

# Biosecurity 101

**AnS 190X**

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# Goals

- Discuss the foundations for biosecurity
- Provide some science behind recommendations
- Provide some resources



# High Standard

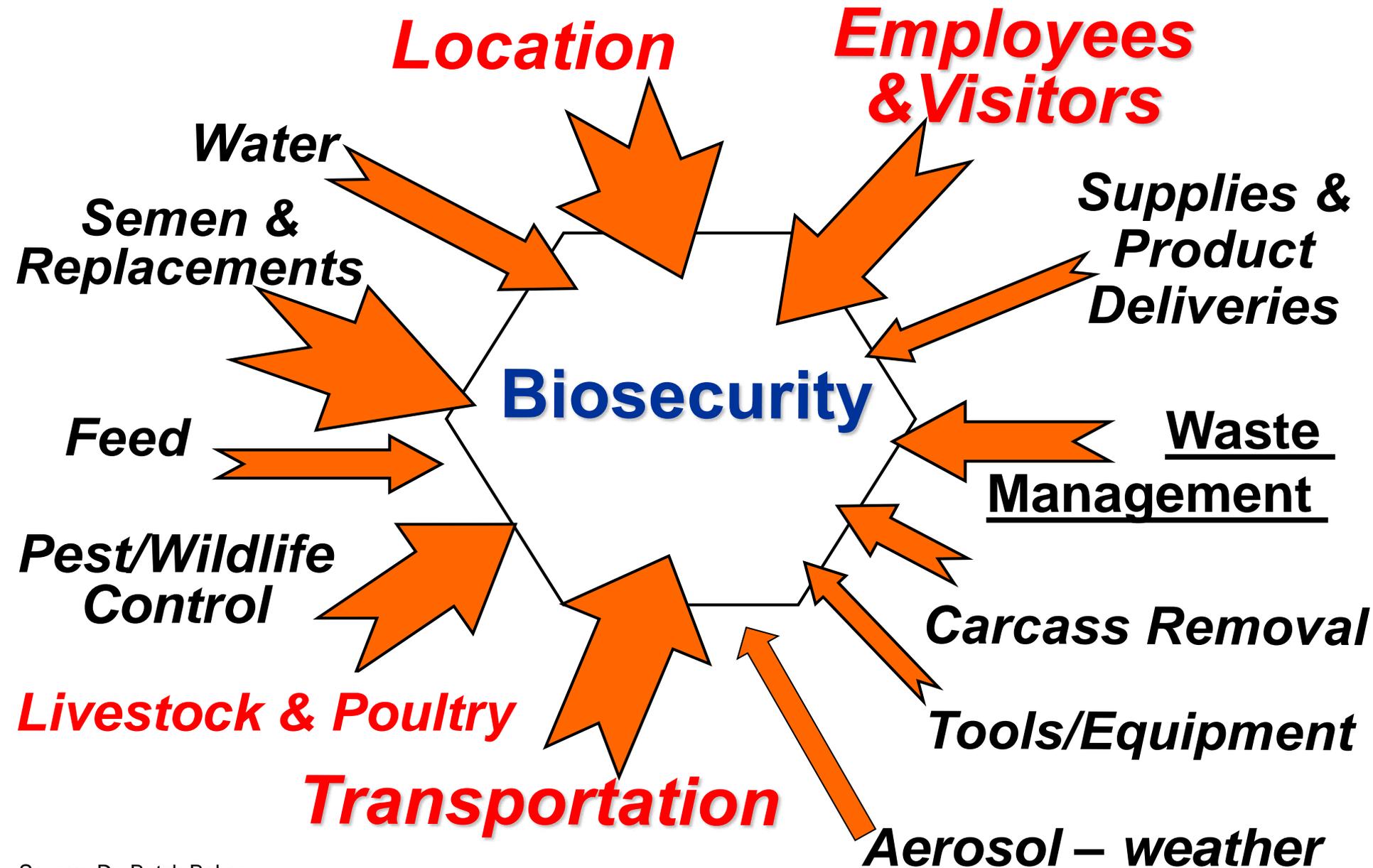


# Biosecurity

- Definition: The steps or process for disease prevention.
  - External – New Introductions
  - Internal – Spread within an operation
- Not all risk can be eliminated!
  - BRM – Biological Risk Management
- Work to minimize the opportunities

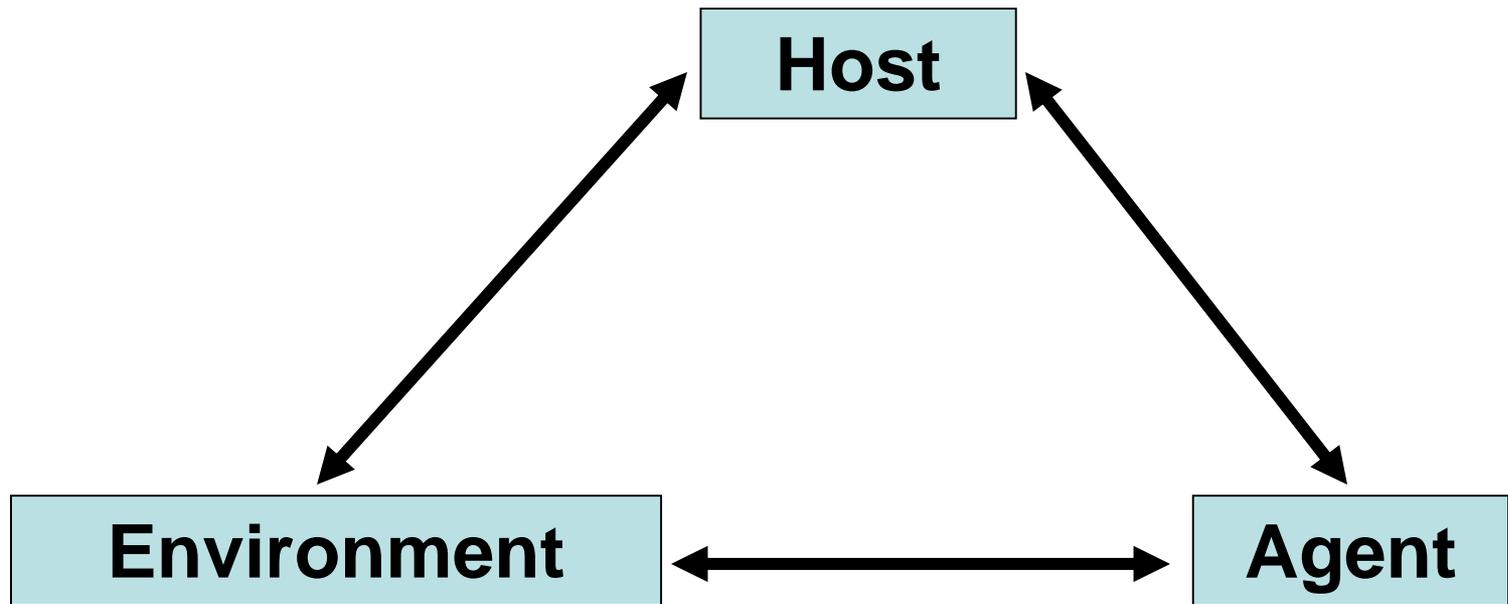


# Bio-Exclusion Considerations



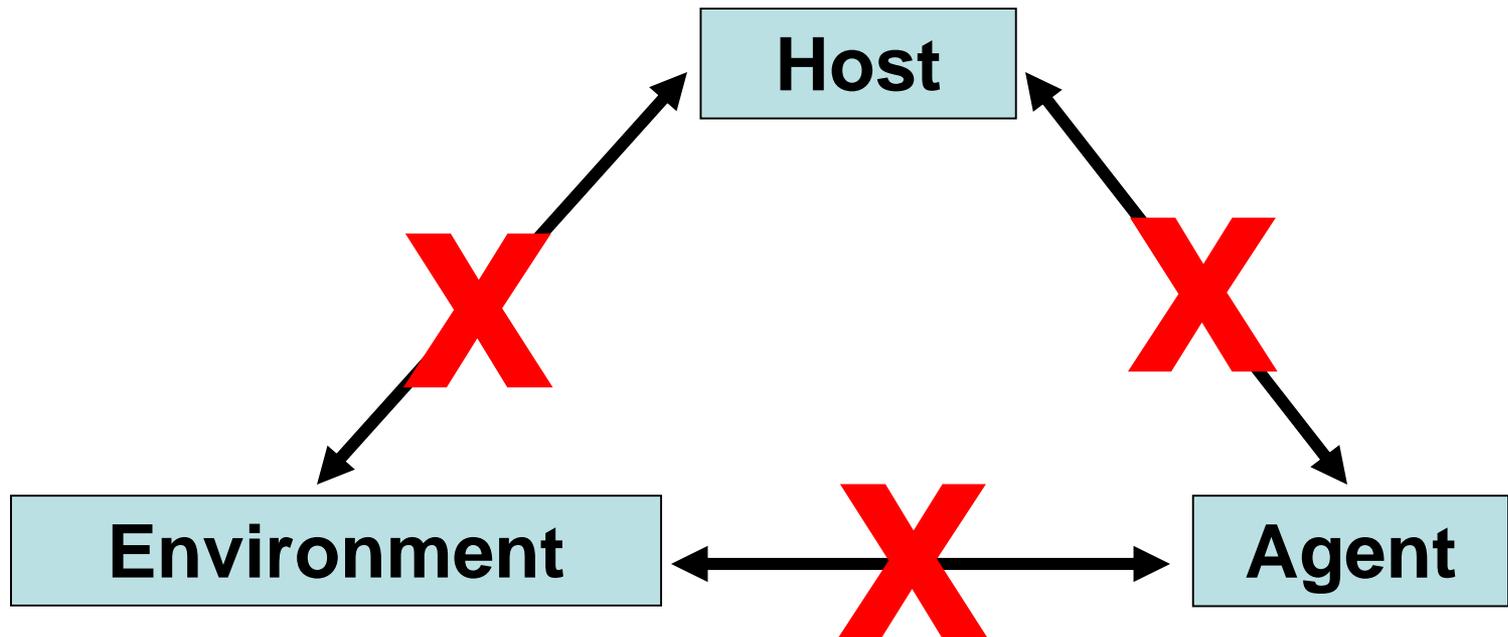
# BRM - Foundation

- Disease triad



# BRM - Foundation

- Disease triad



# BRM - Foundation

- Three basic things to consider:
  - 1) Need to have a disease agent present
    - Live
    - Sufficient numbers
  - 2) Need to have a susceptible host
  - 3) The host must become exposed to the agent in sufficient numbers so as to cause disease
    - Routes of transmission



# Routes of transmission

- Aerosol
- Fomite
- Oral
- Vector
- Direct contact
- Zoonotic

**Biological Risk Management**  
TRANSMISSION ROUTE DEFINITIONS



Disease causing agents can be spread from animal-to-animal or animal-to-human and vice versa, through a variety of transmission routes.

-  - **Aerosol** — Droplets are passed through the air from one animal to another.
-  - **Direct contact** — A susceptible animal becomes exposed when the disease agent directly touches open wounds, mucous membranes, or the skin through blood, saliva, nose to nose contact, rubbing, or biting.
-  - **Reproductive** — A subtype of direct contact that includes diseases spread through mating or to the fetus during pregnancy.
-  - **Fomite** — An inanimate object carrying a disease agent from one susceptible animal to another.
-  - **Traffic** — A subtype of fomite transmission in which a vehicle, trailer, or human spreads organic material to another location.
-  - **Oral** — Consuming disease causing agents in contaminated feed, water or licking/chewing on contaminated environmental objects.
-  - **Vector borne** — An insect acquires a disease agent from one animal and transmits it to another.
-  - **Zoonotic** — Diseases transmitted from animals to humans.

Environmental contamination must always be taken into consideration.

transmission\_routes\_def | www.cfsph.iastate.edu



# PRRS transmission

Route	ID <sub>50</sub>
SQ (parenteral)	~10
Intranasal	~8,000
Artificial Insemination	~31,600
Oral	~158,500
Aerosol	??

Zimmerman 2005



# Formula for disease

**Infectious Agent (viable and dose)**

**+ Exposure**

**+ Susceptible Host**

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**Disease (acute, subacute)**



# Formula for disease

Infectious Agent (viable and dose)

+ Exposure

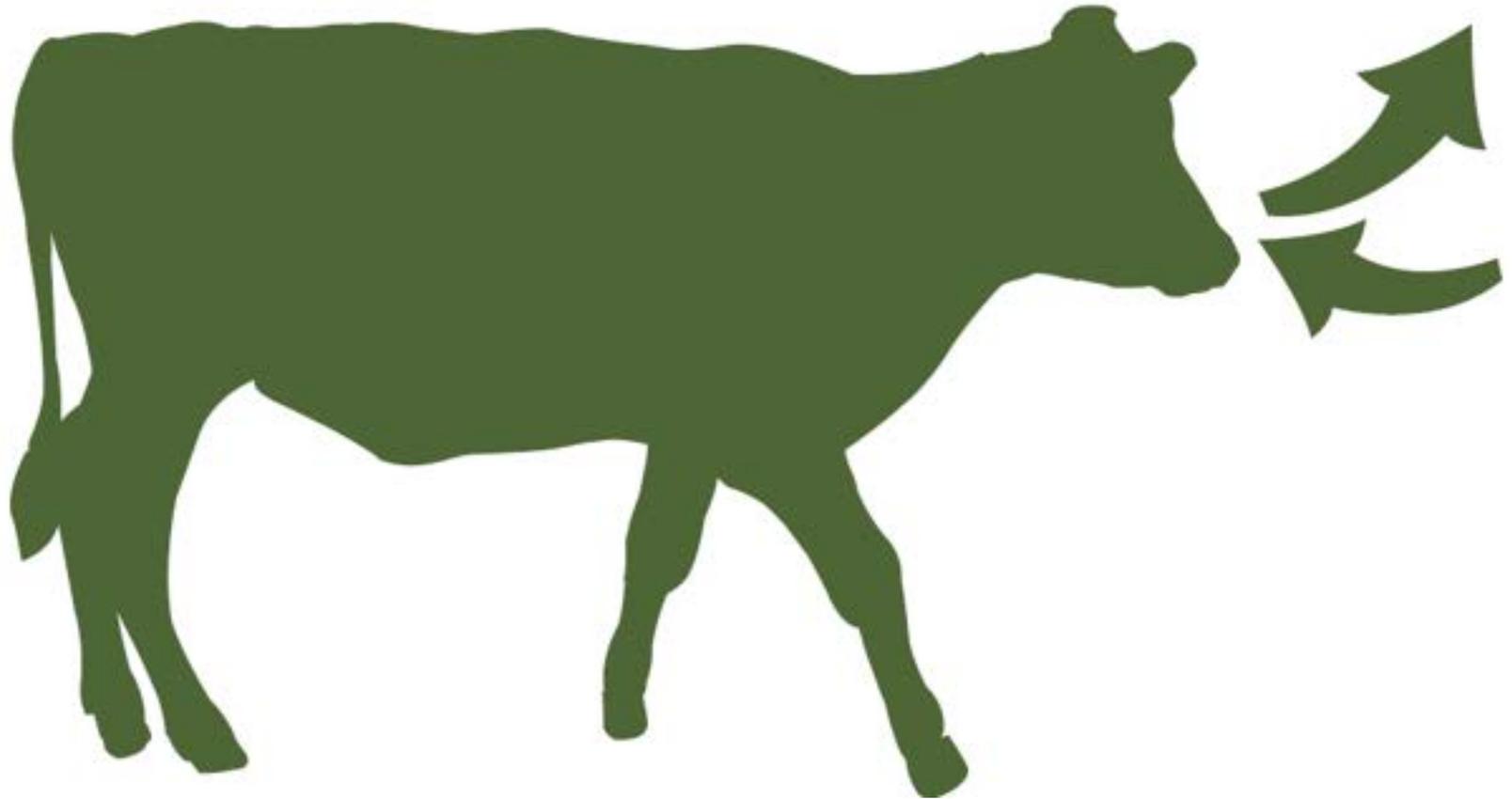
+ **Susceptible Host**

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Disease (acute, subacute)

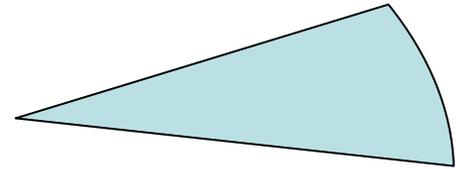


# Aerosol Transmission



# Aerosol Requirements

- Large numbers of pathogens
  - Circle  $\rightarrow$  Area =  $\pi * r^2$
- Low temperature
- High humidity
- Low sunlight
- Short travel distance
- Low wind speeds
- Smooth topography



# Aerosol transmission

- Aerosol  $\neq$  Area spread
- Aerosol = via the air
  - Agent/strain specific
- Area spread = not specific to air, but more related to location



# Aerosol - Biosecurity practices

- Location
  - Low livestock density area
  - Preferably at least 2 miles from other livestock or manure spreading areas
- Ventilation
  - Proper maintenance
  - Use dust reduction protocols in confinement (1% fat in feed)
  - Maintain relative humidity <70%
- Air filtration system?



# Aerosol

- Air filters



[www.reliablefilter.com](http://www.reliablefilter.com)



HEPA vs. MERV vs.  
Disposable



# Aerosol

Air Filter

Costs:

\$250 per sow

\$150 per boar

Maintenance \$30 - 40/head/year



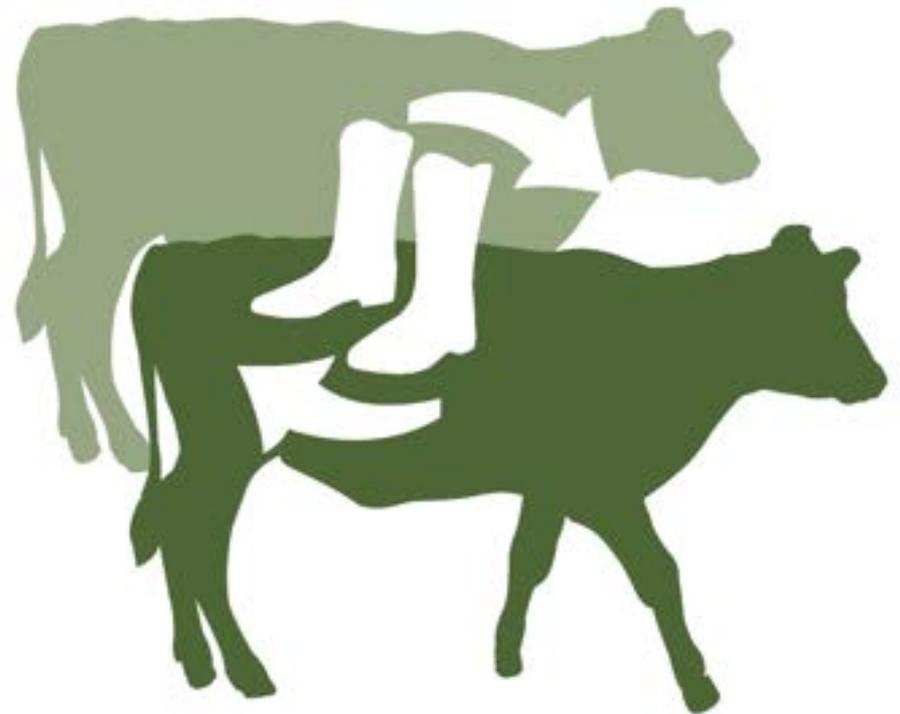
[www.reliablefilter.com](http://www.reliablefilter.com)



# Fomites & Oral



Oral



Fomites



# Fomites & Oral

Fomites are inanimate objects (not alive) that can serve as a means to transport organisms from one animal to another



# Fomites



# Fumigation of all objects entering the site



Photo: RB Baker

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# People



**RESTRICTED ENTRY**

**This is a  
BIOSECURE FACILITY**

**Please Comply  
with ALL posted  
Biosecurity Signs**

**HIGH RISK**      **MED RISK**      **LOW RISK**

**Help Keep Our Animals Healthy**

PAENSA E Department of  
Veterinary Science      Commonwealth of Pennsylvania  
Department of Agriculture



# People

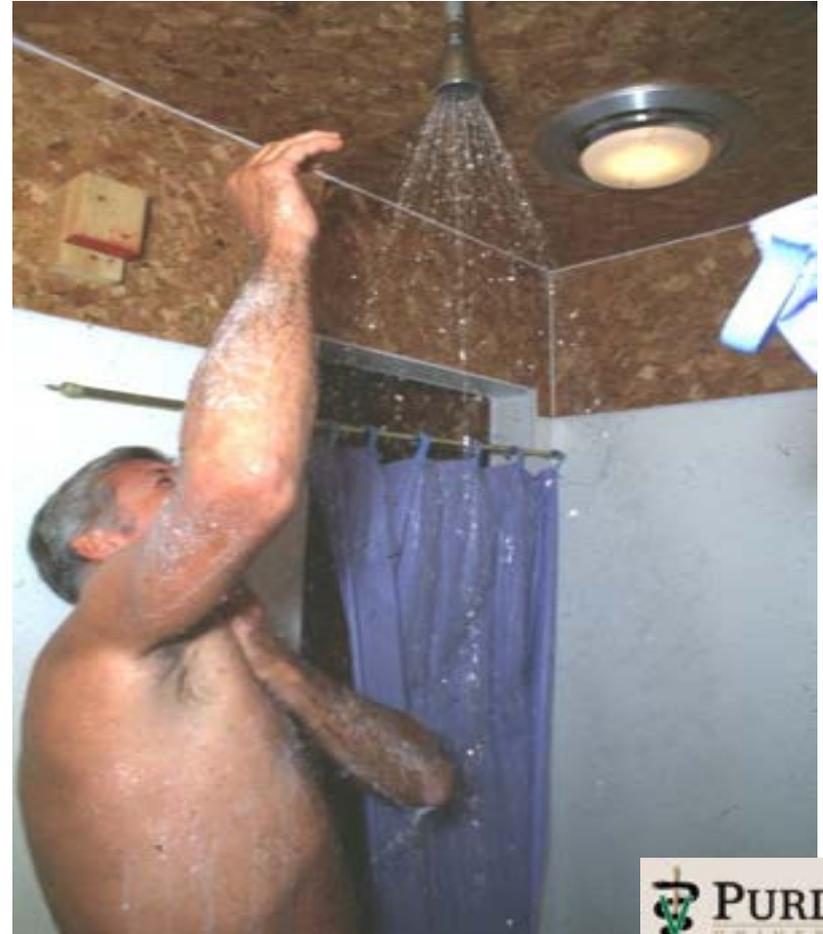
- How many people/vehicles enter your farm operation every month?
  - A study in 2001 reported that larger (>2,000 head) swine herds had contact with people and vehicles who had contact with other livestock facilities an average of 807 times each month.

**Risk = Frequency X Consequence**



# People

- *E. coli* Amass et al 2003
- FMDV Amass et al 2003
- TGEV Alvarez et al. 2002
- Showering and putting on clean outerwear prevented transmission in **ALL** cases!



# People

- Risk is the same for **sow units** as well as **nursery** and **finishing** sites
- Large systems implement showering at **all** phases



# Got boots?



**Help contain disease by wearing  
disposable boots and not crossing  
the LINE OF SEPARATION**





# Boot Changing Stations



# Boots & Coveralls



# Boots & Coveralls



Tan, Charcoal, Royal, Navy, White, Red





# Hand Washing

- Hand washing decreases contamination
- Availability
  - Location
  - Fully stocked
- Gloves are not a substitute for hand washing
- Signage



# Exposure

Variables	N	Swine H1N1*			
		Titer $\geq 1:10$ n (%)	Titer $\geq 1:20$ n (%)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
<b>Swine exposure</b>					
Swine workers who use gloves sometimes or never	34	12 (35.3)	7 (20.6)	<b>21 (4.4-100.8)<sup>†</sup></b>	<b>30.3 (3.8-243.5)<sup>†</sup></b>
Swine workers who use gloves most of the time or always	14	1 (7.1)	0 (0)	2.8 (0.2-34.2)	2.4 (0.1-40.9)
No swine exposed controls	79	2 (2.6)	1 (1.3)	reference	reference
<b>Smoked in past year &gt;5 packs?</b>					
Yes	14	4 (28.6)	3 (21.4)	<b>4 (1.1-14.5)<sup>†</sup></b>	<b>18.7 (2.5-141.3)<sup>†</sup></b>
No	114	11 (9.7)	5 (4.4)	reference	reference

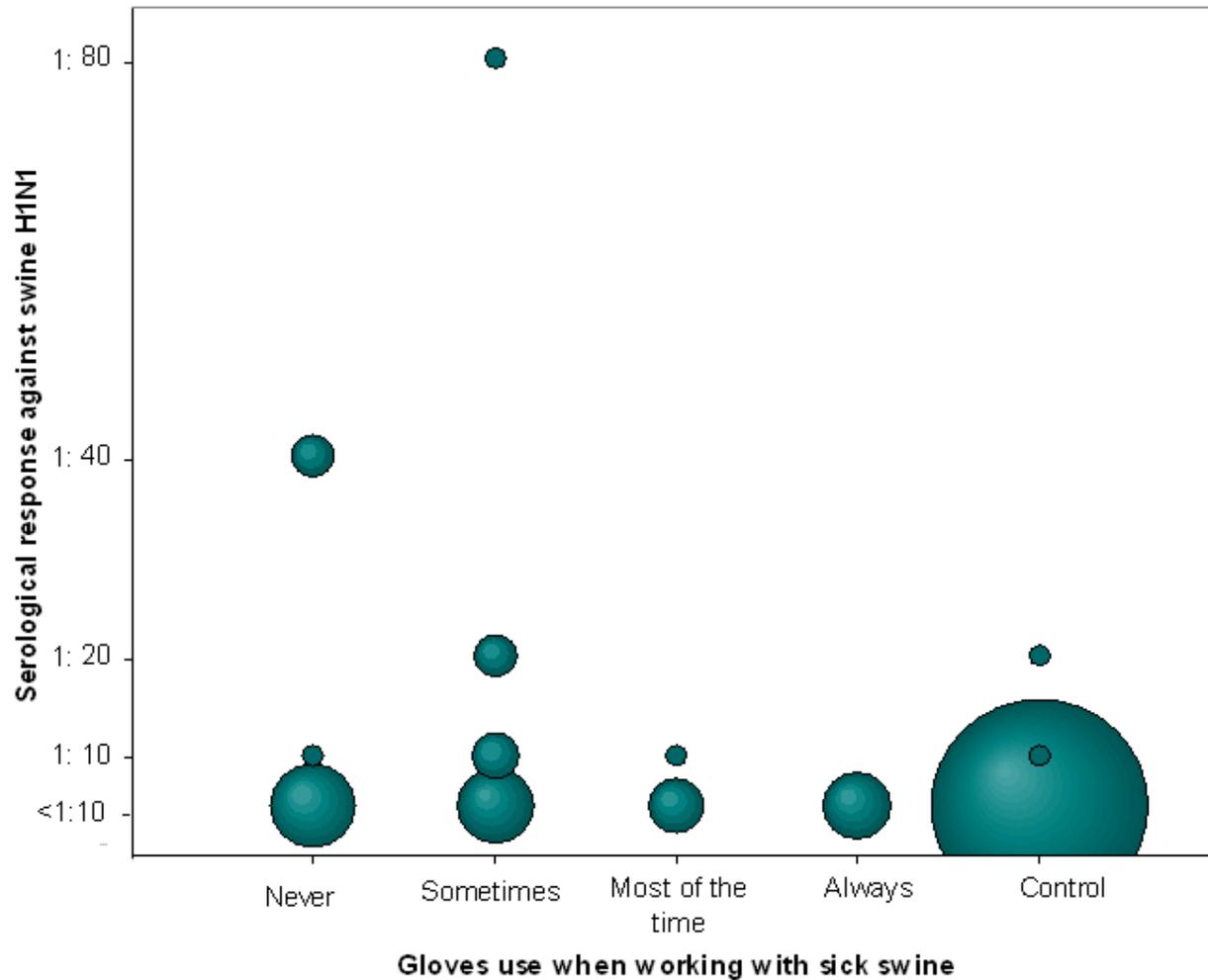
\*Using proportional odds model, these titers were grouped: <1:10, 1:10; >1:10

<sup>†</sup> Significant odds for increased serological response, p-value < 0.05

Ramirez *et al*, Emerg Inf Dis 2006



# Exposure



Ramirez unpublished 2006

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# Vehicles

- Clean vehicles only
- Designated parking
- Proper signage
- TQA program



Syntex industries

<http://www.biosecuritycenter.org/truckwash.php>





Photo: RB Baker



# Truck wash/heat treatment





Photo: RB Baker





Photo: RB Baker

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# Daily Biosecurity Priorities



Photo: RB Baker



# Do we know how to clean?

1. Removal of visible organic material
  - Power washing
    - Pressure vs. volume
    - Hot vs. cold
2. Disinfection
3. Drying



# Disinfect

1. Read the product label
  - Wear protective gear if needed
2. Disinfect
  - Use label dilutions
  - Allow label contact times (10 minutes)
3. Final rinse (if necessary)
  - Low pressure to remove residue
4. Dry before allowing animals to return



# Which one?





## Characteristics of Selected Disinfectants

Disinfectant Category	Alcohols	Aldehydes	Biguanides	Halogens: Hypochlorites	Halogens: Iodine Compounds	Oxidizing Agents	Phenols	Quaternary Ammonium Compounds (QAC)
Sample Trade Names	Ethyl alcohol Isopropyl alcohol	Formaldehyde Paraldehyde Glutaraldehyde	Chlorhexidine Nolvasan® Chlorhex® Virosan®	Bleach Clorox®	Betadine® Providone®	Hydrogen peroxide Peroxyacetic acid Irifectant® Vikon 5® Oxy-Sept 333®	One-Stroke Environ® Pheno-Tek II® Tek-Trol® Pine-Sol, Lysol	Roccal® Diquat® Parvosol® Zephiran® D-256®
Mechanism of Action	•Precipitates proteins •Denatures lipids	•Denatures proteins •Alkylates nucleic acids	•Alters membrane permeability	•Denatures proteins	•Denatures proteins	• Denature proteins and lipids	• Alters cell wall permeability • Denatures proteins	• Binds phospholipids of cell membrane • Denatures proteins
Advantages	•Fast acting •Leaves no residue	•Broad spectrum	•Broad spectrum	•Broad spectrum •Short contact time •Inexpensive	•Stable in storage •Relatively safe	• Broad spectrum	• Good efficacy with organic material • Non-corrosive • Stable in storage • Effective over large pH range	• Stable in storage • Non-irritating to skin • Effective at high temperatures and high pH (9-10)
Disadvantages	•Rapid evaporation •Flammable	•Carcinogenic •Irritation to mucous membranes and tissues •Only use in well ventilated areas	•Only functions in limited pH range (5-7) •Toxic to fish (environmental concern)	•Inactivated by sunlight, some metals •Requires frequent application •Corrodes metals •Irritating to mucous membranes, skin	•Stains clothes or treated surfaces •Inactivated by organic debris and QACs •Requires frequent application •Corrosive	• Damaging to some metals	• Toxic to animals • Can cause skin and eye irritation • NOT effective for FMD	• NOT effective for FMD or John's
Precautions	Flammable	Carcinogenic		Never mix with acids; will release toxic chlorine gas			Toxic to animals, especially cats	
Vegetative Bacteria	Effective	Effective	Effective	Effective	Effective	Effective	Effective	YES—Gram Positive Limited—Gram Negative
Mycobacteria	Effective	Effective	Variable	Effective	Limited	Effective	Variable	Variable
Enveloped Viruses	Effective	Effective	Limited	Effective	Effective	Effective	Effective	Variable
Non-enveloped Viruses	Variable	Effective	Limited	Effective	Limited	Effective	Variable	Not Effective
Spores	Not Effective	Effective	Not Effective	Variable	Limited	Variable	Not Effective	Not Effective
Fungi	Effective	Effective	Limited	Effective	Effective	Variable	Variable	Variable
Efficacy with Organic Matter	Reduced	Reduced	?	Rapidly reduced	Rapidly reduced	Variable	Effective	Inactivated
Efficacy with Hard Water	?	Reduced	?	Effective	?	?	Effective	Inactivated
Efficacy with Soap/ Detergents	?	Reduced	Inactivated	Inactivated	Effective	?	Effective	Inactivated

? Information not documented

DISCLAIMER: Use of trade names does not in any way signify endorsement of a particular product. For additional product names, please consult the most recent Compendium of Veterinary Products.



# Cleaning and disinfecting



# Clean before or after livestock?

- Clean right **before** next group
  - If it's dirty, it will stay dirty no matter how long you wait
  - Hard on equipment
  - Harder to clean
  - Environment for insects and/or rodents
- Clean right **after** this group
  - If it's clean, it will eventually get dirty if you wait long enough
  - Easier to “re-clean” if necessary
  - Long drying time
  - Have more time to do the job right!



# Hot vs. Cold water

- Cold
  - Cheaper
  - Easy to see (no fog)
  - Less sweating
  - **Laundry study** showed 160 °F was just as effective as 72 °F in reducing bacterial counts (Blaser et al, 1984)
- Hot
  - Reduction of labor time!



# Monitoring

- Regular veterinary herd health visits
  - May include biosecurity audits
  - Cleaning and disinfection checks
- Cultures for specific bacterial organisms
- Testing for specific agents
  - Routine testing
  - Sentinel animals



# Vectors



[www.pestvictoria.com](http://www.pestvictoria.com)



# Pest control

- Sanitation
  - Garbage
  - Feed spills
  - Manure spills
- Insecticides
- Rodent control
- Pets
  - Cats & dogs



# Rodent Control

- <http://rodent.swine.unl.edu/>
- Gravel perimeter
  - 2 – 3 feet wide
  - 6 inches deep
  - ½ - 1 inch rock
- Bait stations
  - Location
    - Professionals?
    - Records



# Direct contact



# Animals are #1

- Know source
- Minimize sources
  - Average vs. Lowest
- Testing
- Herd health program



# Summary



# Biosecurity

- Most interventions are expensive
  - Transport ~\$200 - \$400/trailer
  - Shower system ~\$5/employee/day
  - Boar Stud monitoring ~ \$.80/dose
  - Multiplication ~ \$25 per gilt or boar sold
  - Isolation facility/monitoring ~ \$15/gilt
  - Insects and Rodents ~ \$.25/pig
  - Training - ?
  - Filters – Electrostatic & other technologies?

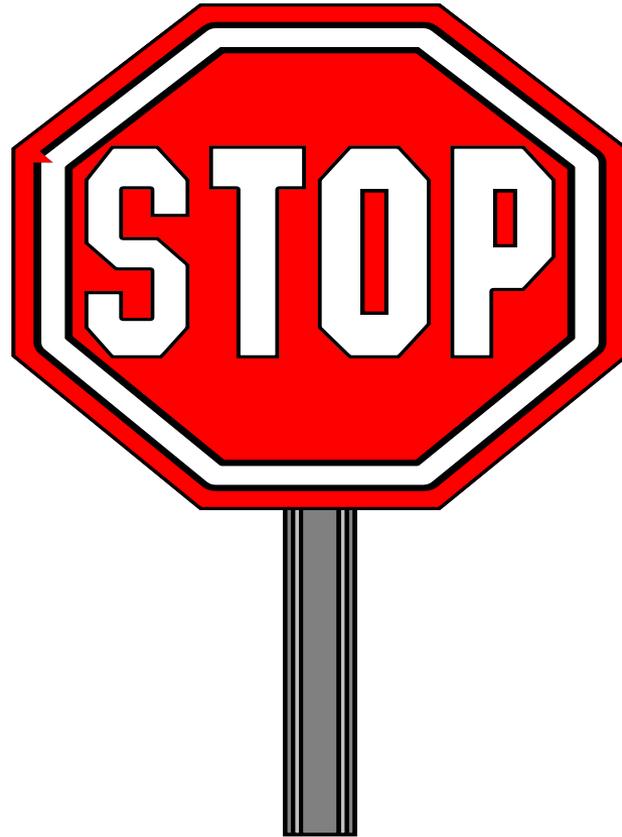


# Best Biosecurity

- Look at animals daily preferably 2x/day
- Maximize
  - Management
  - Nutrition
  - Environment
  - Health program (vaccination)
- Routes of transmission



# BIOSECURITY



• **THINK!!**



**Don't Forget!**

**Frequency**

**Risk = X**

**Consequence**





# WASH YOUR HANDS

- Wet hands and forearms with warm water
- Add at least 3-5 mls of soap (the size of an olive)
- Lather up and vigorously scrub each side of the hands beyond the wrist for 10-30 seconds, cleaning under rings and scrubbing dirty fingernails
- Rinse under warm water until no soap residue remains
- Turn off running water with a paper towel, not bare hands
- Dry hands with paper towel or hot air dryer



 the Center for  
Food Security  
& Public Health  
IOWA STATE UNIVERSITY\*



# Resources

- General Disease Information:  
<http://www.cfsph.iastate.edu/>
- General Prevention: (see left column)  
[http://www.cfsph.iastate.edu/Infection\\_Control/general-prevention-for-producers.php](http://www.cfsph.iastate.edu/Infection_Control/general-prevention-for-producers.php)
- Disinfectant Resources:  
[http://www.cfsph.iastate.edu/Infection\\_Control/disinfectant-resources-for-veterinarians.php](http://www.cfsph.iastate.edu/Infection_Control/disinfectant-resources-for-veterinarians.php)



# Questions?

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# CBP Homeland Security







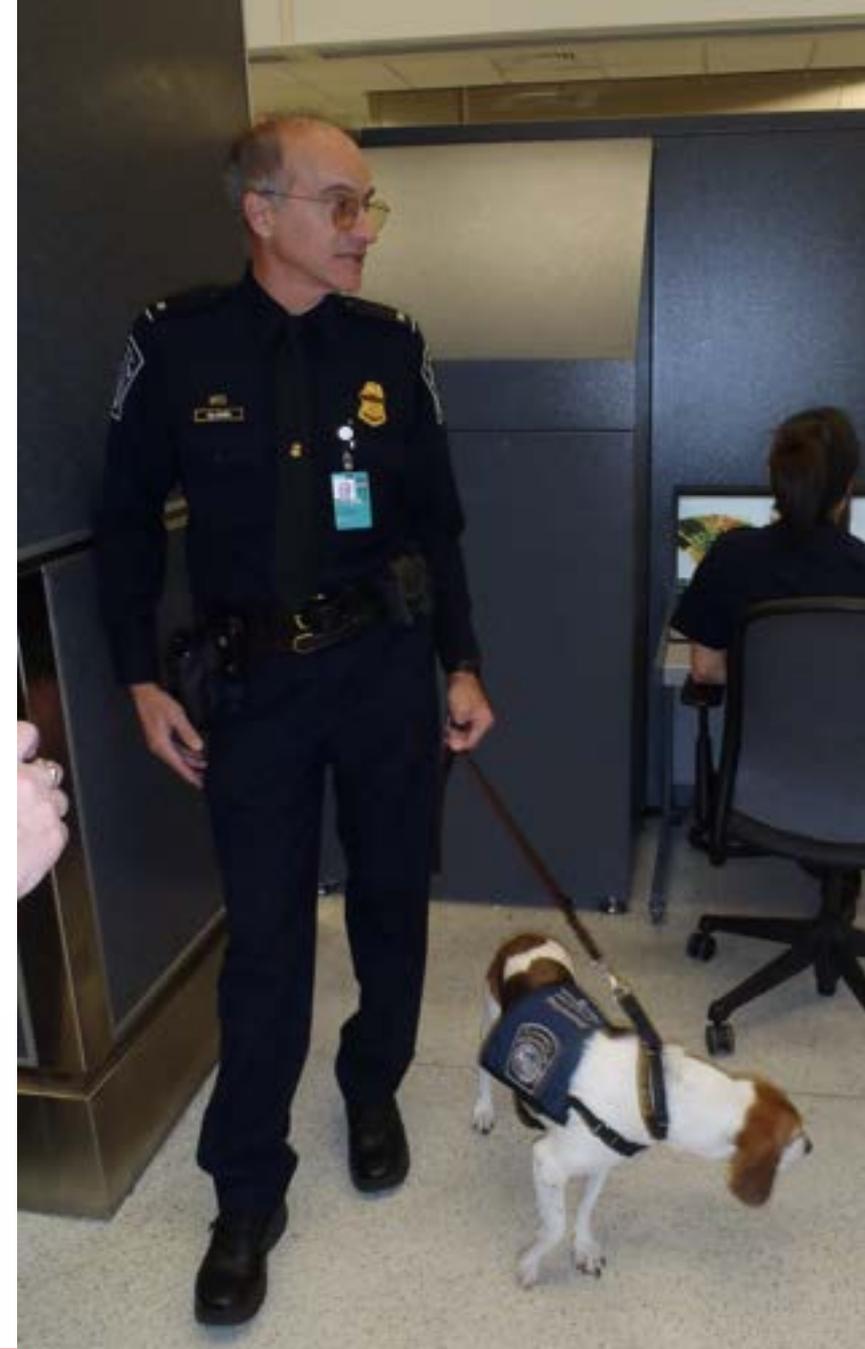




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