



Import Risk Analysis: PRRS virus in pig meat

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Background (1)

- Until 2001, pig meat was imported into NZ without sanitary measures for PRRS
- ~14,000 tonnes imported per year (now ~20,000)
 - 30-35% of total consumption
- >95% frozen
- >90% from Australia & Nth America

Background (2)

- Sep 2001 a new report was brought to MAF's attention by the NZ pig industry
- Lelystad report (Steverink, 2000) commissioned by Australian Government
 - Oral transmission possible by meat
- MAF imposed temporary measures (cooking)
- MAF obliged to complete a full risk analysis

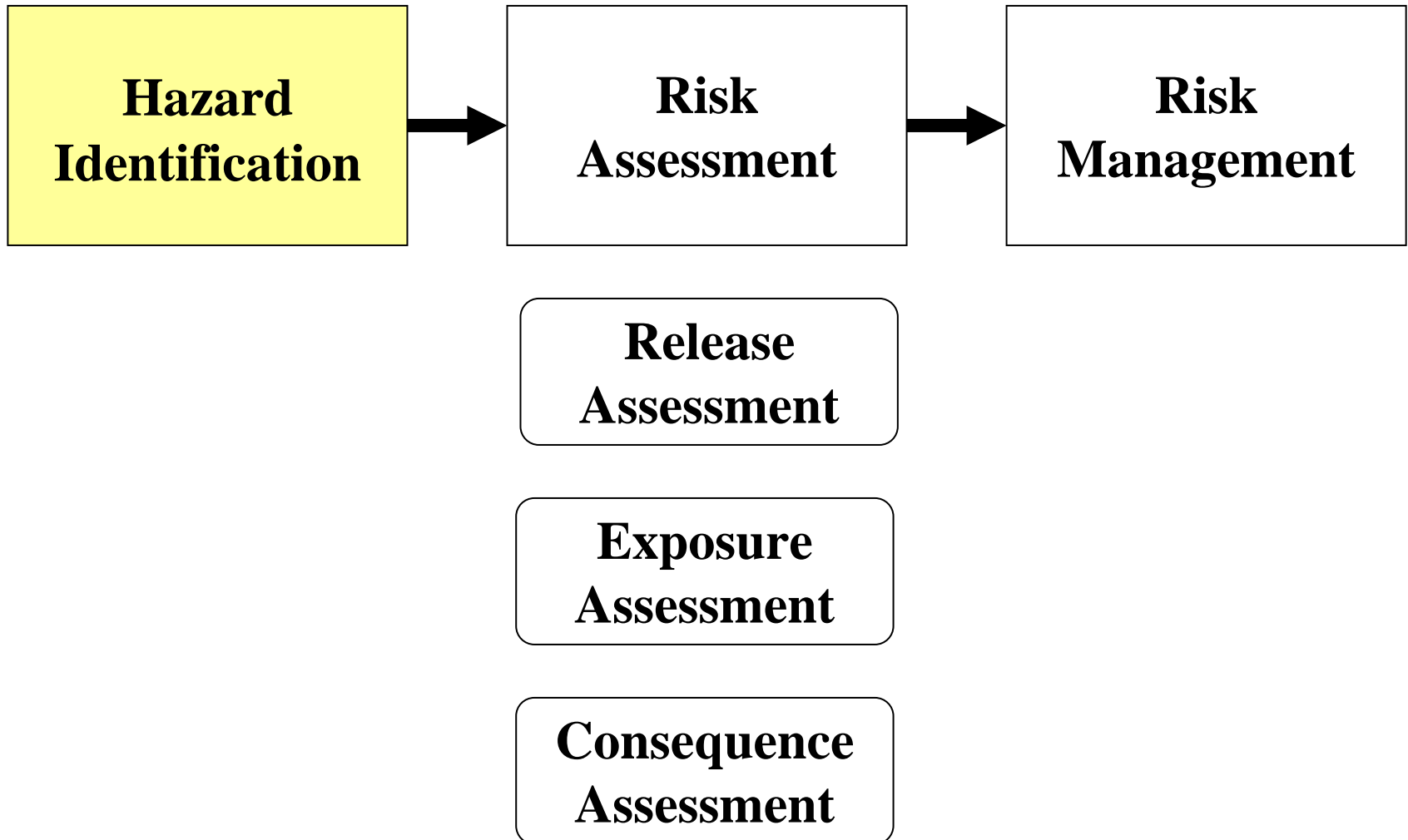
The MAF risk analysis process

- First draft
 - Internal review
 - Redrafting
 - External review
 - Finalise RA document
 - Public consultation
 - Review of submissions
- 3 months
 - 1 month
 - 1 month
 - 2-3 months
 - 1 month
 - 2 months
 - variable

PRRS Risk Analysis : commodity definition

- Fresh or frozen pig meat
 - Any part of the pig apart from offal and hair
 - Includes muscle, skin, bone, lymphoid tissues, oropharyngeal tissues, head

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Hazard identification

- Is the organism likely to be associated with the commodity?
- Consider the nature of the organism, and how it is spread
- Conclusion – the organism is/isn't considered to be a potential hazard

PRRS virus (1)

- ss RNA virus, genus Arterivirus, family Arteriviridae
- With: equine arteritis virus, lactate dehydrogenase-elevating virus, simian haemorrhagic fever virus
- Restricted host range (PRRS infects only pigs)
- High mutation rate
- Isolates vary considerably genetically and in pathogenicity
- Nth American and European groups appear to be significantly different

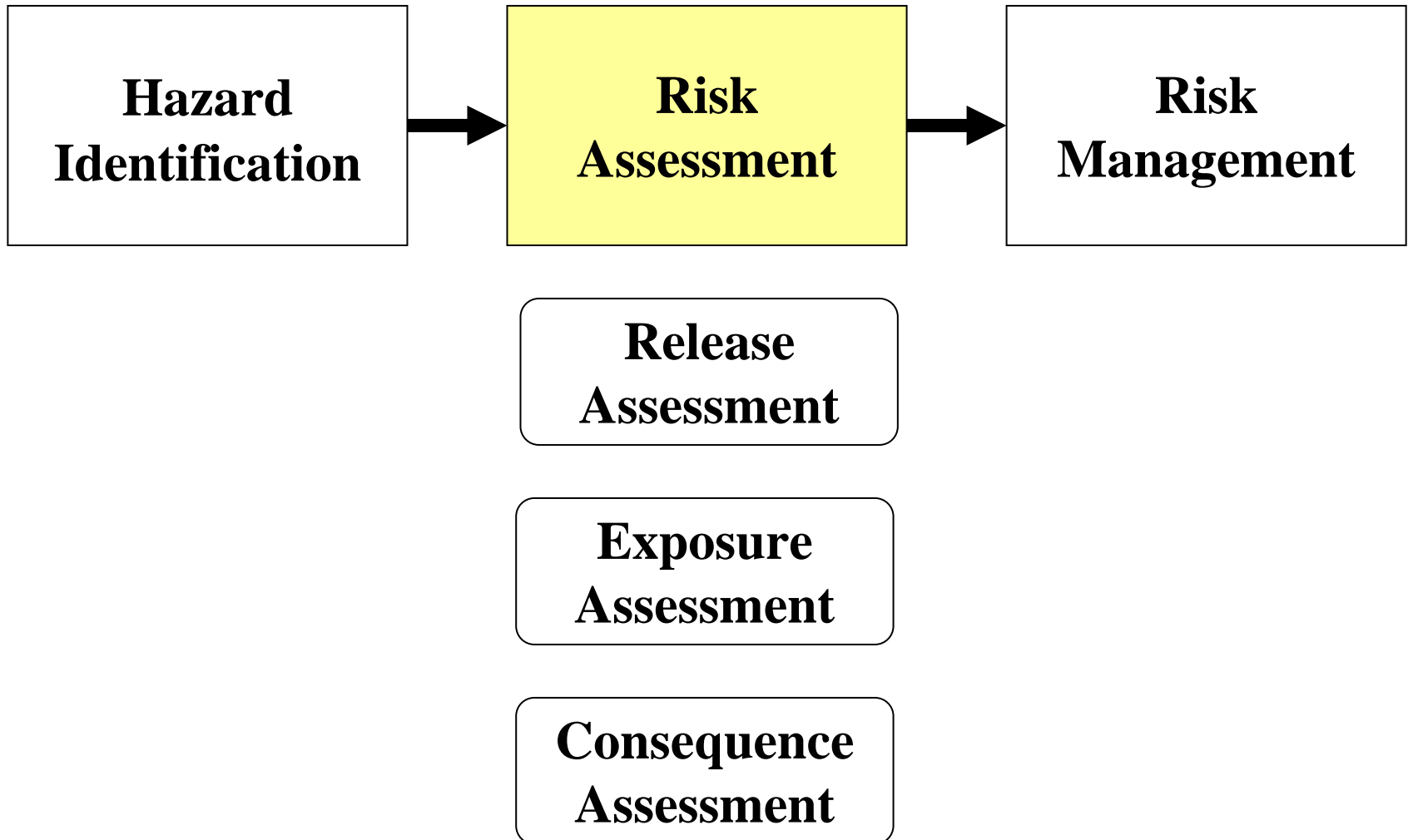
PRRS virus (2)

- Respiratory and reproductive disease
- Macrophages are primary target cells
- Transmission
 - horizontal (respiratory, contact)
 - vertical (semen)
- Stable at pH 6.0 to 7.5
- Inactivated in 6-20 minutes at 56°C (i.e. by cooking)

Hazard identification conclusion

- Transmission of PRRS is primarily by contact between infected and susceptible animals, and by semen from infected boars
- Until the release of the Lelystad report in 2000, PRRS was generally considered *not* to be a potential hazard in pigmeat
- This was challenged as a result of the Lelystad report's conclusions

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Release Assessment

Exposure Assessment

Consequence Assessment

What is the likelihood that the imported commodities harbour the organism?

Release assessment (1)

- MAF completed first version in Dec 2001
- Quantitative model :
 - 26% chance in oropharyngeal tissues,
 - 0.3% chance in meat
- Conclusion likelihood of release was non-negligible in slaughter-age pigs
- External technical review 2002
- Significant opposition from abroad
 - especially for reliance on Lelystad report (unpublished, not taken seriously)

Lelystad study (1)

- 24 pigs artificially infected (intranasally)
- Slaughtered at 11 dpi
- Meat samples taken
- 2 / 24 pos by virus isolation
 - Limit to detection: $10^{1.8}$ TCID₅₀ per g meat
- 23 / 24 pos by PCR

Lelystad study (2)

- Meat from 24 pigs fed to 2 recipient pigs each (48 recipients)
 - Each recipient ate 500g meat (250g /d, 2 days)
- 24 / 48 viraemic at 3 days
- 48 / 48 viraemic at 6 days (some horizontally?)
- Published 2003 (van der Linden et al)

Canadian study (1)

- Apparently designed to challenge Lelystad results
- Work began mid 2002
- 1027 meat samples at random from pigs at slaughter (2 plants in Canada)
- 1 / 1027 pos by virus isolation
- 19 / 1027 (1.85%) pos by PCR

Canadian study (2)

- Meat from 11 PCR pos pigs fed to recipients
- Viraemia in 7 / 11 recipient pairs
- Amount fed was variable
 - 500 to 900 g / recipient over 2 days
- Conclusion: 1.2% of pigs at slaughter have enough virus in meat for transmission by this route
- Published 2004 (Magar & Laroche)

Release assessment conclusion

- More work required on infectious dose
 - How much meat must be fed to cause infection?
- Virus isolation has limited sensitivity
- PCR results probably over-estimate
- If enough raw meat is fed, infection by the oral route is possible

Infectious dose?

- Hermann et al (2005)
estimated PRRS dose -
response relationship by oral
routes (in TCID₅₀)
- Oral exposure requires much
higher doses than by
parenteral route (LDHEV in
mice)

P(infection)	TCID ₅₀
0.01	10 ^{1.7}
0.10	10 ^{3.6}
0.20	10 ^{4.2}
0.25	10 ^{4.4}
0.30	10 ^{4.6}
0.40	10 ^{5.0}
0.50	10 ^{5.3}
0.60	10 ^{5.6}
0.70	10 ^{5.7}
0.75	10 ^{6.1}
0.80	10 ^{6.4}
0.90	10 ^{7.0}
0.99	10 ^{8.9}

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**Release
Assessment**

**Exposure
Assessment**

**Consequence
Assessment**

**How would
susceptible species
be exposed to the
organism if it were
introduced in the
commodities?**

Likelihood of exposure

- PRRSv inactivated by cooking
- Raw meat scraps must be fed to pigs
- Garbage may contain uncooked pig meat
 - Households, retailers, restaurants
 - No information on likelihood / scrap size
- But feeding of any raw meat to pigs is illegal
- Non-compliance most likely in backyard pigs or marginal semi-commercial units

The OIE Risk Analysis Framework



**Release
Assessment**

**Exposure
Assessment**

**Consequence
Assessment**

**What
consequences
would arise from
introduction and
exposure?**

Consequences (1): backyard herds

- Infection may go undetected
 - Especially in small groups of fatteners
- Epidemic fadeout likely in small breeder units
- Spread to other herds unlikely unless there was movement of infected animals or semen
- Likelihood of airborne spread negligible

Role of airborne spread ?

- Early 1990s : assumed responsible for much of “area spread” up to 3km
 - Role of long-term carriers not understood
- Mid 1990s : speculation abated – still thought possible over 2-3km
- Late 1990s : experiments to test the hypothesis
 - Very difficult to demonstrate even over short distances involving high doses virus
- 2006 : general agreement that biosecurity is much more important
 - Airborne spread probably a rare event under field conditions, if it occurs at all

Consequences (2): commercial herds

- Variable, depending on
 - Strain of virus
 - Immune status of herd
 - Intercurrent disease
 - Management factors
- May be serious in epidemic period
 - Breeder units – abortions, stillbirths, piglet mortality
- Infection likely to be widespread if AI centres become infected

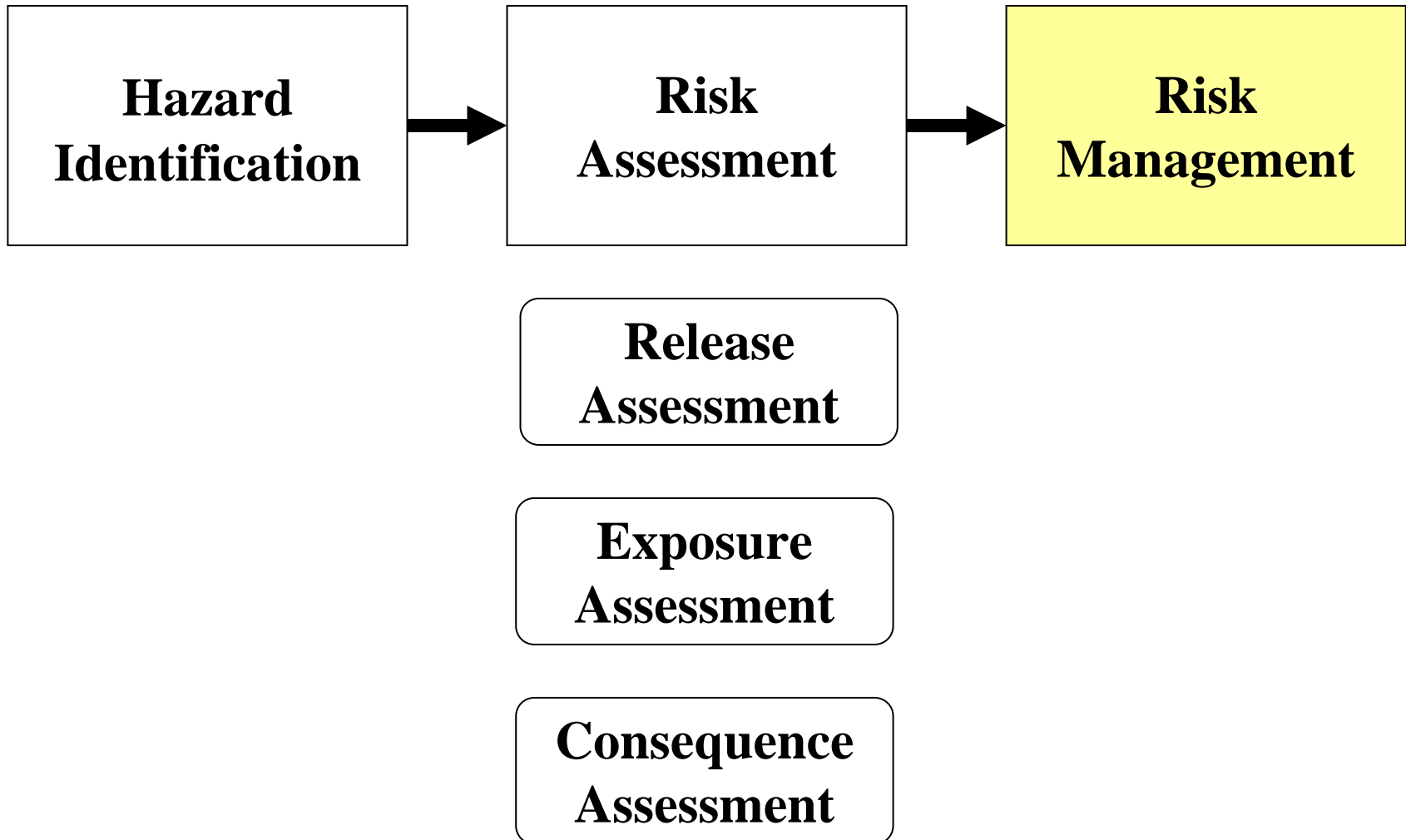
Consequences (3): other effects

- Human Health- PRRSv infects only pigs – no human health issues
- Environment – unlikely to be maintained in feral pigs, not other possible effects
- Economy – no export market to lose, the virus is everywhere except Aus/NZ, main pig producing countries do not consider meat to be a vehicle, consumer benefits from cheaper imported pork

Risk assessment conclusion

- The risk is non-negligible
- Risk management is warranted

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Risk management

- No OIE standards for PRRS
- Options
 - Reduce likelihood of release
 - Removal of high risk tissues (lymphoid)
 - “Stabilised herds”
 - Treatments (e.g. cooking)
 - Reduce likelihood of exposure
 - “High value cuts”

Recommended measures

- Country freedom
- Cooking (status quo)
- Consumer ready high value cuts
 - Lymphoid tissues largely removed
 - Likelihood of raw scraps generated is low

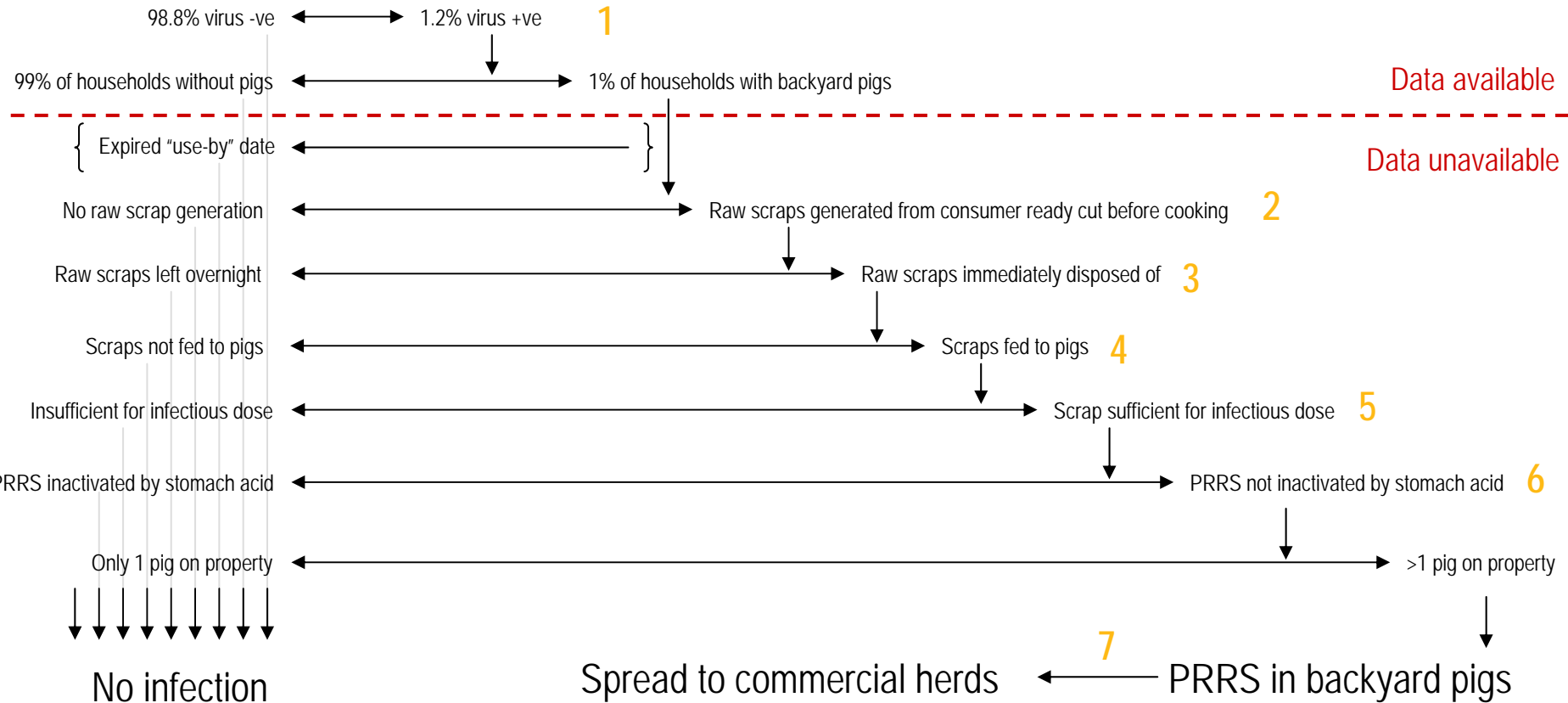
Peer review

Scott Dee	University of Minnesota	USA
Jeff Zimmerman	Iowa State University	USA
Colin Wilks	University of Melbourne	Australia
Lis Alban	Veterinary Epidemiologist Danske Slagterier	Denmark
Torben Grubbe	Veterinary & Food Administration	Denmark
Noel Murray	Risk Analyst	Canada
Spiridon Doudounakis	Ministry of Agriculture	Greece

Public consultation

- Final RA document released July 2006 (~70 pages)
- 44 submissions (~270 pages)
 - Strong opposition to imports of fresh meat from
 - NZ pig farmers (26)
 - NZ farmers organisations (4)
 - NZ pig veterinarians (5)
 - Strong opposition to any measures for meat
 - Overseas trading partners (7)
 - Generally in favour of recommended measures
 - NZ pork importers/processors (2)
- Review of submissions June 2007 (~330 pages)
 - Further round of expert technical review on points in PIB submission
 - No change to recommendations

“Cascade of risk reduction” and key points discussed in the review of submissions



Conclusions

- MAF conducted the risk analysis following standard processes and procedures
- Best available scientific information was used
 - Information gaps (infectious dose)
- External review by recognised international experts
- Significant differences in opinions on the level of risk
- Risk acceptability remains a contentious issue
- Role for CBA to determine optimal level of regulation?

Thank you

