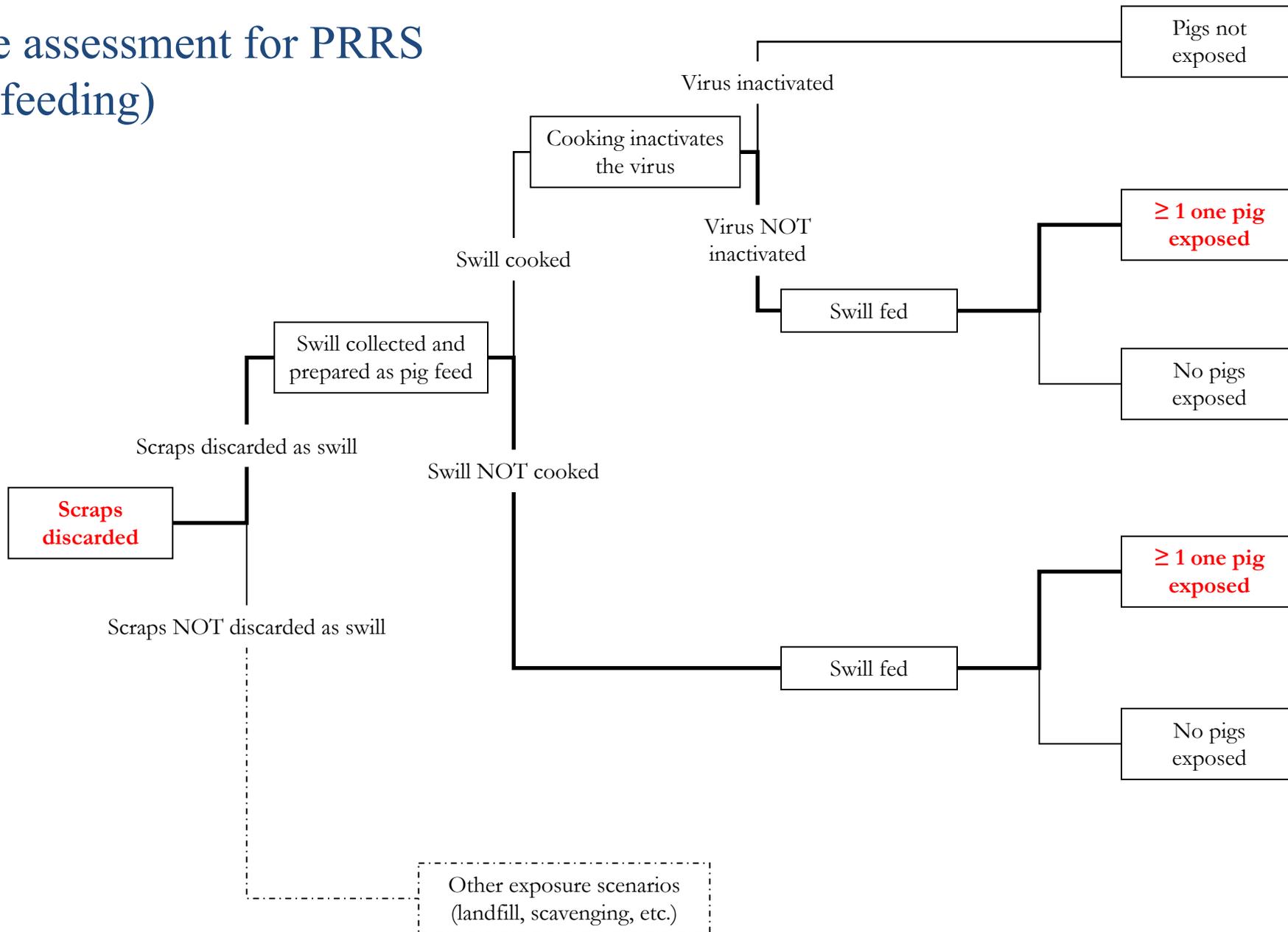
Entry assessment for PRRS virus



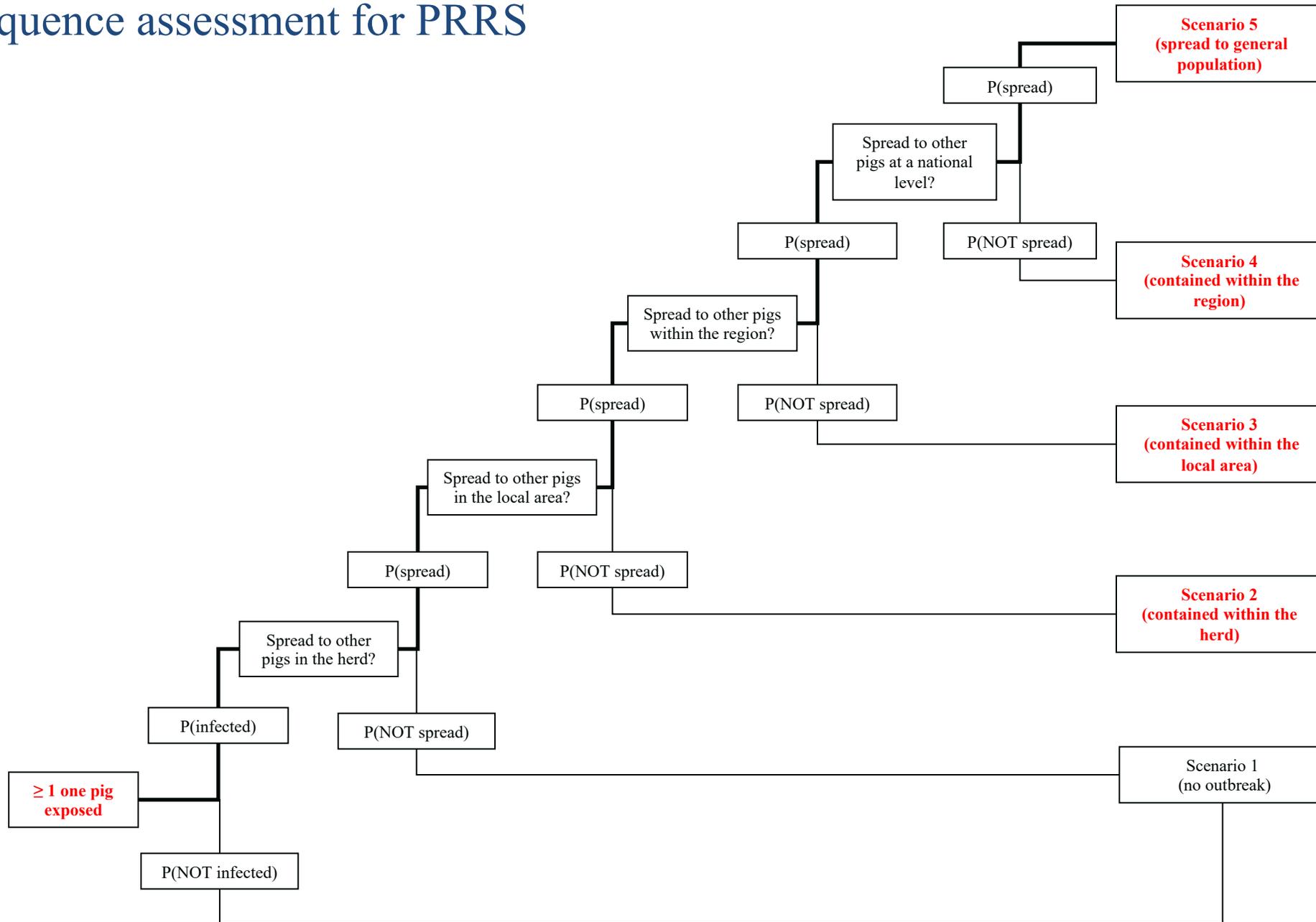


Exposure assessment for PRRS
(a. scraps discarded)

Exposure assessment for PRRS (b. swill feeding)



Consequence assessment for PRRS



Example of a risk analysis: African Horse Sickness (AHS)*

- Title
 - Live domestic horses (*Equus caballus*) imported from a country or zone in Southern Africa where African Horse Sickness is endemic
- Purpose
 - to assess the likelihood of African Horse Sickness virus (Family *Reoviridae* Genus *Orbivirus* African Horse Sickness viruses 1 to 10) spreading or becoming established in New Zealand and its likely consequences as a result of importing live domestic horses (*Equus caballus*)
 - to recommend sanitary measures if appropriate

* Reference: OIE Handbook on Import Risk Analysis for Animals and Animal Products. Volume 1. Introduction and Qualitative Analysis, 2010

Hazard identification (1)

- pathogenic agent
 - African horse sickness virus (Family *Reoviridae* Genus *Orbivirus* African horse sickness viruses 1 to 10)
 - OIE Listed disease of equine animals
 - not zoonotic
- New Zealand's status
 - exotic

Hazard identification (2)

- epidemiology
 - infectious, non-contagious, seasonal viral disease of Solipeds transmitted by *Culicoides* midges
 - domestic horses are usually accidental hosts with a high mortality rate
 - a mild non-lethal form “Horse sickness fever” may develop in some animals
 - viraemia from field or vaccine virus may last up to 21 days
 - horses that recover develop a sterile immunity

Hazard identification (3)

- conclusion

- recently infected, mildly affected or vaccinated animals are potentially capable of harbouring AHS virus

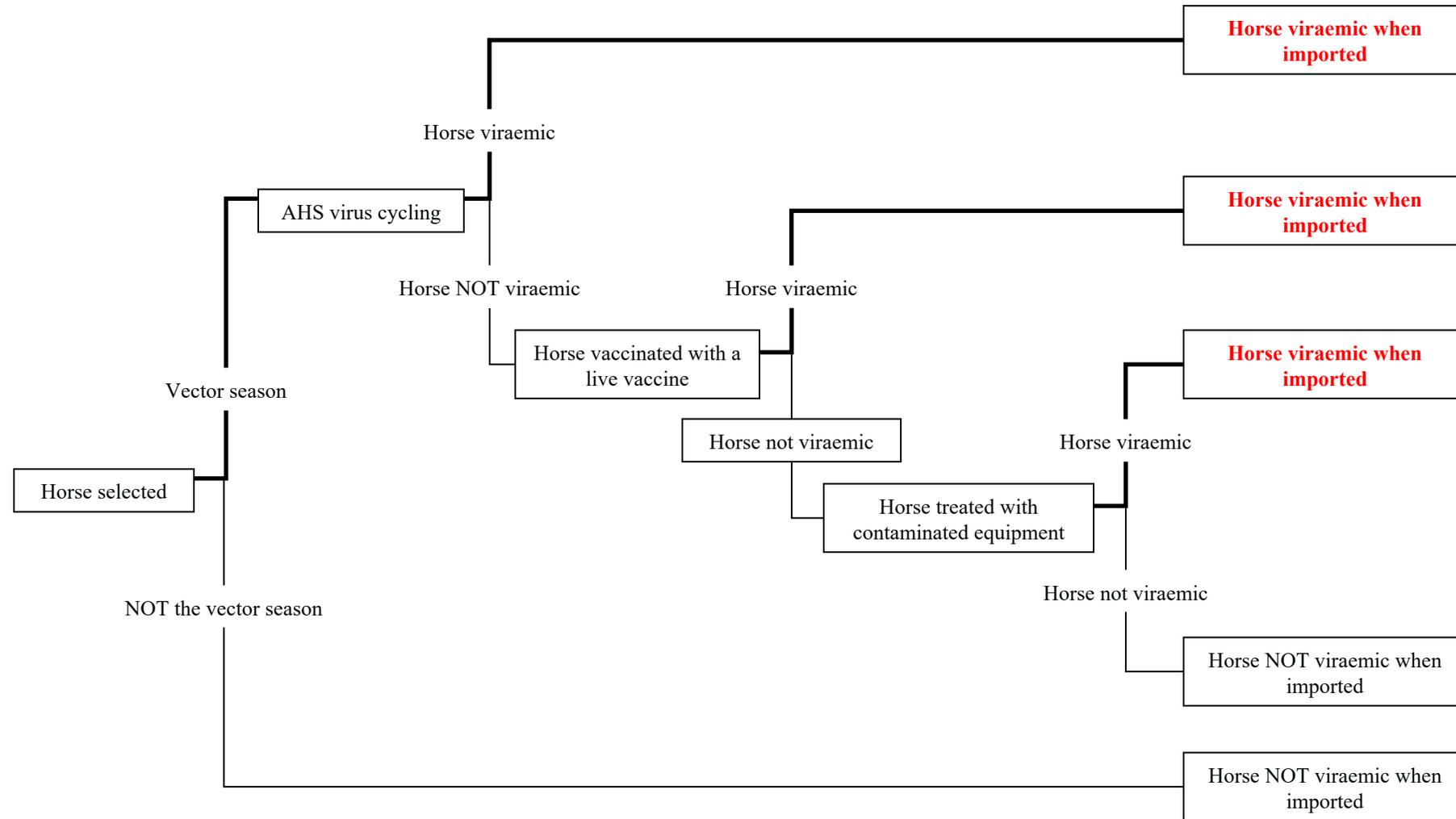
therefore

- AHS virus is classified as a hazard for further consideration in a risk assessment

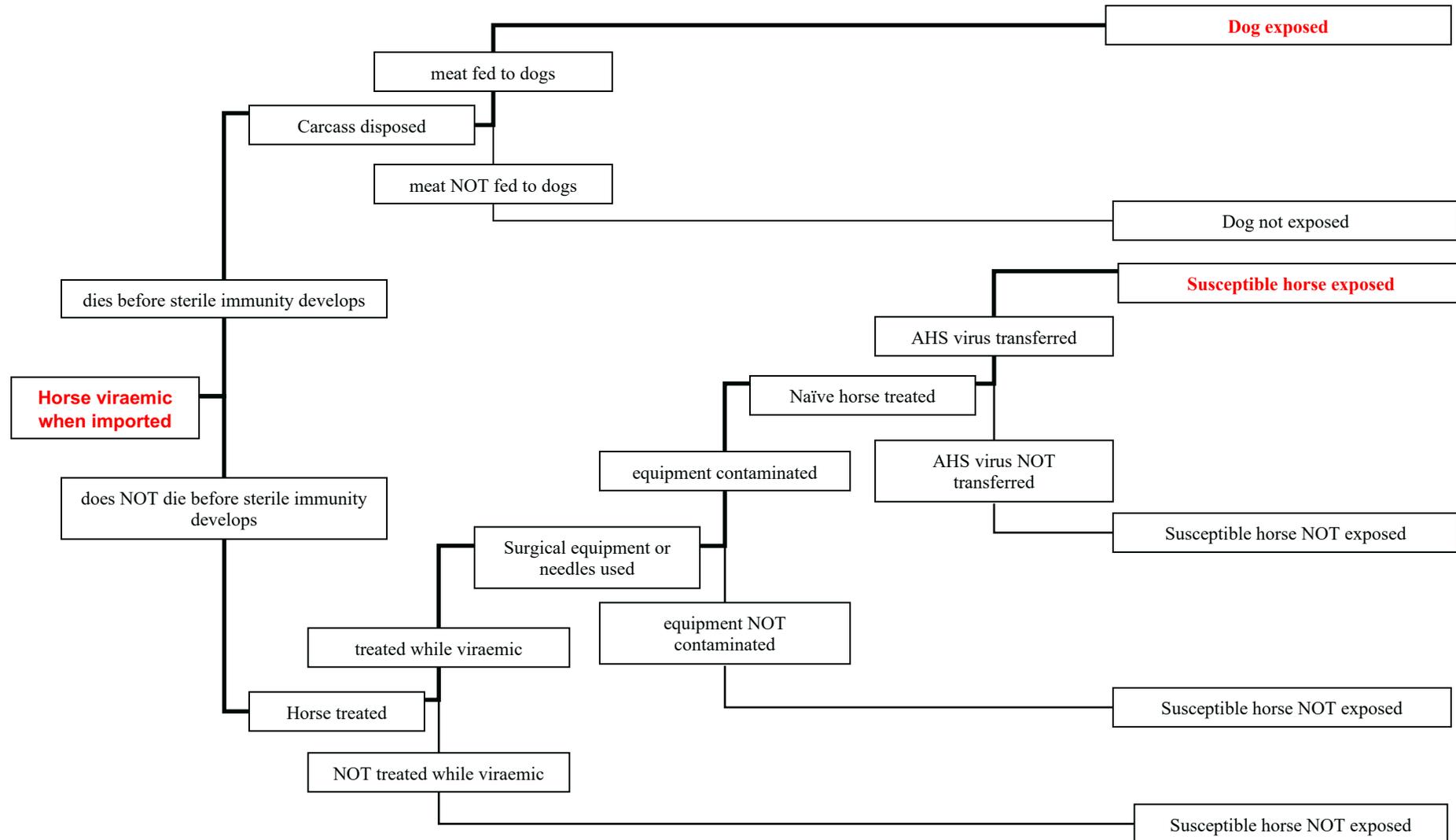
Although the *Code* provides sanitary measures for African Horse Sickness virus ...

... for the purposes of continuing with the worked example, it will be assumed that domestic legislation in New Zealand requires that a complete risk analysis be undertaken

Risk pathways for the entry assessment of AHS virus into New Zealand



Risk pathways for the exposure of susceptible animals to AHS virus in New Zealand



Exposure assessment for AHS virus (1)

- Summary of the relevant risk factors
 - AHS has never established outside Africa despite several short-term outbreaks in the Middle East and Iberian peninsula
 - potential vectors do not exist in New Zealand
 - horses and dogs are the only susceptible species in New Zealand
 - readily transmitted iatrogenically
 - an imported infected animal would only be viraemic for a short period
 - limited opportunities for exposure through
 - iatrogenic transmission
 - ingestion of horse meat
 - coitus or artificial insemination

Exposure assessment for AHS virus (2)

Exposure pathway	Likelihood	Explanation
Insect vectors	Negligible*	Competent vectors do not exist in New Zealand
Iatrogenic	Very low	Needle sharing etc. not common
Meat fed to dogs	Very low	Practice of feeding horsemeat to dogs not common
Semen	Negligible*	Stallions would not be used for several weeks after importation

*As the likelihood of this scenario is negligible, it is not considered any further in the risk assessment.

Identify potential outbreak scenarios ...

- disease does not spread within the exposed population
- disease spreads within the exposed population, but is quickly identified and eradicated
- disease establishes within the exposed population and spreads to other populations before eventually being eradicated
- disease establishes within the exposed population, spreads to other populations and becomes endemic

Estimate the likelihood of each outbreak scenario and ...

- the likely magnitude of the associated consequences at various levels
 - farm or village
 - district
 - regional
 - state
 - national

Potential outbreak scenarios associated with horses for AHS virus...

1. no spread within the stable
2. spreads within the stable
3. spreads locally to other horses
4. spreads further to other horses within a region
5. spreads to horses at a national level

Likelihood of each scenario in New Zealand

- low likelihood of a short term, limited spread to a very small number of animals within a stable or locally
- negligible likelihood of spreading to horses regionally or nationally

Likely magnitude of consequences in New Zealand

- negligible environmental consequences at any level
- severe biological consequences for individually infected animals
- costs of any investigation and control program likely to be minimal and restricted to a stable/local level
- negligible economic consequences at a regional or national level

Risk estimation for AHS virus in New Zealand

- summarises the results and/or conclusions from the entry, exposure and consequence assessments
- a prerequisite step to risk management that determines whether or not sanitary measures may be warranted

Entry assessment

- Is the likelihood negligible that the commodity is carrying the hazard when it is imported?
 - The likelihood of a horse harbouring AHS virus if it is imported into New Zealand from an endemic area in Africa in the summer and autumn months is low.

Exposure assessment

- Is the likelihood negligible of susceptible animals and/or humans being exposed via each and every exposure pathway?
 - The likelihood of susceptible animals (horses or dogs) being exposed to AHS virus in New Zealand by pathways involving
 - insect vectors or semen is negligible
 - contaminated surgical equipment, needles etc. or the oral ingestion of contaminated horse meat is very low.

Consequence assessment

- Is the likelihood of each and every significant biological, environmental or economic consequence for New Zealand negligible?
 - negligible environmental consequences at any level
 - negligible economic consequences at a regional or national level
 - while the likelihood of one or a few animals becoming infected is low, it is highly likely that the biological consequences for these animals would be high

Overall risk estimate for New Zealand

- There is a negligible risk of AHS virus becoming established.
- The likelihood of AHS virus being introduced in imported horses and spreading to susceptible animals is very low. However, there is a moderate to high likelihood of severe consequences arising for those animals that become infected, particularly if affected by the pulmonary, cardiac or mixed form of the disease.
- As a result, the overall risk estimate for AHS virus is greater than negligible and risk management measures can be justified.



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