AFRICAN SWINE FEVER, ANIMAL DISEASES, AND THE IMPORTANCE OF FEED SAFETY

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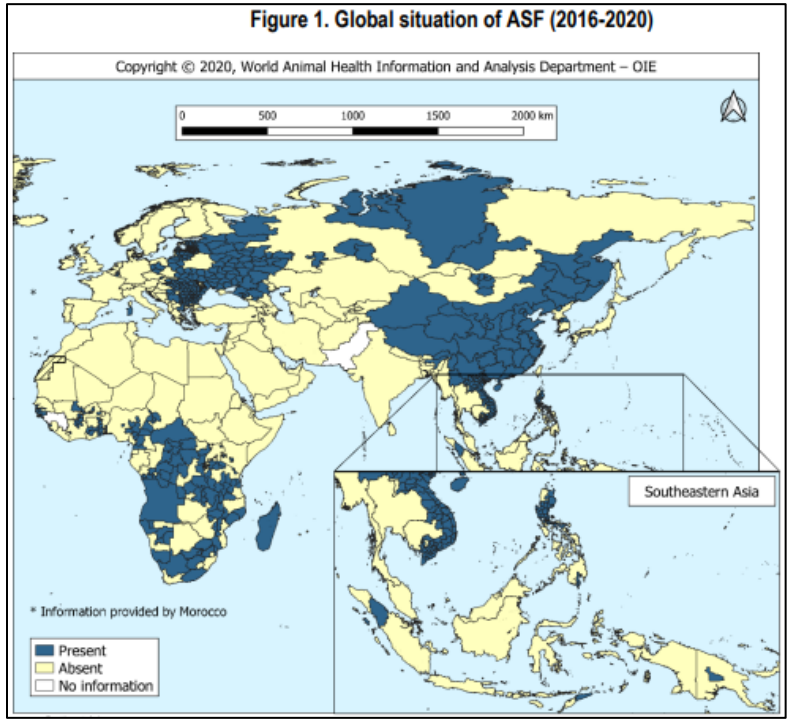
2021 DGTC Symposium

K·STATE Research and Extension

African swine fever virus (ASFV)

- Highly contagious virus affecting domestic and wild pigs
- Varying degrees of sickness/mortality
  - Fever, loss of appetite, red, blotchy skin, others
- Circulated in Africa, Europe, Asia for many years
- **<u>Huge impacts on global trade</u>**



Too close to home…

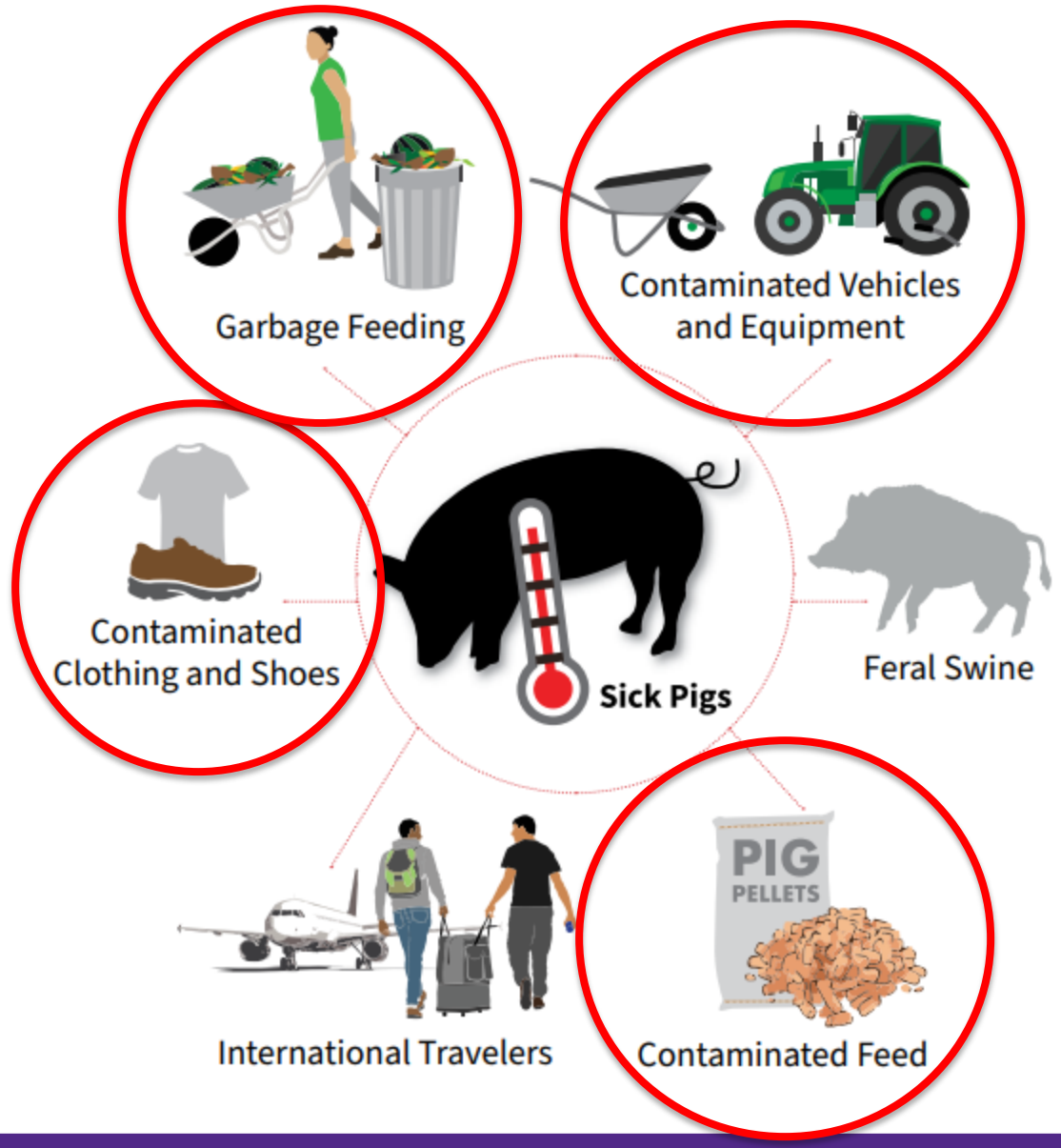
- ASFV diagnosed in D.R. in late July 2021
  - First time in western hemisphere since early 1980's
- Control strategy will largely involve depopulation of affected pigs.

USDA Statement on Confirmation of African Swine Fever in the Dominican Republic

Published: Jul 28, 2021

Print

Source: freeworldmaps.net; USDA



What potential routes are directly involved with the feed supply?

Source: USDA APHIS

Pathogens with potential transmission via feed

- Prions
  - Bovine spongiform encephalopathy and other TSE
- Bacteria
  - *Salmonella* spp.
  - *Listeria monocytogenes*
- Viruses
  - Porcine epidemic diarrhea virus
  - African swine fever virus
  - Foot and mouth disease
- Other agents, such as fungi, protozoa, worms

Addressing Feed Safety

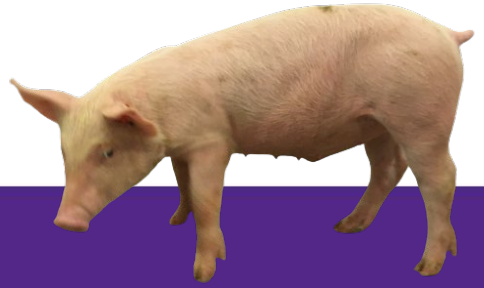
1. Is it likely to get contaminated?

2. Can it survive?

3. Is it infectious?

Prevention

Intervention



1. Is it likely to get contaminated?

- Risk of contamination depends on:
  - Geographical considerations
    - Countries/regions with active disease outbreaks
    - Location of pigs with disease relative to location of ingredient production
  - Agricultural practices
  - Packaging
    - Single use bags or totes vs. re-used totes or bulk trailers

1. Is it likely to get contaminated?

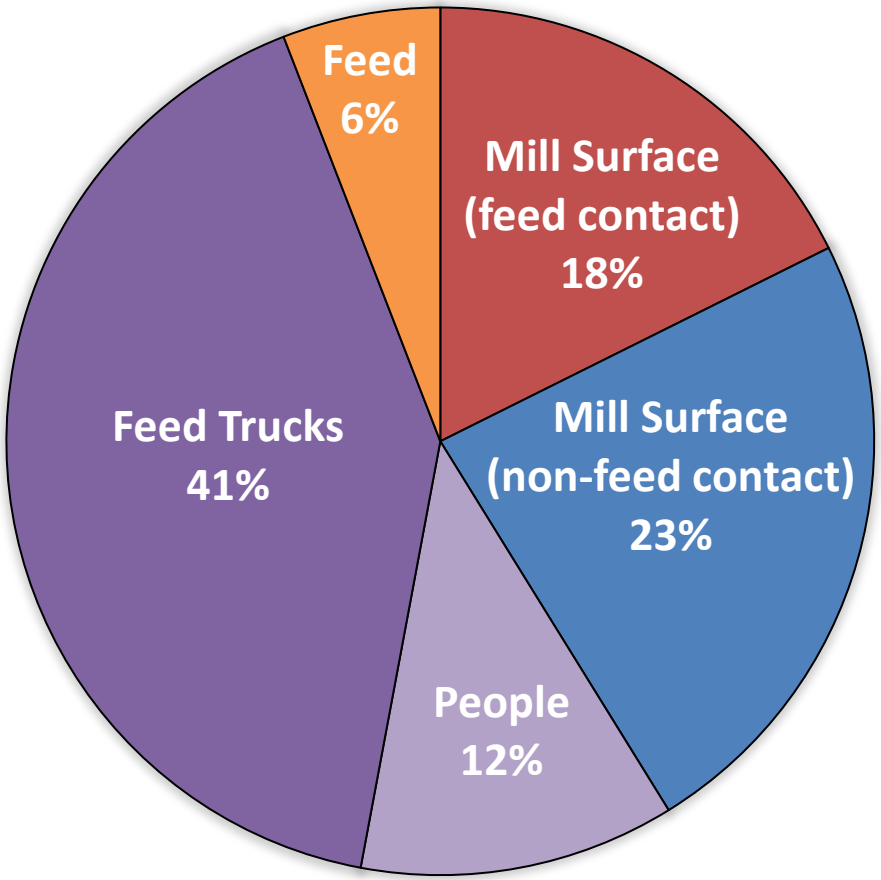
Areas where improvement would be beneficial

1. Is it likely to get contaminated?

Where is the contamination at?

- Diagnostic investigation in Vietnam to understand what surfaces would be associated with ASFV contamination.

- 17 of 2,328 samples (0.7%) from the feed supply chain contain ASFV DNA as determined by PCR
  - 3 Feed-Contact Surfaces in Mill
  - 4 Non-Feed-Contact Surfaces in Mill
  - 2 Employee clothing in Mill
  - 1 Complete Feed
  - 7 Feed Trucks



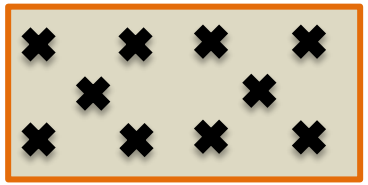
Key finding: People and fomites are incredibly important!

Gebhardt et al., 2021

1. Is it likely to get contaminated?

Risk of ASFV carryover if feed after contaminated batch

Batch	Ingredients
1	Negative
2	ASFV Inoculated
3	Negative
4	Negative
5	Negative
6	Negative



Elijah et al., 2021

1. Is it likely to get contaminated?

Risk of ASFV carryover if feed after contaminated batch

Detection of African swine fever virus (ASFV) p72 DNA in feed samples						
	Batch of feed					
	1	2	3	4	5	6
Batch	Negative	Positive	Negative	Negative	Negative	Negative
Non-detected	10	0	0	0	0	0
Suspect	0	0	0	1	1	3
ASFV detected	0	10	10	9	9	7

ASFV was still detected after 4 subsequent batches of feed

pork checkoff

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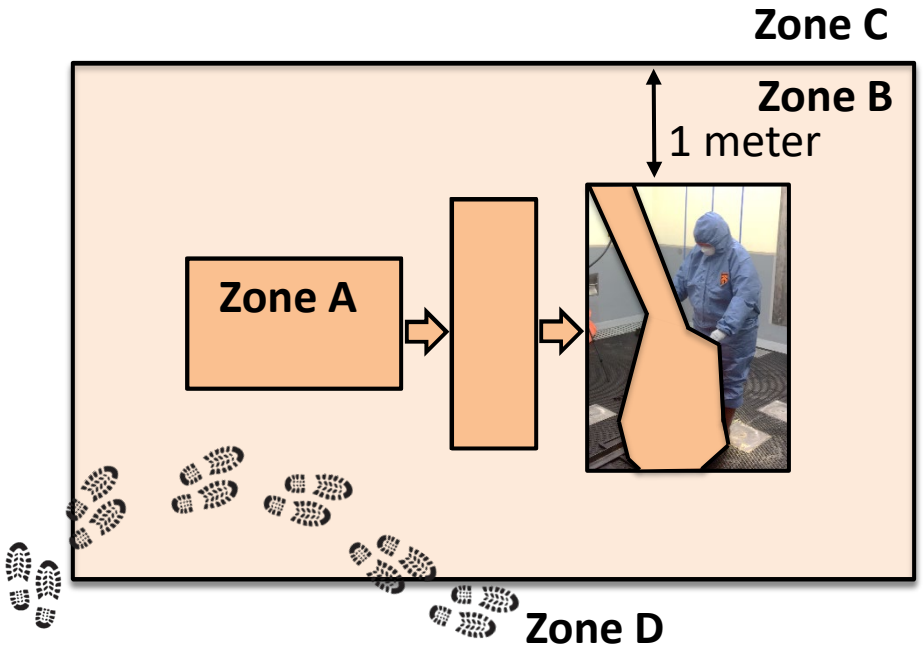
Elijah et al., 2021

1. Is it likely to get contaminated?

Risk of ASFV carryover on feed surfaces and within environment after contaminated batch



Elijah et al., 2021

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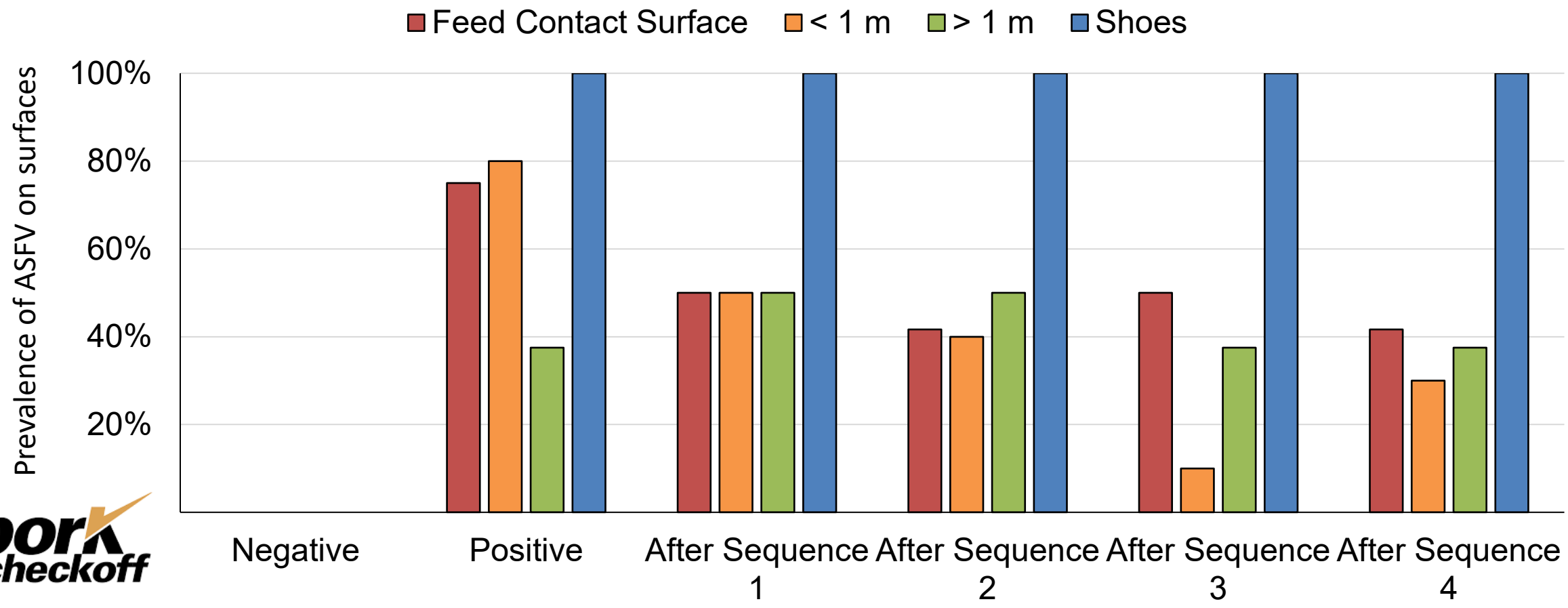
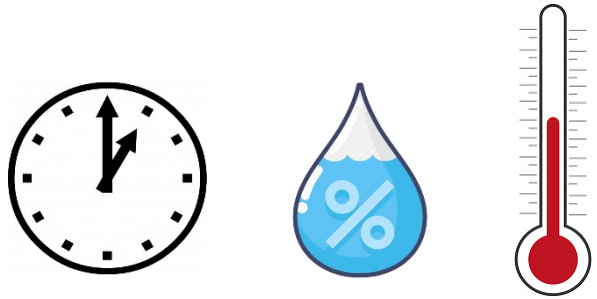
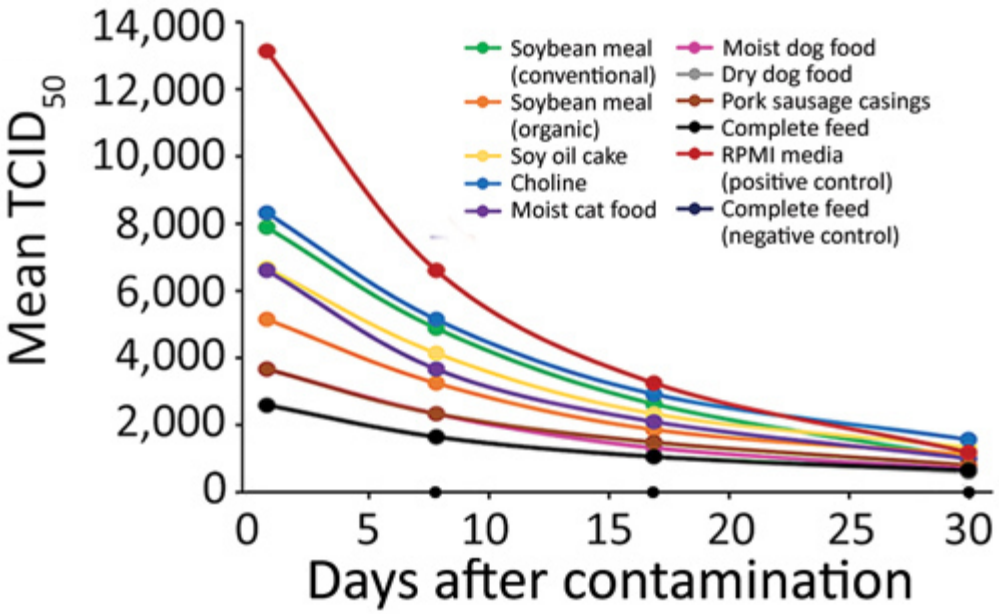


Elijah et al., 2021

2. Can it survive

- Pathogen has to survive on surface to cause infection
  - Viruses do not replicate outside of host
  - Naturally decay over time (lose infectivity)
    - Time, temperature, humidity, environment
- Greatest survival in:
  - Choline
  - Soybean meal
  - Soy oil cake



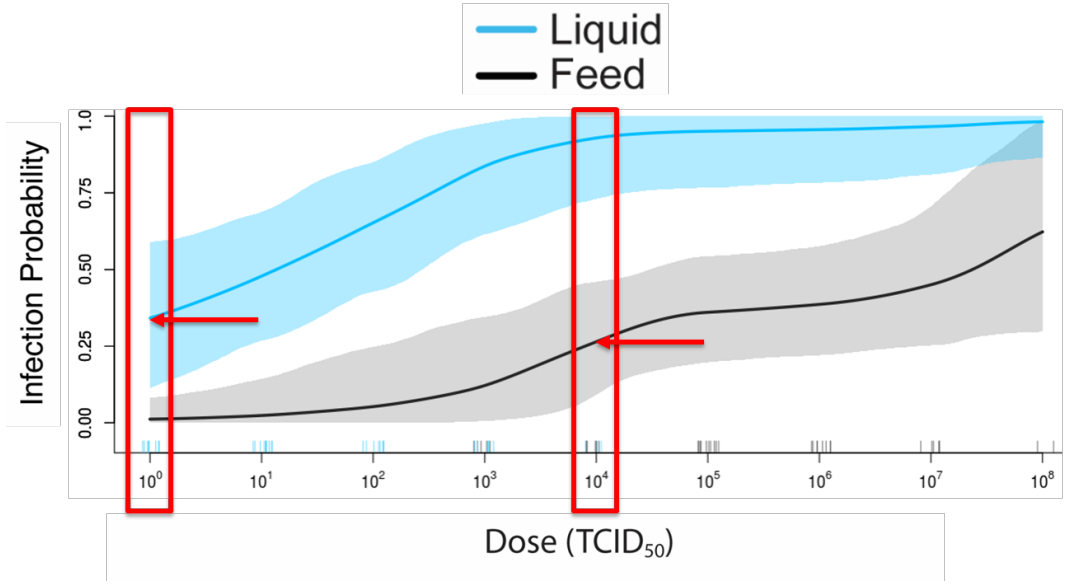


Stoian et al., 2019

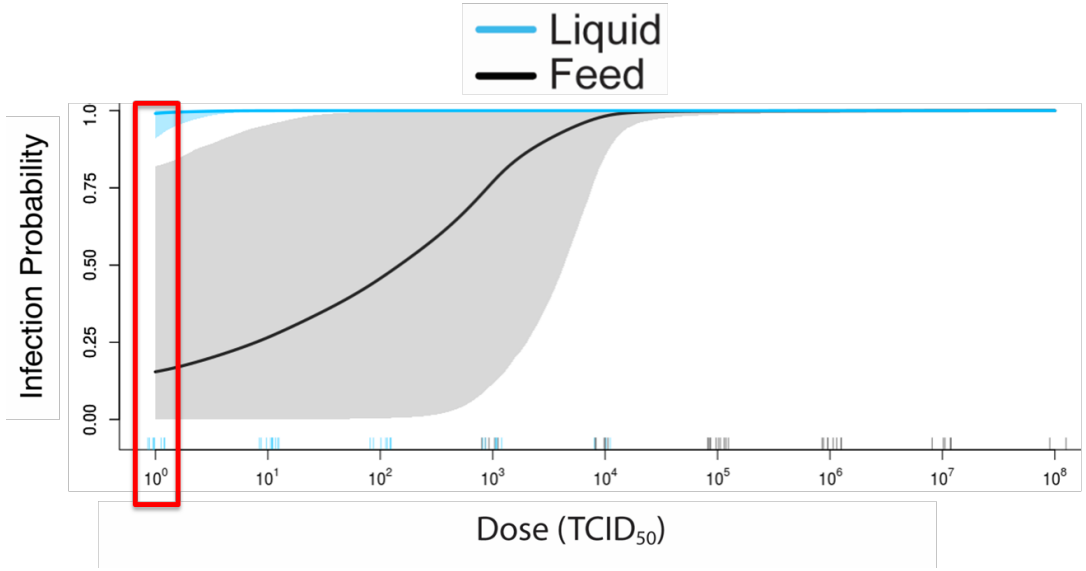
3. Is it infectious?

Feed as vector for disease

Single Exposure to a Single Animal
(100 g × 1 time)



Multiple Exposures to a Single Animal
(100 g × 20 times)



Multiple exposures increases risk of infection

Niederwerder et al., 2019

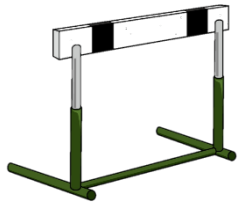
3. Is it infectious?

Feed as vector for disease

- For PEDV, 1 gram of feces from an acutely infected pig can contaminate 500 tonnes of feed – with EACH GRAM being infective

Schumacher et al., 2016

Feed Biosecurity:
Hurdles to Prevent Pathogen Transfer through feed supply chain



<u>Prevention</u>

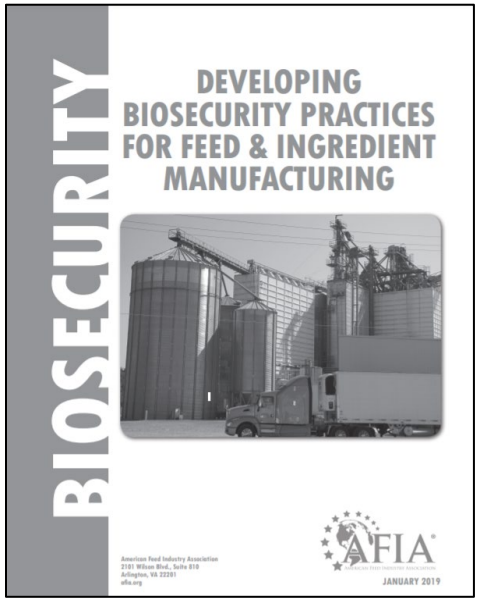
- Ingredient sourcing
- Biosecurity

<u>Intervention</u>

- Point-in-time
- Residual

Prevention

- Biosecurity at feed mills
  - Routine training/re-training
  - Audits – positive experience instead of negative



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Swine Feed Mill Biosecurity Audit

This audit has not pass/fail score. Instead, the intent is for producers to use this audit as a method of engaging in discussion with feed manufacturers about potential methods that may be employed to maximize feed safety from biological hazards.

Feed Mill Name and Address: _____ Date: _____

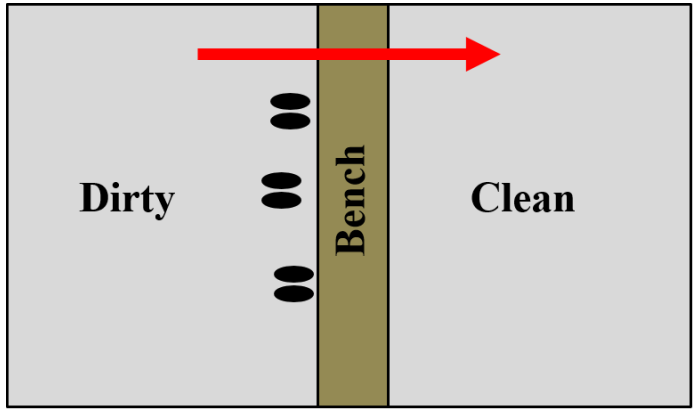
GENERAL

- Distance of nearest pigs: ☐ < ½ mile ☐ ½ to 1 mile ☐ > 1 mile
- Is the mill in compliance with the Food Safety Modernization Act (FSMA)? ☐ Yes ☐ No
- Does the mill have any hazards requiring a preventive control? ☐ Yes ☐ No
  - If Yes, describe:

Feed mill biosecurity plans: A systematic approach to prevent biological pathogens in swine feed

Roger A. Cochrane, MS; Steve S. Dritz, DVM, PhD; Jason C. Woodworth, MS, PhD; Charles R. Stark, MS, PhD; Anne R. Huss, MS, PhD; Jean Paul Cano, DVM, PhD; Robert W. Thompson, DVM, MS; Adam C. Fahrenholz, MS, PhD; Cassandra K. Jones, MS, PhD

Prevention

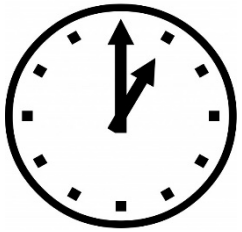


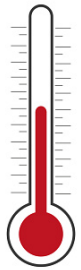
- Extend biosecurity to feed mills to limit contamination from trucks and people
  - Use receiving mats/funnels
  - When possible, don't let drivers out of trucks
    - Use your own employees to unload
    - Start treating your mill like your farm – physical barriers, foot baths, zoning
- Consider truck disinfection

Intervention

Point-in-Time

- Susceptible to recontamination
  - Time
  - Irradiation
  - Thermal processing





Residual

- Have some level of residual activity to help combat possible recontamination
  - Acids and alkalis
  - Essential oils
  - Formaldehyde-based products
  - Medium chain fatty acids

Intervention

Point in time: Holding time

- Based on half-life estimates, recommended holding times have been established
  1. Temperature
  2. Humidity
  3. Ingredient matrix

Mean Holding Time for 99.99% SVA Degradation			
	Days at 4°C (39.6°F)	Days at 15°C (59°F)	Days at 30°C (86°F)
Conventional SBM	143 days	52 days	26 days
DDGS	494 days	182 days	26 days
Vitamin D	39 days	26 days	26 days
Lysine	78 days	13 days	13 days

Mean Holding Time for 99.99% ASF Degradation at 54°F Avg.[3]			
	Average	95% Confidence Interval - Lower	95% Confidence Interval – Higher
Conventional SBM	125 days	113 days	135 days
Organic SBM	168 days	150 days	186 days
Choline	155 days	142 days	168 days

https://www.swinehealth.org/wp-content/uploads/2020/02/Holding-Time-Calculations-for-Feed-Ingredients-to-Mitigate-Virus-Transmission-Print-02.04.20.pdf

Intervention

Point in time: Thermal processing

	Feed	0 dpi	2 dpi	4 dpi	6 dpi	7 dpi	7 dpi Cecum
No PEDV	0	0	0	0	0	0	0
38°C	9/9	0	1/9	3/9	3/9	3/9	3/9
46°C	9/9	0	3/9	3/9	3/9	3/9	3/9
54°C	9/9	0	0	0	0	0	0
63°C	8/9	0	0	0	0	0	0
71°C	8/9	0	0	0	0	0	0

No infectivity in diets pelleted ≥ 54°C (129°F)

Cochrane et al., 2017

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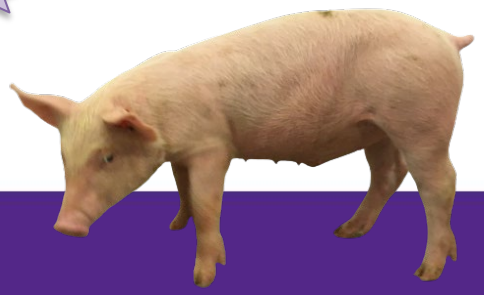
Intervention



Keys to a successful biosecurity program

Culture

- Consistent expectations and accountability at all levels of organization
- Financial support

Training

- Training and re-training
- Focus on **WHY**

Biosecurity

Infrastructure

- Facility designs must accommodate biosecurity practices
- Minimize inconvenience = more consistent implementation

Continuous improvement

- Routine audits
- Sampling and diagnostic testing to identify potential gaps

Kansas State University Feed Safety Team

Dr. Jordan Gebhardt – Diagnostic Medicine/Pathobiology

Dr. Cassie Jones – Animal Sciences & Industry

Dr. Chad Paulk – Feed Science

Dr. Jason Woodworth – Animal Sciences & Industry

www.ksuswine.org → Feed Safety Resources

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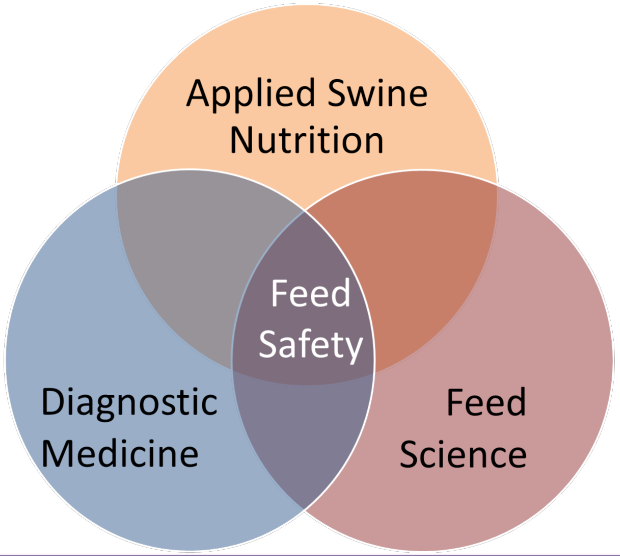

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